National Biofuel Policy and Scope of Biofuels in India in Coming Future

Kanishka Jha[1], Dilip Dhakad[2*], Aaditya Ojha[3]

[a.b.c] School of Mechanical Engineering, Lovely Professional University, India -144411.

ABSTRACT

Burning of fossil fuels causes air pollution which in turn results in global warming. Global warming is responsible for the melting of glaciers, ice which finally results in the rise in sea water level which is a major threat to the island countries of the world like Maldives, Mauritius, Indonesia, Japan, India and many other developing countries of the world. So, in-order to overcome the problems like global warming, ozone layer depletion, pollution, emission of green-house gases etc. a number of research's have been carried out and are subsequently going on. The research's which had already been carried out tells us to minimize the use of fossil fuels and to switch towards alternative sources of energy such as solar energy, wing energy, geothermal energy, hydroelectricity, biomass etc. which are a pollution free and clean sources of energy. For a better future, there is a need of adopting better fuel policies which will help countries to curb with the problems of pollution, and increase in fuel prices and their dependence on countries producing oil thereby reducing their imports. Another method that can be used in order to curb pollution, reduce our dependency on oil producing countries, reducing carbon emissions is to develop bio fuels will are relatively less polluting and more eco-friendly.

Keywords: Biofuels, Biodiesel, ethanol.

1. Introduction

Energy can be described as the power produced or generated either via burning or combustion of fossil fuels like petrol, diesel, coal, kerosene, coal tar, etc. Or by means of soaking up the sunrays with the help of solar panels and so forth. In order to run industries, factories, vehicles, homes, automobiles we require energy which should be a clean source of energy to have positive effect on the surrounding environment. No doubt that most of the countries in the world produce energy by means of burning of fossil fuels which might be polluting in nature and as a result adversely affect the surrounding environment and own a risk to the fitness of human beings as a result ensuing in inflicting various fitness hazards.

Energy conservation law states that energy can neither be created nor be destroyed, it can simply be transferred from one form to another[1].

Energy can broadly be categorized into namely two categories i.e. Renewable and Non Renewable sources of energy. Renewable energy is that energy which can again be renewed and is generally non-polluting in nature whereas non-renewable energy is that energy which is non-renewable i.e. they cannot be renewed once exhausted and takes millions of years for their formation and are polluting in nature[2 , 3]. Fossil fuels are one of the largest sources of green house gas emissions which ultimately leads to the rise in earth's temperature, which in turn results in global warming and it also results in ozone layer depletion[4]. During the beginning of 20th century, model Ts, the child brain of Henry Ford were fueled with ethanol and peanut oil. Later, the discovery of petroleum deposits around the globe led to a decade of cheap and readily availability of gasoline and diesel. Meanwhile, biodiesel was completely neglected. However, nowadays with recent hike in global oil price along with global warming, the popularity of bio -fuels have been regained[4, 5, 6].

1.1 Objectives of Research

- Importance of bio fuels in coming future.
- How bio fuels are cleaner fuels?
- How they will reduce import and dependency on other countries?
- How can they be useful in a longer run?
- How production of bio fuel can generate employment?
- How the prices of petrol and diesel can be reduced?

2. Bio fuels

Bio fuels are suitable for cooking purpose and can be an alternative fuel option for automobiles as well. Byproducts obtained from biofuels are good fertilizers[8]. It also finds its application as a heating element in boilers. The benefit of bio fuels is that they are renewable and can easily be degraded and are completely derived from biomass i.e. organic materials. In comparison to other sources of renewable energy they are quite simple and easy to use. They also help in reduction of greenhouse gas emissions. Bio fuels do not add any extra carbon-dioxide into the atmosphere and thus helps in maintaining the level of carbon-dioxide in the atmosphere[9]. They can be used in the conventional petrol or diesel engines by just combining them either by petrol or diesel in the fuel tank. No special equipment or modification of the engine is required[10]. Being a quality fuel it

improves the performance of the engine and helps in cleaning the fuel system. It also helps in increasing the octane number and thereby reducing the harmful emissions. The other major advantage is that it is readily available and readily affordable. Its domestic production can create job and job opportunities in the market. Consequently, the dependence of fossil fuels on other countries will also be reduced. Bio fuels have a very promising potential. Thus it provides significant energy security and environmental advantages as compared to the traditional sources of fuel[11]. Liquids or gases such as animal fats, vegetable oils or solids such as wood, saw dust, domestic refuse, agricultural waste, charcoal, all can act as biofuels[12].

