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ENERGY, ECONOMIC AND ENVIRONMENTAL IMPACT OF PALM OIL BIODIESEL IN MALAYSIA

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ABSTRACT

Malaysia is among the lushest places on Earth with nearly countless varieties of flora and fauna residing within it. An interesting one being the palm oil tree, a stereotypically tropical sight. A specific variety of it known as Elaeis, is used to extract palm oil from it. Apart from being a nutrient rich vegetable oil consumed by people as an edible, it is also used to a lesser degree for refinement into biodiesel for energy. A tree so abundant in Malaysia and has the potential to be a viable energy source is definitely something that needs a closer examination of on its potential. Which is what this study aims to do.

KEYWORDS

Palm Oil Biodiesel, Renewable and Sustainable Energy, Energy; Economic, Environment.

1. INTRODUCTION

1.1 Background of the Study

The requirements of energy in the Twenty-First Century have skyrocketed as to drive nations to look for alternative and sustainable energy requirements. As Malaysia continues to develop, its energy requirements have also predictably increased. However unfortunately non-renewable sources such as coal are the primary providers of energy in Malaysia with a consumption rate increasing by 10.8% per year. Based on a study, while natural gas being a close second, also increasing at 7.3% [1]. Clearly the ever-greater increase in consuming non-renewable fuels cannot be sustained due to their eventual depletion and negative impact on the environment.

Clearly it is for the benefit for all around the world to look for renewable energy sources so that the demand for energy can stay in sync with the supply. Renewable energy sources have gained great prominence throughout the world as from 2006 to 2016, the energy generation from renewable sources has doubled worldwide. According to research, modern renewables, such as wind, solar, etc account for approximately 10.2% of the world's energy and interestingly traditional biomass used chiefly for eating and cooking in remote, rural areas of developing countries and is equivalent to 9.1% of the total consumption [2].

Palm oil can be harvested not only as an edible but also as biofuel. For Malaysia this is an ideal situation. Study showed currently 14% of Malaysia's entire land is planted with oil palm plantations [3]. It is obvious that if Malaysia is to one day become the front-runner in global renewable generation, it is vital to understand one of its key biofuels and how its usage could impact the energy sector, the economy and the environment. Needless to say, non-renewable energy is in limited supply. Due to the exponentially growing energy needs of the global population it is absolutely vital for the human species to look towards a renewable and sustainable energy source. A biofuel such as palm oil may have potential to be harnessed as a biofuel, ultimately alleviating the energy crisis.

Therefore, the overall objective of this study is to identify the pros and cons of using palm oil as a biofuel. Specifically, the possible energy gains or losses relative to traditional diesel fuels, the possible effects it may have on the economy and whether it can be harvested without undue damage to the environment.

2. ENERGY IMPACT

As palm oil is derived from a plant, it has the potential to be truly sustainable and renewable unlike other energy sources that deplete over time. Biodiesel has been used in Malaysia since 1996 and has been an established diesel substitute. Malaysia has been testing biodiesel in vehicles, particularly one known as B5 which contains a mixture of 5% biodiesel from palm oil and 95% conventional diesel [4]. A comparison of biofuel against diesel fuel will be discussed further in the next section.

2.1 Comparative Analysis of Biofuel against Diesel fuel

The merits of B5 (also known as Envo-Diesel) as purely a biofuel may rival those of traditional Diesel fuel. Whilst comparing it with diesel fuel, biodiesel has greater oxygen content, reduced volatility and a higher viscosity, but has a narrow boiling range [5]. Also, it is completely soluble in diesel fuel which allows it to be mixed in any ratio with it. According to research, it has been demonstrated that biodiesel can be used as an alternative to diesel without modifications in a Variable Compression Ratio engine, granting nearly equivalent performance [6]. A 2011 study compared the use of palm-oil biodiesel versus diesel in cars, and it showed that B5 produced slightly lower brake power than ordinary diesel, less CO, HC, Nox emissions, and slightly higher CO2 emissions [7]. In the case of gains from production, biodiesel is produced with yields of 90.4%, with laboratory analyses showing the quality to be acceptable by some common biodiesel parameters [8]. A scholar said the metric used to asses energy performance or palm biodiesel is the NER and Renewability both of which show that the production of biodiesel leads to a noticeable net energy gain, allowing an opportunity to help reduce the dependency on fossil energy [9]. Therefore performance-wise Palm-Oil Biofuel is almost evenly matched with diesel fuel in terms of performance.

2.2 Possible Future as an Energy Source

Presently palm oil biodiesel may be seen as a viable substitute for traditional diesel fuel. However unfortunately it is just that, a viable substitute with no practical measures taken to ensure its harvesting and production meet the ends of energy production. While palm oil on its own will not eliminate the need for non-renewable form of energy, it will

definitely allow Malaysia for a lesser reliance on it and serve as a noticeably better alternative.

