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Adoption and Barriers of Biofuels

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***Abstract*: The depletion of resources has led to the increase in demand of the renewable energy. Among the different sources of renewable energy bio fuel has considered essential due to various reasons like combating climate change, expansion of energy consumption, scarcity of resources and for maintaining the ecological sustainability. This paved the way for growth and significant rise in bio fuels. There are many purposes for biofuels considering as applicable technology for both developed and developing countries. As there are many technological opportunities for the adaptation of bio fuels there are also some hindrances for the growth of the bio fuels. The shortage of feedstocks, high production cost set up, difficult distribution facilities and fluctuation in market dynamics can be few barriers for the transition of the bio fuels. In this study, mainly focus on the different opportunities for the adaptations and barriers faced by the implementation of bio fuel.**

***Keywords*: Biofuel, Opportunity, Transition, Barriers.**

1. Introduction

The depletion of resources has led to the increase in demand of the renewable energy. The continuous urge to develop a substitute for fossil fuel is growing every day, which paved the way for the significant need, growth and rise in the bio fuels. The bio fuel has considered essential source of energy due to reasons like combating climate change, expansion of energy consumption, scarcity of resources and for maintaining the ecological sustainability. The extended usage of the fossil fuels has resulted in increased level of greenhouse pollution. The transportation industry is one of the main sources for this cause that produce Co2 emission and accelerate global warming. Today, fossil fuel provides 98 percentage of the total energy consumed in the transportation sector [Liew, W. H; Hassim; M. H; Ng, D. K. S].

Bio fuel refers to those solid, liquid or gaseous fuels that are made from the bio- renewable feedstocks. The two substitutes that can be used instead of fossil fuels are bio-diesel and bio ethanol. These substances can be produced from the food crops like sugarcane grains, potatoes, sorghum, vegetable oils, recycled waste vegetable oils and animal fat.

In the current scenario, biofuel is considered one of the potential alternatives for fossil fuel that helps to reduce the emission level of the pollutants and also helps in maintaining the environment sustainability. Due to its similarity in source of energy and the chemical structure with the fossil fuel, the bio fuel is remedy to lower emissions of greenhouse gases and wide range of availability of feedstocks [Leduc, S.; Natarajan, K.; Dotzauer, E.; McCallum, I.; Obersteiner, M].

The biofuels can be considered as applicable technology for both developed and developing countries as there are many economic opportunities for the rural population that helps to strengthen the economy. For the developing countries that import oils, adopting the bio fuel is a feasible decision to revitalize their economy and also to provide job opportunities in the rural areas. Thus, the bio fuel is important as it is a clean and sustainable source of energy fuel that is a necessity for protect the environment from the air pollution and green house effects. There are studies also analysed that includes different types of barriers for the development and implementations of biofuel industry in the market, financial and technical nature and also due to non-technical issues [Xie, Y.; Ben-David, Y.; Shimon, L.J.W.; Milstein, D] [McCormick, K.; Kåberger, T].

2. Literature Review

1) (Karl R. Rabago) - "A review of barriers to biofuel market development in the united states" says that there is number of barriers to the biofuel and they talked about the different barriers and mechanisms and how they overcome across those barriers, the first one is feedstock, in this it is extracted from the crop that is produced annually, and the availability of this is very limited, the availability of feedstock and current use patterns have impacted the biofuel markets but the biofuel feedstock have less energy than the fossil fuels , where in the fuel manufacturing segment they face only fuel price volatility but also the risk associated with the prices for feedstock.

The other barrier is technology, in this to develop a corn plants which takes more time to get the processing to reach the acceptance levels, even after it is developed to adopt to new technologies it has to be effectively distributed to the marketplace and do the practical demonstration before it can becomes acceptable.

2) (Jay J. Cheng, Govinda R. Timilsina) - "Status and barriers of advanced biofuel technologies" says that the development of biofuel from renewable resources leads to the sustainability of world's economy and climate change, this article mainly talks about the second generation of biofuel technologies including bioethanol from lignocellulosic materials and biodiesel from microalgae, the conversion of lignocelluloses to ethanol involves steps namely Pre-treatment, hydrolysis and fermentation, this article talks about the conversions of cellulose materials into different form and can be cost effective technologies can be used to convert the sugars into ethanol

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which in turn used as substitute for the fossil fuels.