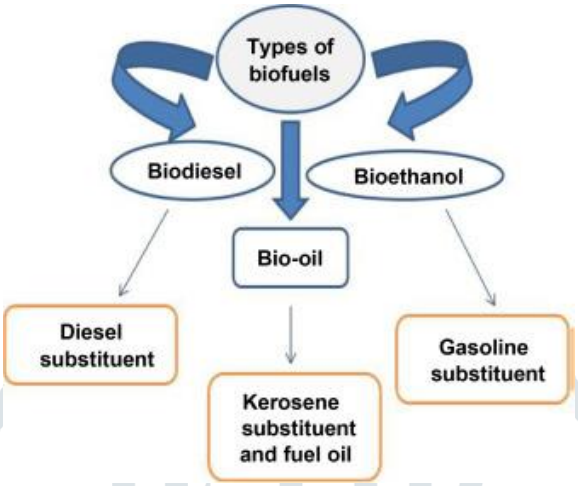

Figure 1. Types of Biofuels

2.1 Bio fuels are categorized as

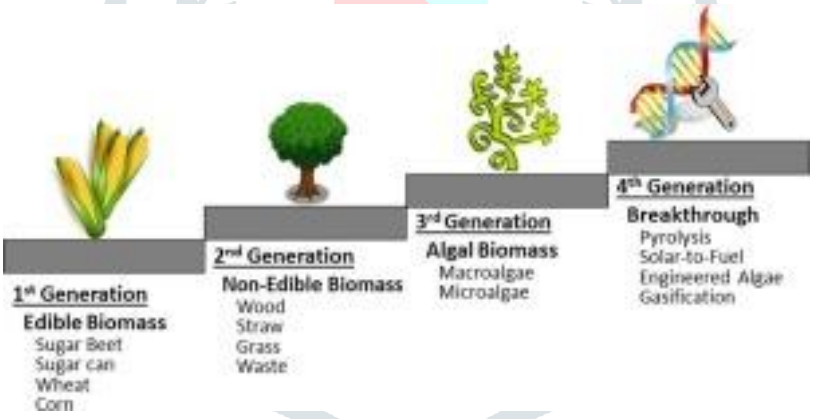

Figure 2. Generation of Biofuesls

1G bio fuels – bio ethanol, biodiesel and advanced bio fuels obtained from crop residue.

2G bio fuels – includes fuels obtained from non-food crops such as municipal waste[13].

3G bio fuels – bio CNG etc. – produced from algae and other microbes.

4G bio fuels – tapping CO_2 and hydrogen can be used for producing bio fuels[14].

