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# Biofuels - Future Prospects and Benefits for India

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## Abstract-

*Energy plays a vital role in the economic growth of any country. The human population is anticipated to surpass 9 billion by 2050 and this will also increase the utilization of Petroleum Oil. Biofuels have emerged as an ideal choice to meet these requirements. Huge investments in research and subsidies for production are the rule in most of the developed countries. All over the world, governments have initiated the use of alternative sources of energy for ensuring energy security, generating employment, and mitigating $CO_2$ emissions. Similarly, liquid biofuels are of particular interest because of the vast infrastructure already in place to use them, especially for transportation. The liquid biofuel in greatest production is ethanol, biodiesel, methane gas and biogas. These all kind of biofuels are playing a crucial role in reducing the use of natural petroleum resources. Finally, we see how biofuels investment enhances growth and poverty reduction despite some displacement of food crops by biofuels. We also discuss about the emission of $SO_2$ and $NO_x$ in this because it is a very important factor that cannot be neglected.*

**Keywords-** Bioenergy, biofuels, agriculture, energy, commodity futures, ethanol.

## 1. Introduction-

**Biofuels** which are often considered as environmentally friendly energy have recently attracted the attention of those who want to take actions for the use of fossil fuels and for global climate change. Biofuel, any fuel that is derived from biomass - that is, plant, wood waste, algae material or animal waste. Since such feedstock material can be replenished readily, biofuel is considered to be a source of renewable energy, unlike fossil fuels such as petroleum, coal, and natural gas. Biofuel is commonly advocated as a cost-effective and environmentally benign alternative to petroleum and other fossil fuels, particularly within the context of rising petroleum prices and increased concern over the contributions made by fossil fuels to global warming. Liquid biofuels are of particular interest because of the vast infrastructure already in

place to use them, especially for transportation. The liquid biofuel in greatest production is ethanol, which is made by fermenting starch or sugar. Brazil and the United States are among the leading producers of ethanol. The second most common liquid biofuel is biodiesel, which is made primarily from oily plants (such as the soybean or oil palm) and to a lesser extent from other oily sources (such as waste cooking fat from restaurant deep-frying). Biodiesel which has found greatest acceptance in Europe, is used in diesel engines and usually blended with petroleum diesel fuel in various percentages. Other biofuels include methane gas and biogas-which can be derived from the decomposition of biomass in the absence of oxygen-and methanol, butanol and dimethyl ether-which are in development.

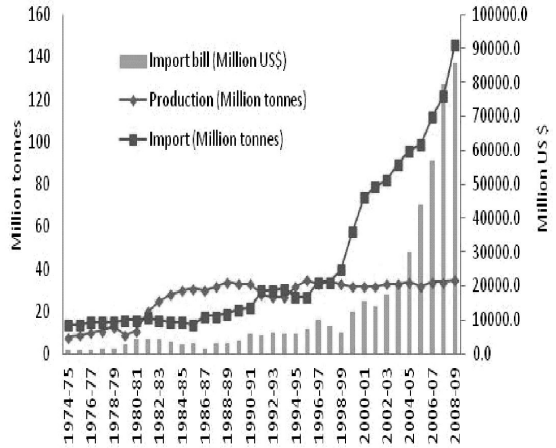


Figure 1: Domestic production and import of crude oil in India: 1974-75 to 2008-09 [3]

As we can see in above graph the use and consumption of crude oil is increasing drastically. In year 1980-81 it was about 20 Million tonnes and became 7 times within decades and will become multiple more times if its substitution is not found. So biofuels can replace it for an instance but still they are not enough to replace it completely. Use of biofuels in increasing drastically so that the dependency on traditional fuel sources can be overcome.

2. **Literature review-**

| S. no | Title, author, year of publication | Methodology/Basic principles | Scope of work/conclusion |
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| **1.** | Next-Generation Biofuels—Opportunities and Challenges<br><br>Naveen Kumar , Ankit Sonthalia , Harveer S. Pali and Sidharth<br><br>January, 2020 | The human populace is anticipated to surpass 9 billion by 2050 which will increment the calorie admission and push the generation of nourishment crops on rare arable land to its limit. The interest of the vitality will likewise increment. An examination of the world complete essential vitality supply (TPES) in 1973 and 2016. The vitality utilization of the world expanded from 6101 Million tons of oil equal (Mtoe) in 1973 to 13,699 Mtoe in 2016, an expansion of 124%. The petroleum products give amajor piece of the vitality prerequisite, in any case, exhausting saves alongside value instability combined with ecological issues block their use as a primary energy source. Most of the countries are moving toward renewable and cost-effective options which are biodegradable and abundantly available. | India is presently the 6th biggest economy of the world and the mechanical alongside the transportation area has seen an amazing development over the most recent two decades. The vitality utilization has expanded multi-overlap and Government of India is pushing inexhaustible alternatives for a maintainable vitality blend in with negligible carbon impressions. Biofuels are a developing alternative for India, and significant activities are taken by government for their commercialization and in this unique circumstance, National Biofuel Policy is adjusted to bridle natural, cultural, and financial advantages. The program can be effective just when the partners draw in with the administration to handle the different issues emerging during the program usage. |