3) (Masjuki Hj. Hasan, Md. Abdul Kalam) - "An overview of biofuel as a renewable energy source: Development and Challenges" says about the use of biofuel cause problems which is associated with the usage of automotive engine compatibility in long term operation and also food security issues that stem from biofuel production from food-grade oil seeds. It also talks about the problems associated with the biodiesel engine in which it has issues like damage on fuel line parts, metal corrosion due to the acid value and methanol in it. In this article they also talked about the palm oil which is rapidly grown in forest areas but there will be required more palm plantations in order to meet the demands and does not affect the forest reserves and the environment, due to use of biofuel some researchers found that it causes less emissions form the engine and due to use of palm oil where the electricity production has been reduced in comparison to coal based electricity.

4) (Peter Oosterveer and Arthur P.J. Mol) - "Biofuels , trade and sustainability : A review of perspective's for developing countries" says that they are aiming to provide an overview of state-of-art biofuels trade from developing countries with special emphasis on issues of access and sustainability and also they mention about biofuel policy and the some of the international initiatives for sustainability certification and labelling of biofuels, in biofuel policy they mentioned about the difficulties of reaching different countries for many agricultural products is complicated and for the production of biofuel and its very costly to import and it has tariff to pay for imports , for some countries there is certain limitation to have access for the imports and exports of bioethanol and biofuels and there is high cost of feedstock and fixed quantity of conversion happening across the countries. There is concern about the market protection by developed countries, they concern about the producing of biofuels, and demands for security food production and all the conditions are preventing the biofuel from keeping apart and this talks about the various issues of stakeholders and developing countries and they emphasis on issues like trade barriers and sustainability relevant for developing countries.

5) (Sudip das) - "The National policy of biofuels in India" says that the policy allowed the sugarcane juice and other materials related to sugars are used for the ethanol production and the policy also seeks to promote the R & D across different phases of biodiesel and it also allows foreign direct investment in biofuel sector and this is approved only for domestic consumption, in the ethanol blending petrol programme they linked with sugarcane production as primary feedstock which in turn produces ethanol, the government amended the sugarcane control in order to reduce the huge loss in sugar prices and production cost it allowed to generate ethanol and government fixed prices for ethanol, through biodiesel blending programme got affected due to lack of sufficient feedstock with some percentage of GST. The use of food grains as feedstock for biofuel to other nations resulted in reduced economic efficiency. The higher funding and incentives proposed to 2G ethanol production in National policy on biofuels to 1G ethanol also as majority of the ethanol production happens through 1G. This paper talks about the biofuel policies and features of NPB and the programmes related to BBP and EBP has given attention to the usage of different sugarcane materials that is converted to different forms of biofuels.

6) (Nelson Abila) - "Biofuels adoption in Nigeria: A preliminary review of feedstock and fuel production potentials" say about the harnessing and producing different types of crops that yield feedstock and Nigeria is the major producer of palm oil and groundnut which is high yield of biofuels, the crops grown are used for generating electricity and the charcoal is used as substitute for biofuel, the Nigeria currently uses the biofuels such as fuel wood, charcoal as well as bioethanol, there are different biofuels which in turn produced bioethanol and biodiesel by using crops, production and palms that are significant in Nigeria, further the Nigeria has crop production and processing of biofuel that has significance effect on economic change, environmental change and political and social change, these are mainly focussed on food and crop production and the needs to capture the energy consumption and that drives the reduction in fossil fuels and maintaining the environmental aspects that caused by production of biofuels feedstocks results in significant change in arable lands and agricultural needs and there is successful implementation of policies and decision making process are designed and focussed on harnessing the biofuel potentials in Nigeria

7) (Shabbir H. Gheewala, Beau Damen and Xunpeng Shi) - "Biofuels: Economic, environmental and social benefits and costs for developing countries in Asia" talks about the perceived benefits like reduced greenhouse gases, improved energy when compared to the fossil fuels and the economic development especially in the rural areas, the dependency of fossil fuels is reduced and there is more usage of biofuels generated within the countries and kept as national energy security and reducing the imports of fuels and energy sources, this article also talks about the reduced GHG emissions and also its cost efficient to reduce these gases by using bioenergy, and by more usage of bioenergy there is lot of rural employment growth happened and that increases the rural income and improve their living conditions, and there is lot of constraints in producing the biodiesel and bioethanol in terms of agricultural characteristics, location and climate change and the government also helps by providing support prices and by giving tax incentives to improve the financial viability for biofuel projects, even though biofuels viewed as threat to food security but it also leads to improved productivity in agriculture over the long term with rural benefits and livelihood.