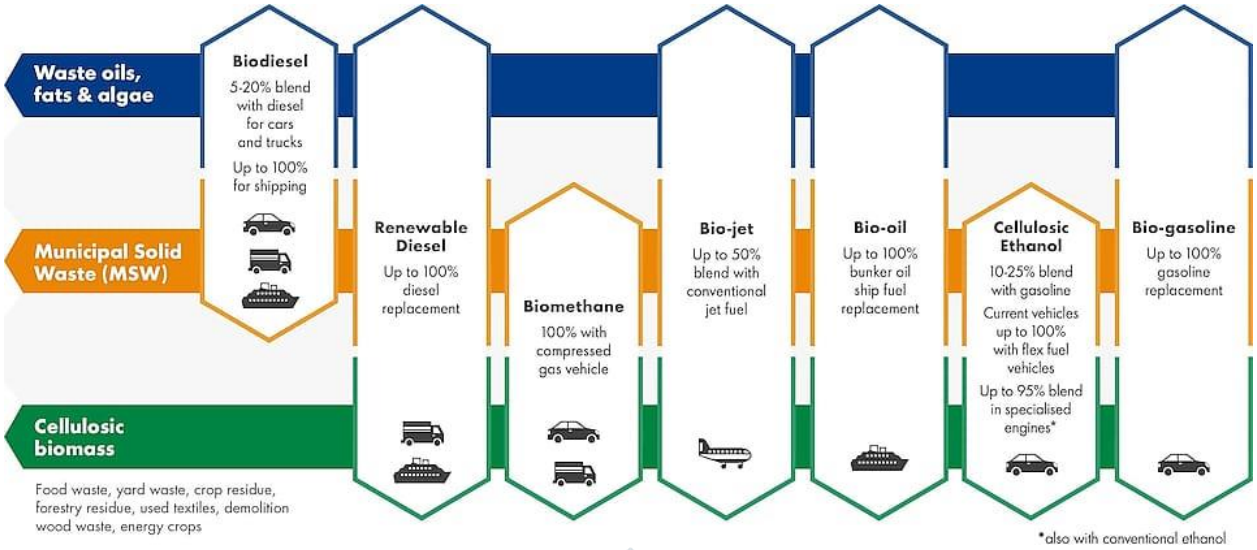

Figure 3. Life Cycle of Biofuels

2.2 Process involved in producing Bio fuels

There are a number of ways to produce biofuels. They can be produced using a process where starch is converted into sugar and further the fermentation of sugar takes place and is converted into ethanol. Post that distillation of ethanol into a form which can finally be used as fuel.

Ethanol one of the byproduct of fermentation can be produced by the process of hydrolysis wherein lignocelluloses found in the tissue of plants are used[15].

It can also be made via a chemical process known as trans-esterification in which the separation of glycerin takes place from fats or vegetable oil. It also leads to the production of two valuable by products – methyl ester which can act as biodiesel and glycerin.

There is yet another process which can be used to produce biofuels known as lash pyrolysis[16]. In this solid fuels are heated at around 500 degree Celsius for a short interval of time.

Biomass obtained from organic materials can be used to produce biogas by recovering Hydrogen from it and converting it to methanol or ethanol[17].

3. Ethanol as a Fuel

One of the biofuel widely used is ethanol. Ethanol is used as an additive to control vehicular emissions and to get a significant increase in octane number. Ethanol engines give slightly better power output as compared to traditional gasoline engines. Due to the smaller energy density of ethanol as compared to gasoline more fuel stops are required for ethanol fuel tanks for covering the same distance as compared to gasoline tanks. Brazil and America are two countries which use ethanol as a fuel and both these countries encourage the production of ethanol which is the main reason why they largest producer of ethanol[18]. Ethanol fuel is produced by the process of fermentation process of sugar present in corn, potato skin, wheat, sugarcane etc[1].