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| **2.** | Biofuels in India: Potential, Policy and Emerging Paradigms<br><br>S S Raju<br>Shinoj Parappurathu<br>Ramesh Chand<br>P K Joshi<br>Praduman Kumar<br>Siwa Msangi<br><br>April, 2012 | Biofuels are rising as an inexhaustible and eco-accommodating wellspring of vitality which could help in improving the independence in vitality and limiting reliance of a country on imported petroleum products. Towards this try, the Government of India has started a few projects to enlarge creation and utilization of biofuels during the previous decades or somewhere in the vicinity. The National Biofuel Mission, propelled in 2003, is the leader of such activities, with Ethanol Blended Petrol Program (EBPP) and Biodiesel Mixing Program (BDBP) as its fundamental segments. In these programs, determined, time-bound targets have been laid for mixing of 5 percent, 10 percent and 20 percent biofuels with petroleum and diesel in a staged way in order to catalyze the change from a totally non-renewable energy source based vehicle framework to a mostly biofuel-driven framework. | In India, nearly 70 per cent of the population lives in the rural areas and depends on agricultural and related activities for livelihood. Moreover, in the rural India, around 33.8 percent people still belong to the below poverty line (BPL) economic status. Food security continues to be a priority for the Indian government in all its developmental efforts. Even though India is self-sufficient in terms of food production, almost 50 per cent of the children and practically the same number of women suffer from protein calorie malnutrition in the country as judged by anthropometric parameters. Therefore, any large-scale biofuel programme has to ensure that it does not compromise with the food and nutritional security of the nation. |

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| **3.** | Emissions of SO2 and NOx from biofuels in india<br><br>Ranu Gadi,<br>U. C. Kulshrestha,<br>A. K. Sarkar,<br>S. C. Garg,<br>D.C. Parashar<br><br>8 Nov. 2002 | Concentrations of oxides of S and N in the atmosphere are strongly influenced by the emissions taking place from the burning of biofuels. This is particularly important in the developing countries where most of the energy requirement in the rural sector is met from biofuels. An experimental setup has been built to carry out controlled biomass burning and to derive emission factors for SO2 and NOx (NO and NO2) from various biofuels commonly used in India. Using these emission factors and the consumption data obtained from Tata Energy Research Institute's (TERI) Energy Data Directory and Yearbook 1998–99, the budget of SO2 and NOx from biofuels used in India has been estimated as 0.4 ± 0.3 and 1.0 ± 0.4 Tg, respectively, for the year 1990. | The evaluation of emission factors, based on the laboratory studies carried out on various biofuels, shows that SO2 emissions are lowest from bagasse and highest from dungcakes, while for NOx it is the opposite. Based on the annual consumption for 1990, the budgets for SO2 and NOx have been estimated as 0.4 ± 0.3 Tg and 1.0 ± 0.4 Tg, respectively, for biofuelscommonly used in India. |
| **4.** | An Assessment of the Biofuels Industry in India<br><br>Joseph B. Gonsalves<br><br>18 October 2006 | The current manufacturing cost of ethanol and biodiesel in India is about Rs. 21/litre ($0.46/litre), roughly the same as petrol and diesel. This puts biofuels in a favourable position for meeting India's energy needs, especially as the cost | The biofuels industry is poised to make important contributions to meeting India's energy needs by supplying clean domestic fuel. The ethanol industry is mature, but with efficiency improvements, the use of alternate crops and the |

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| | | of petroleum is expected to continue its upward trend. In addition to providing energy security and a decreased dependence on oil imports, biofuels offer several significant benefits such as reduced emission of pollutants and greenhouse gases and increased employment in the agricultural sector.<br>In India ethanol is produced by the fermentation of molasses – a by-product of sugar manufacture. India is the fourth largest ethanol producer after Brazil, the United States and China, its average annual ethanol output amounting to 1,900 million litres with a distillation capacity of 2,900 million litres per year. For a 5 per cent ethanol blend in petrol nationally, the ethanol required would be 640 million litres of ethanol in 2006-2007 and 810 million litres in 2011-2012. Current capacity can potentially satisfy this demand. | deployment of new technologies like enzymatic fermentation of cellulosic material, it can easily supply the ethanol requirements for 5 per cent or even 10 per cent ethanol blending. As for biodiesel, R&D work on high oil-yielding Jatropha seeds is complete and pilot projects for plantations and transesterification plants are under way. The industry is in the incubation stage, but large-scale Jatropha cultivation and the infrastructure for oilseed collection and oil extraction must be established before the industry can be placed on a rapid-growth track. In the meantime imports could help, as could income generated from the sale of certified emission reductions from biodiesel projects approved by the CDM executive board. |
| **5.** | Biofuels in India: Future Challenges<br><br>P. Shinoj, S.S. Raju, Ramesh Chand, Praduman Kumar and Siwa Msangi | Biofuels are globally considered sustainable and ecofriendly source of energy to enhance national energy security and decrease dependence on imported fossil fuels. During the past | The importance of developing a strong biofuel industry to tackle the challenges of energy security and fuel selfsufficiency has been widely acknowledged in |