3. Barriers of the Bio Fuel

The development of bio fuels from renewable resources is vital to maintain the sustainability the global economy and also to slow down the global climate change. Bio fuels is called as "alternative energy" as it is one of the important aspects of growing interest in present scenario. Currently, a significant amount of bioethanol and biodiesel are produced as biofuels to partially replace gasoline and diesel, respectively, in the transportation sector worldwide.

However, these biofuels represent a tiny portion of the total

fuels consumed.

From the following above literature review, there are multiple factors identified for the need and also some of the barriers for biofuels to penetrate and to flourish in the fuel industry. Biofuel markets have advanced significantly from the end of the last ten years, which denoted a defining moment in interests in 1G (bioethanol plants utilise sugarcane juice and molasses, by products in the production of sugar, as raw material).biofuels yet additionally a beginning stage for expanding interest in 2G innovations .Interest in the particular obstructions for the 2G biofuel(while 2G plants utilise surplus biomass and agricultural waste to produce bioethanol)industry has become as of late as experience of the victories and disappointments of the primary treatment facilities has begun to gather.

Some of the important obstacles that affects the implementation and flourishment of the bio fuel are as follows:

A. Difficulties in mobilizing feedstocks

There are many challenges faced due to the mobilizing various feedstocks like absence of established logistics infrastructure, storage of the feedstocks and

Transportation of them from remote regions. The quality, consistency and homogeneity of feedstocks are important factors to meet its standard level. The high pre-treatments and economic competing uses (demand from various other sectors) result in higher feedstock prices.

The stakeholders identify the most crucial barriers related to feedstock supply is the lack of clarity about environmental constraints. The absence of harmonized regulations on sustainable farming practices for residual biomass and dedicated energy crops is another difficult challenge for the yield. The high cost of feedstock and lack of harmonised regulations on sustainable forest management all result as a major barrier for the accumulation of the feedstock and development of the bio fuels.

B. High production cost set up for the advanced biofuel technologies

As stated above the bio ethanol is produced from the sugarcane and corn whereas bio diesel is produced from the crop and plant oils. The production of these raw materials is limited due to availability of the land. However, it is unrealistic to increase the bio fuel production using the limited feedstock, instead it is feasible to adopt advanced or 2nd generation bio fuel production technologies.

The 2nd generation biofuel technology includes producing the bio ethanol from lignocellulosic materials and bio diesel from microalgae are potential to replace fossil fuel in future. These advanced biofuel technologies produce the fuel with zero or less co2 emission to the atmosphere. The limitations for the production of 2nd generation bio fuel technologies are mainly due to high production costs. The high cost for the penetration and treatment of enzymes in different process of conversion of the biofuel is a major challenge. Hence cost efficiency methods should be considered for the adoption of the advanced technology in bio fuels [Jay J. Cheng, Govindudu R. Timilsina]

C. Lack of competitive pressure

The previous studies show positive relationship between the competitive pressure and the environmental practices [Dai, J.; Cantor, D.E.; Montabon, F.L] [Sharma, V.K.; Chandna, P.; Bhardwaj] But according to [Zalini et al] discovered that the existence of over competition in the Malaysian transportation industry and price is an important role that provides numerous alternative choices for fuels. This proves that using bio fuels instead of fossil fuels is costly. The lack of competitive pressure has a negative effect and discouraging factor for the adoption of bio fuels.

D. Distribution and end use within transport sector

The top priority barrier listed by the stakeholders regarding the distribution and end-use within the transport sector are the structural financing mechanisms to bridge the price gap between renewable and fossil-based fuels. The high production cost of RES (Renewable Energy Sources) fuels in comparison to fossil fuel costs is another important barrier for the flourishment of bio fuels in the market. The fossil fuels still receiving subsidy that attracts the manufacturers and consumers. The manufacturers unwillingness to change from fossil fuels to bio fuels is also another important challenge for the growth and development of bio fuel. Due to the reasons like Insufficient availability and slow development of refueling infrastructure the production of bio fuel has limited possibilities (Godfroij et al. 2008). The High costs of constructing refueling infrastructure, or convert existing infrastructure and High-RES fuel price at the pump when compared to fossil fuels are some of the hindrances for the growth of the bio fuel in the market. The Lack of customer/manufacturers awareness and market acceptance all constitutes as a barrier for the extension of the bio fuels. (Godfroij et al. 2008).