3.1 Typical Process Outline

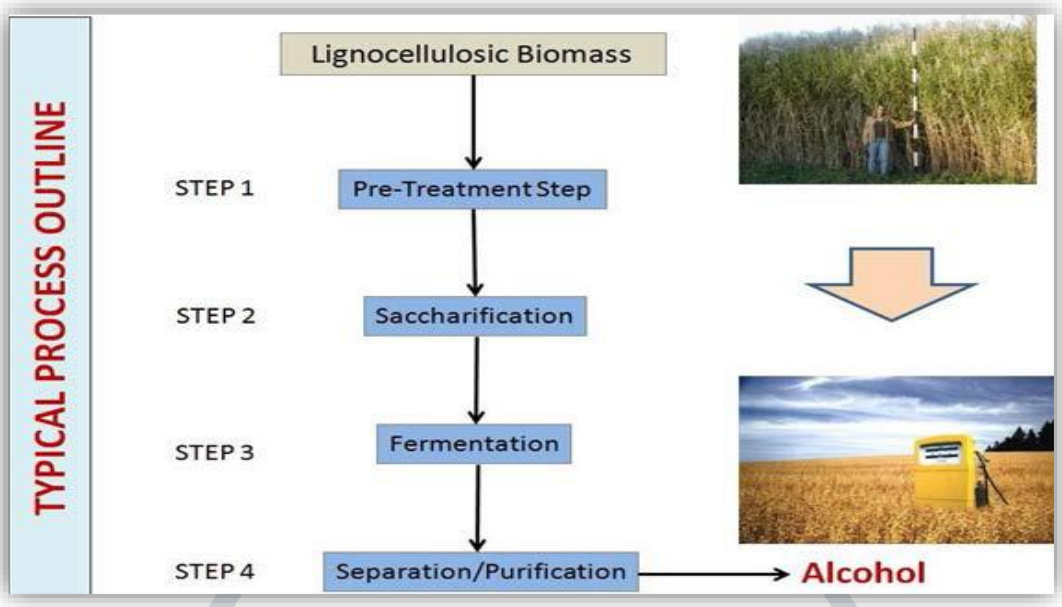

Figure 4. Process Outline

4. Biodiesel

Biodiesel is a renewable, clean and lower emission fuel in comparison to petroleum-based fuels like petrol and diesel[19]. It is easy to transport and handle as it is biodegradable. It can be made compatible with unmodified engines by just mixing it with petroleum engines emitting fewer toxic emissions. Biodiesel is widely used in European countries. It can be easily replenished by recycling in the farms as it is made from plants. Biodiesel and ethanol both are clean fuels and are locally and readily available sources of energy. Thus biofuels are socially and economically viable.

Biodiesel made from vegetable oils or recycled cooking oil just costs around Rs.55.

4.1 Steps of Making Biodiesel

Process of producing biodiesel from used cooking oil.

a) Firstly the oil is being stored in containers. This oil is unsuitable for cooking and biodiesel production purpose as it contains food and water particles in it.
b) Oil collected in the container is being taken by vacuum trucks for its refining.
c) This oil is then transferred into a holding tank wherein it is heated in order to remove the water content present in it. This water free oil is then transferred to a multi stage filtering process wherein it is treated to produce biodiesel.

5. Pros of Bio fuels

Bio fuels are environment friendly therefore the level of pollution will also be less. And we all know that the pollution is a major issue in all developing countries of the world. However, fossil fuels are depleting day by day and are non-renewable and cause tremendous polluting and thus affecting the environment and thus need to be used in a proper way. Therefore, we are moving towards alternative sources of energy that are renewable, less polluting or environment friendly. We are importing crude oil from gulf countries. In these countries civil war or war like situation continues as a result crude oil prices are fluctuating in the global market. If in the coming years we are having an option for alternate fuel then it is going to be beneficial for our country's economy. Oil that we produce within our own country is only one-fourth of our country's demand and so in order to meet this remaining three-fourth demand we import oil. Bio fuels result in less pollution. They result in less carbon emissions. The most polluting sector in our country is the automotive sector. The use of bio fuels has, therefore, become important in view of the tightening automotive vehicle emission standard to curb air pollution. When we will move from Bharat stage 1V to Bharat stage V1 then vehicle emission standards will further improve as a result the level of pollution

will subsequently reduce. But instead of shifting from BS V1 to BS V1 and so on, there is a need of developing bio fuels which can be very effective since they are less polluting and will be able to fulfill the desired requirements.

5.1Reduce import dependency

Nearly 80% of the crude oil we import in order to meet our fossil fuel demand or requirement. But we have an option like bio fuels, then we can do blending with conventional fuel as a result we can reduce our imports to a great extent. Blending is a good option. For example, if you are blending 100 ml ethanol in 1-liter crude oil then you are importing 100 ml less crude oil. If we are going to do blending of 1 crore liter bio ethanol then we are going to save nearly 28 crores of foreign exchange. Blending 150 crore bio ethanol with conventional fuel is going to save Rs 4000 crores foreign exchange. It will also result in balance of payment. It will also reduce trade deficit. Blending 1 crore liter bio ethanol with conventional fuel will reduce 20000 tons of carbon emission. Therefore, it is very useful for the environment.