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| | April, 2010 | one decade, Government of India (GoI) has initiated several measures to augment production and use of biofuels. The National Biofuel Mission launched in 2003 is the frontrunner of such efforts in the country. The 'National Policy on Biofuels' released in 2009, foresees biofuels as a potential means to stimulate rural development and generate employment opportunities, as well as aspires to reap environmental and economic benefits arising out of their large-scale use. The Policy aims at mainstreaming biofuels by setting an indicative target of their blending up to 20 per cent with petrol and diesel in the transport sector by the year 2017 (GoI, 2009). It is categorically mentioned in the Policy that the program is to be carried out based solely on the non-food feedstocks that are raised on degraded or wastelands not suitable for agriculture. | India. Even though the food versus fuel debate is quite relevant at the global level, it is largely irrelevant to the Indian biofuel production program due to the country's policy decision not to use any edible feedstock for bio-energy production. The National Biofuel Policy has been designed to harness the various environmental, social and economic benefitsarising out of large-scale development of biofuels in the country. However, the success of the program would largely depend on the readiness of the stakeholders and the government machinery to tackle the challenges that the program may face from time to time. It has becomeapparent that bioethanol production solely based on sugar cane molasses is neither economically viable nor sustainable in the long-run. |

## 3. Ethanol and Biodiesel:-

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.

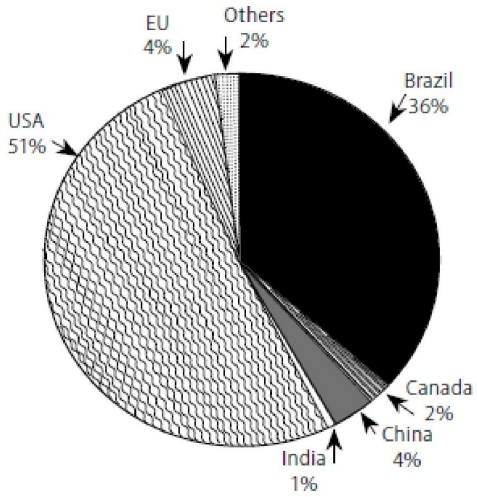


Figure 2: Ethanol production by country, 2008

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.[4],[7]

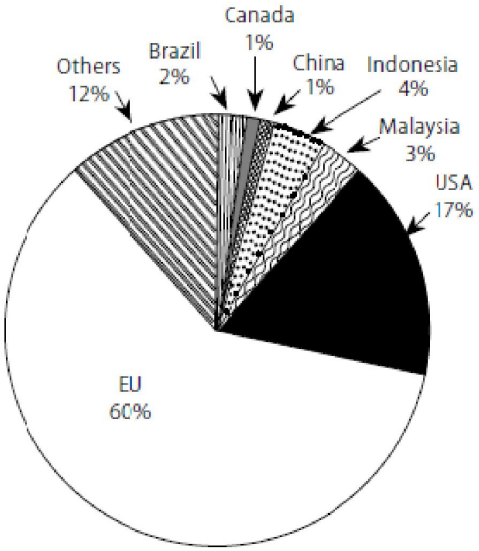


Figure 3: Biodiesel production by country, 2008

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. 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. [4],[10],[11] High production cost and overemphasis on one feed-stock also contributes to low production of biodiesel in India. Getting adequate quantity of wastelands is difficult because of its impact on forest conservation. [8],[9]

## 4. Emissions of $SO_2$ and $NO_x$ from Biofuels:-

Biofuels are used by more than 50% of the world's population as a major source of domestic energy (Boleij et al., 1989).[13] In the developing countries biomass energy use is predominant in rural areas, where it often supplies over 70% of the total energy requirements (Hall, 1991).[14] The major sources of biofuels are fuel wood, crop residues, dungcakes and charcoal. These are burnt in a variety of cooking stoves made locally to suit local needs. These are also burned in rural industries and in the urban service establishments. It is common to use bagasse in the sugar industry and rice husk in rice mills. India is experiencing rapid economic and population growth. It is estimated that by 2010 over four billion people will be living in the Indian sub-continent and eastern Asia. At current growth rates the Asian energy demand in general is doubling every 12 yr. Biomass is major source of energy in India, and 45% of the total primary energy consumption is based on biomass. The household sector is the major end user, consuming 83% of the total biomass energy leading to per capita biomass consumption of 380 kg for the year 1990–91 (Narang et al., 1999).[12] With the growing population and energy requirement the demand for biofuels will also increase. The use of fuel wood alone in India is predicted to increase by a factor of three from 1985 to 2015 (World Resources, 1993).[15] Increased energy use will result in a large increase of SO2 and NOx emissions leading to regional increase in precursors to acid deposition, tropospheric ozone and ambient aerosols. Developing an accurate and detailed picture of nitrogen oxide and sulfur dioxide emissions in India from biofuels serves multiple purposes.

## 5. Conclusion:-

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 Biofuel' 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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