E. Technological barriers

The savvy biofuels creation from biomass relies upon the effectiveness of cellulolytic parasitic catalysts and biofuel maturing strains that can age various kinds of sugars (6-carbon and 5-carbon). Accordingly, the improvement of trend setting innovations and such original strains through hereditary designing should be additionally refined and created to work with and resolved these issues. Honestly, biofuels delivered from energy crops and microalgae appear to be the most proficient and alluring arrangement. It should be examined or grown further to improve biofuel creation utilizing hereditary designing on a bigger business scale.

The technologies that exploit mainly the cellulose part of lignocellulosic biomass with very basic lignin utilization (e.g., as a fuel itself) result in low overall efficiency. They do not sufficiently exploit the potential of all fractions of biomass that would help them cross a respective profitability threshold and make them more attractive as a whole.

There exist limited conversion efficiency in production of bio fuel and challenges to design the bio refineries with multiple products (i.e., not only producing a dedicated product-fuel).The main challenges are related to the integrating conversion technologies into existing (petrochemical) process (includes

very high costs of renewable hydrogen) This is both a technical and economical challenge, since such bio refineries need to be somewhat flexible with respect to their production mix to address challenges from the economic environment (i.e., logistics, prices of fuels and co-products).

4. Overcoming the Barriers: Why?

A major barrier to biofuel production is the high capital investment requirement of the commercial production facilities. The Capital costs for building lignocellulosic bio refineries vary by the choice of feedstock, the conversion technology, and the size of bio refinery. Owing to very high capital costs, there are considerable financial barriers to RES fuels development and deployment. High capital investment requirements combined with risks experienced during the emergence RES fuels restrict access to project finance. Likewise, there is limited financial support for research, development, demonstration and early deployment activities pose a barrier as these are needed to reduce some of the risks experienced during the emergence of advanced fuels. Addition of, continued subsidy support to fossil fuels (including tax breaks to reduce the price of diesel) (Gençsü et al. 2017) and exclusion of external costs result in low fossil fuel prices. That results in more in the flourishment of fossil fuels than the bio fuels. In addition, low oil prices have been a major barrier to the competitiveness of the biofuel industry this discourages investments in the biofuel industry.

How:

The dedicated targets and incentives to advanced fuels will be essential for innovative technologies with high risks and high capital expenditures. In addition to that, only long-term and stable policy support will be able to create sufficient investor confidence in investing in these technologies. The Past experiences have shown that many European projects have been delayed as a result of policy uncertainty. The Regulatory RES fuels require dedicated policy support (in the form of dedicated targets and incentives). The need for long-term and stable policy support to provide stability and security for the industry (including pricing and regulation of competing fossil fuels) will help to overcome the difficulties and barriers in the bio fuel industry.

5. Suggestions

The development of new bio-fuels technology is mainly focused on the use of abundant biomass feedstocks that can be produced without the harm to the environment.

The necessary measures should be adopted to prevent the deterioration of land use for bio-fuels production through monoculture utilization. Feedstocks which require minimum water that can be promoted.

By giving subsidies and tax reduction for the bio-fuels we can promote it and that leads to the economic development

More financial support is needed for the biofuel technologies to make more advanced biofuels bio-based products, Investment should be promoted for technology in order to increase the process and efficiency that results in good utilization of technology in bio-fuel production.

By leveraging the regulations and policy on biofuels that will lead to more economic benefits such as reduction of agricultural surplus stock, and dependency of imported oil and sustainable agriculture.

6. Conclusion

In Conclusion, Bio-fuels remain as key solution as a substitute for the fossil fuels. The different set of barriers of biofuels include Limited Feedstock, Distribution cost, Competitive pressure and technology. The feedstock costs are most significant and it cost even lesser than the Crude oil prices but it contributes to production of bio-fuels to some extent considering the land usage, agricultural by-products and availability, there is huge competition for the fossil fuels and bio-fuels in terms of pricing, but biofuels give more yield when compared to the fossil fuels.

The government should also ensure that it has policies that supports the bio-fuels, which in return enhances the energy security. It also makes policies that reduces the risk and uncertainty of volatile feedstock and energy prices. It also should subsidize the tax credits and other preferential taxes to overcome the higher cost of bio-fuel production relative to the fossil fuels.

Biofuel production will likely be most profitable and environmentally benign due to the technological advances and efficiency gain by higher yield that could reduce the economic cost and environmental impacts of biofuel production.

By overcoming of all the barriers, and support from the governments the biofuels can have higher production and share compared to the fossil fuels which results in increased usage of biofuels.

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