5.2 Cleaner environment

Crop residues, waste material can also be used for making bio fuels. This will result in reducing the burning of crop residues. We know that burning of these crop residues or stubble burning causes huge pollution in the capital city of our country Delhi[20]. So, instead of burning these crop residues, the farmers will be able to sell their crop residues to nearby bio refineries and this will result in cleaner environment.

5.3 Health Benefits

Food processing industries involves the use of cooking oil in large quantity and most of the times the same cooking oil is reused again and again and if we reuse the same cooking oil multiple times then it can be harmful to our body, so to avoid this food processing industries can sell this used cooking oil to refineries. And this cooking oil can be used for biodiesel production.

5.4 MSW Management

Nearly 620 lakh tons of waste is produced annually in India as a result of which spreading of diseases takes place, level of pollution i.e. land, water, air pollution are rising. But this municipal waste can be converted into wealth i.e. electricity with the help of some kind of technology or you can also utilize this waste in the production of bio fuels.

5.5 Infrastructural investment in rural areas

Development of 2G bio industries or factories will lead to the infrastructural development and prosperity in rural areas. It will also result in employment generation. It will also result in infrastructural development. Additional income source to farmers.

10th august 2018 was observed as World Biofuel Day by The Ministry of Petroleum and Natural. Chief guest for its inaugural session was our Hon'ble Prime minister, Shri Narendra Modi. Speaking on the occasion he stated that "India is bestowed with abundant resources to produce biofuels, which are sustainable and eco-friendly". Keeping this in view its production and consumption should be encouraged in every way possible. The usage of biofuels has the potential to change the lives of all Indian citizens. After, that FSSAI started RUCO initiative to enhance collection and conservation of used cooking oil to produce biodiesel. According to FSSAI regulations, maximum permissible limits for total polar compounds (TPC) have been set at 25% beyond which the cooking oil is unsafe for consumption. As of today McDonald's is already making biodiesel from used cooking oil. In a report by PTI Vikram Oracle, director general of McDonald's India stated that his firm is capable of converting more than 35000 liters of used cooking oil to biodiesel each month, which directly or indirectly results in saving 420000 liters of crude oil a year. Thus, the fuel produced releases 75% fewer carbon content as compared to fossil fuels like petrol, diesel etc.

6. Cons of Biofuels

After all having all these advantages the biofuels have some disadvantages too.

- To increase biofuel production, more agricultural land is required[21].
- Biofuels are not presently accessible easily due to lack of infrastructural facilities and advanced technologies.
- Biodiesel usage can result in deposits of mounts on the walls of pipes and tanks, leading to fuel filter clogs when used for 1st time.
- Use of biodiesel may lead to the removal of automobile chassis paint eventually. This can be taken care by immediately washing with small amounts of soap and water.
- Biodiesel has the tendency to freeze at low temperatures thereby resulting in the freezing of fuel system and injection pumps. However, it can be taken care of by keeping it warm using some kind of additives in the oil.

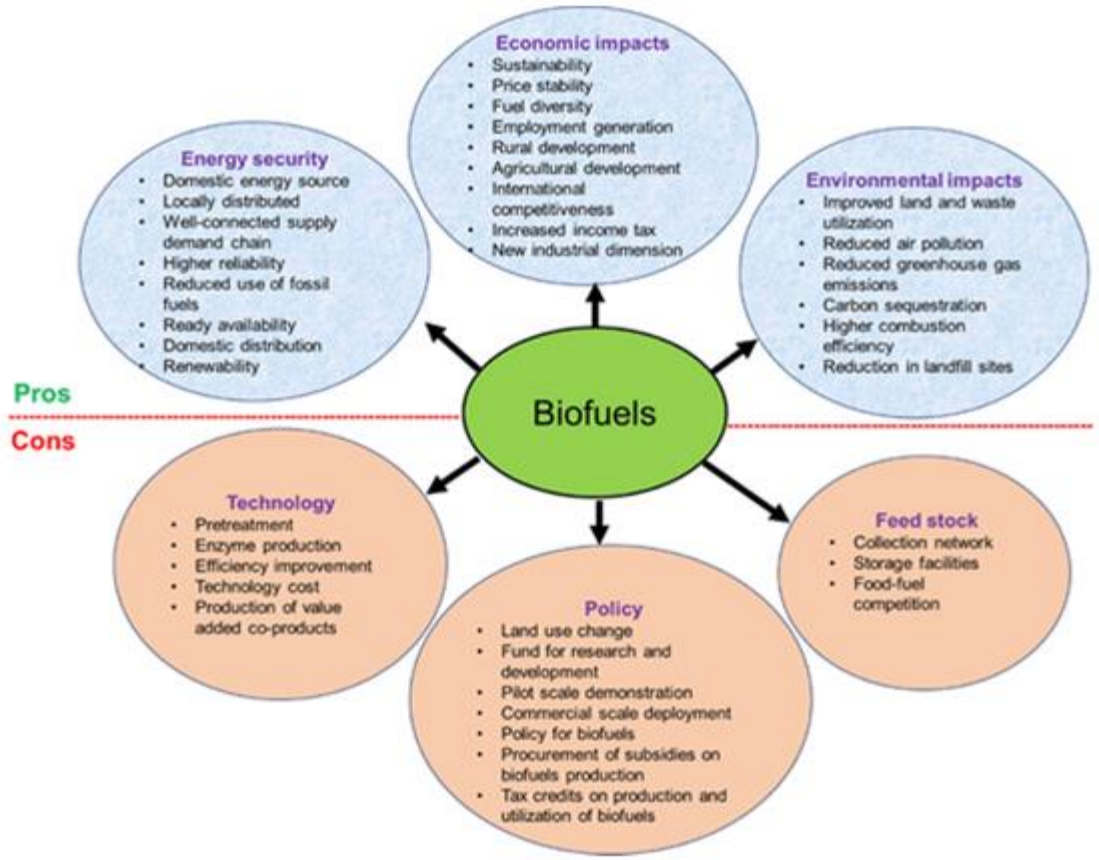

Figure 5. Pros and Cons of Biofuels

7. National Biofuel Policy 2018

The policy expands the scope and viability of raw materials for ethanol production by allowing usage of sugar containing materials like sugarcane, sugar beet, etc. and starch containing materials like corn, cassava, damaged food grains like wheat, etc. for ethanol production. The policy allows usage of surplus food grains for production of ethanol blending with petrol with the approval of the National Biofuel Co-ordination Committee. But there is a disadvantage too of this policy because if the farmers are getting better price for selling their crops in biorefineries, then they will prefer to sell most of their food grains to these refineries thereby affecting the food security[22]. With a push on advanced production of biofuels, the policy indicates the gap in the funding scheme for 2nd Generation biorefineries in addition to additional tax incentives and higher purchase price as compared to first generation biofuels. The policy encourages the setting up of a viable supply chain mechanism for production of biodiesel from non-edible oilseeds, Used Cooking Oil, short gestation crops etc[23].

7.1 Implementation Questionable

In Odisha – The fuel blending rate is 0%.

In Australia – 85%blended petrol

In Brazil – up to 100% blended petrol, whereas mandatory blending rate is 27%.

India - has an abysmal 2-4% blending rate.

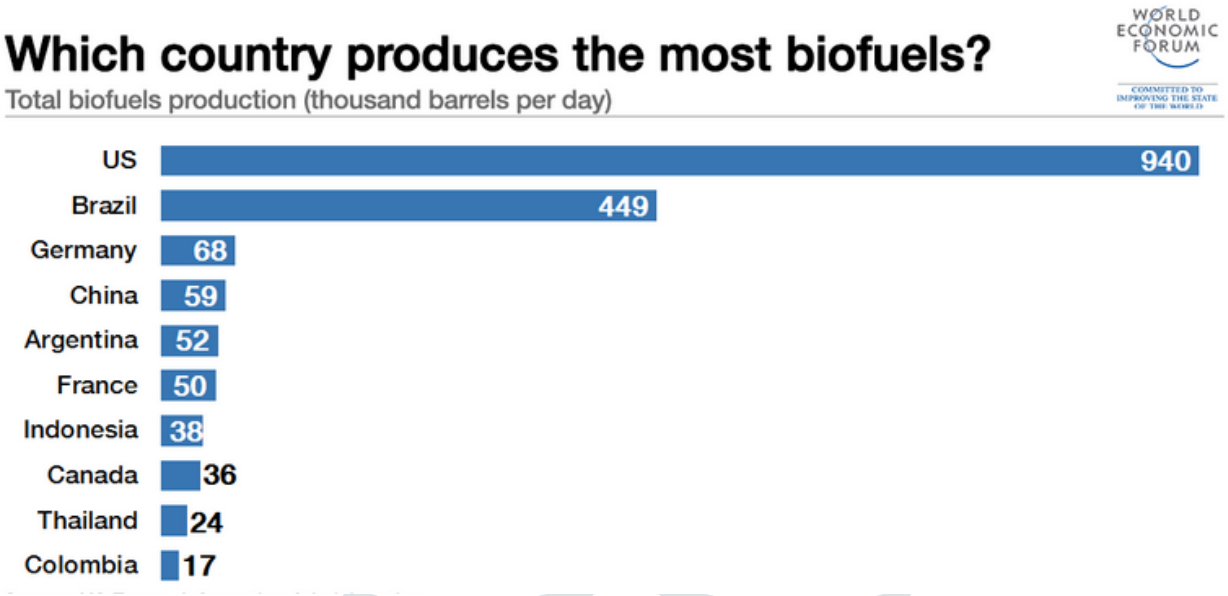

Figure 6. Trends in Biofuels Market

The priorities of the government in implementing the National Biofuel Policy were finding a solution to air pollution, maintaining affordable fuel prices, cleaner fuel options, energy self-sufficiency, and reduced crude oil imports. But there is no clearly defined road map for India. Moreover, in this policy, nothing was said about Octane Number. We know that more is the octane number, better will be the quantity of fuel and lesser will be the carbon-dioxide and carbon monoxide emissions and more will the efficiency.

8. Problems and Its Solution

We import most of our crude oil from Iran and recently US has imposed various sanctions on Iran and has warned other countries of the world to cut oil imports from Iran.

Same is for India. Therefore, instead of total dependence on foreign countries for crude oil we should find some way to reduce our dependence on crude oil and when we will reduce oil imports than our GDP will also improve and we will try to develop new technologies or techniques which could lead to the development of alternative energy fuels which could have positive impact on the environment. For example, biofuels which can replace fossil fuels and which will create employment opportunities within the country. This will also help us to eradicate unemployment. India is trying to promote biofuels to reduce our dependence on fossil fuels. On August 10, World Biofuel Day was organized in Delhi where Hon'ble Prime Minister Shri Narendra Modi released the "National Policy on Biofuels 2018".This policy describes biofuel as being produced from the renewable sources of energy and used as an alternate or in blend with diesel, petrol, etc. for transport and other applications.

The Indian approach to biofuels can potentially lead to conflict with food security. We know that biofuels are produced using food crops and if food crops are going to be used for producing biofuels then they are going to create an unbalance and will hamper the food and energy security. Non-food stocks should be raised on degraded or wastelands which are not suitable for agriculture, thereby avoiding a possible conflict of fuel and food security. The development objectives of our country focus on overall economic growth, equity and human well-being. The energy strategy of our country should aim at efficiency and security and to provide environment friendly access.

9. Main Objective of Using Biofuel in Flights

It is to make air travel economical and bring some respite to the airlines reeling under high fuel price through the use of alternate fuel[24].

India's 1st biofuel flight by SPICE JET from Dehradun to Delhi.

Aviation leaders are worried a lot over the rising fuel costs and have demanded the government to bring aviation turbine fuel under GST. GST on biodiesel is 18%. Therefore, the Biodiesel Association of India is demanding a drop on GST from 18% to 5% on biodiesel. Dear Prime Minister common man is grappling with skyrocketing fuel prices whose ambiguous policies and untested technology are being laid out.

2003- Ethanol blended petrol program (EBP) started with 5%blending of molasses-based ethanol with petrol.

2008- 10% blending target.

2009- National Biofuel Policy proposed a target of 20% blending for ethanol and biodiesel by2017.

10. Paris Climate Agreement

The Paris Agreement formally known as Conference of Parties (COP 21) is a global protocol on combating climate change[25]. It is world's first comprehensive regime and dialogue forum on tackling climate change within UNFCCC[26].

10.1 Why exactly do we need this?

We need it in order to avoid and minimize the worst impacts of climate change, such as severe droughts, floods and storms. Global sea levels are rising at an alarming rate and the world's ice-cap is melting. Sea levels have risen by 6-8 inches in the past 100 years. The level of water in sea and oceans is rising at a very fast rate, over the few years which are a major threat to the island countries of the world[27]. Moreover, the world's ice is melting at a fast rate which is also not a good sign.

10.2 How can the Paris Agreement Help?

The main purpose of Paris Climate Agreement is to curb pollution or to reduce carbon emission and to prevent the average temperature of earth from rising above 2^0 Celsius and if possible, to restrict it below 1.5^0 Celsius[28].

As per this agreement India is enforced to reduce the carbon emission by 33 to 35 percent of its total GDP by the year 2030 from 2005 level and this is possible only by shifting from fossil fuels to some alternate sources of energy which are less polluting in other words more ecofriendly like biofuels[20 , 21].

11. SDGs of India

In order to meet the sustainable development goals such as good health and well being, clean water and sanitation, affordable and clean energy, climate action, the country needs to shift from fossil fuels to eco-friendly sources of energy which are less polluting as well as renewable because these sources of energy cause minimal pollution and when the pollution will be less than then emission of green house gases like carbon dioxide, nitrogen dioxide, Sulphur dioxide, carbon monoxide will also be less thus will help in controlling the global warming[31]. Moreover, the diseases that are caused because of the pollution caused by the burning of fossil fuels will also be reduced such as asthma and other lungs related diseases.

12. Hubbert Curve

It is a graph that shows a point at which the global oil production would reach a maximum ('peak oil') and also the point at which we would ultimately run out of fuel[32]. After reaching the peak of production a time will come when the production of oil will start to decline and thus resulting in the increase in prices of fuels which will result in energy crisis[33]. Therefore, it is quite important for us to find an alternate to these fossil fuels. One of the alternates can be switching to biofuels.

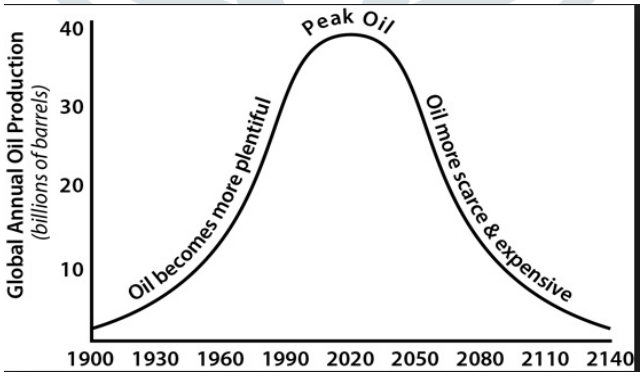

Figure 7. Hubbert Curve

13. CONCLUSIONS

Therefore this paper concludes that ethanol is a cost effective and less harmful oxygenate and be a sustainable option for expensive and harmful imported aromatics. The domestic production of 1st generation biofuels should be increased and encouraged while the technology to produce 2nd generation ethanol is developing and proving its commercial viability. These corrections in the policy will lead to lower fuel prices, cleaner air, foreign currency savings and efficiency in the oil economy. Moreover, use of biofuels will reduce our oil import dependence on foreign countries of the world and helping our country to overcome trade deficit. It will help our country to eradicate pollution caused to the burning of fossil fuels which is very