3. ECONOMIC IMPACT

A renewable and sustainable source of energy has great potential to benefit an economy. However, once the feasibility is laid out several factors may help or hinder such a cause. In the case of using palm oil as biofuel there are yet some hindrances that need to be addressed.

3.1 Current Economic Situation

As mentioned previously Malaysia has a colossal supply of oil palms. Based on a research, palm oil export for Malaysia in 2016 accounted for RM 67.6 Billion in Revenue [10]. However, its use as biofuel has posed some economic problems. Many studies have shown that it is not yet economical to use palm oil as fuel. The industry has faced setbacks as the cost of raw materials has consistently been too high. Some reasons for the overall high price of extracting palm oil include, the cost of the land for planting and harvesting, fuel used in machinery for cultivation, labour costs, processing costs, etc. Currently the production cost of oil palm is five times higher than rapeseed and ten times higher than soybean [11]. According to a study, the profitability of the biodiesel industry is greatly dependent on the price of crude palm oil relative to crude oil, which unfortunately has not boded well for palm oil, with the price of the former being higher [12]. However, there is some potential for economic advantage in the future. Assuming the B5 biodiesel mixture becomes the norm, only a 5% mixture of palm oil with any type of diesel available in the country can theoretically create demand for 260,000 tonnes of palm oil production. A simple calculation reveals that this is equivalent to a revenue of approximately RM 520 million per year.

3.2 Economic Future

Recently there has been a surge in palm oil prices due to the food vs fuel debacle, making it more expensive than regular diesel [13]. Since palm oil has two-fold uses, as food and for fuel, the debate has raged on as to which one should be given priority over the farmland. This has indefinitely stifled further growth of palm biodiesel as the high prices and lack of a sizeable market for biofuel has stunted any economic effects that could be observed. It is vital for the biodiesel sector to grow so that corporations and farmers are incentivized by the markets to divert more of the quota from palm oil production towards biofuel, giving a good reason for its use.

4. ENVIRONMENTAL IMPACT

The cultivation of palm oil can be thought to have a mixed relationship with the environment. Traditionally the widespread use of palm oil has resulted on one hand, grave damage to both flora and fauna whilst harvesting it, however on the other hand its uses a biofuel may potentially result in an overall positive impact due it being a renewable energy source.

4.1 Advantages for the Environment

The foremost advantage needless to say is the simple fact that this energy source is renewable, meaning it can be produced indefinitely given the optimal circumstances. Apart from the title of renewable there are measurable benefits of using palm oil biodiesel that have been observed towards the environment such as the emitted levels of CO2, CO and THC, which are common greenhouses gases, being significantly lower compared to the combustion of regular diesel [14].

4.2 Disadvantages for the Environment

The major disadvantage of the palm oil biodiesel industry is deforestation, which will ultimately impact the whole of the ecosystem. The surge in this industry has resulted in vast expanses of trees being ripped for the purpose of palm oil extraction. This has also negatively impacted animal habitats, particularly of the orangutan, an endangered species which has greatly been reduced due to this industry. Based on a research, it has also been shown that there are higher NOx emissions for palm oil relative to ordinary diesel [15]. It has also been shown that release of some gases such as ammonia and some oxides of Nitrogen can cause acid rain, a problem faced by traditional fossil fuels as well. Finally, the agricultural procedure of harvesting oil palm, especially with the use of fertilizer, may cause eutrophication which can deplete oxygen levels in lakes and rivers.

4.3 Overcoming the Disadvantages

The number one way to curb the many disadvantages is sustainable forest management. According to a study with a greater emphasis on sustainability and best management practices for growing crops, there can be a reduction in the damage by deforestation and has the potential to revive forest areas and protect habitats [16]. It is also wise to utilize the by-products from palm oil production. It has been shown that there are no net GHG emissions from the use of fuels in palm oil mills when the palm oil mill by-products are efficiently reused. These measures may ensure that the damage posed to the ecosystem is minimized.

5. CONCLUSION

Palm oil has immense potential in Malaysia to serve its ever-increasing energy needs. However, that potential at the moment is difficult to realize. There are great barriers still ahead for palm oil biodiesel to become a widely used fuel. Unlike other renewable energy sources, biodiesel while being prominent in rural communities, has not proved its usefulness in a global landscape. It is clearly far more efficient to use fossil fuels presently compared to palm oil. Some reasons are higher costs of extraction relative to fossil fuels, limited present demand for biofuel, similar but not exceptional performance relative to presently-used diesel and only slight environmental protections granted by it. Perhaps there is need of a technological breakthrough, either in the refinement of crude palm oil or in the design of techniques to harness this fuel far more efficiently. In either case, there have been very limited studies conducted to properly assess in-depth a feasibility into palm oil being used as biodiesel. It is evident that much more research needs to be conducted to properly understand how to harness one of Malaysia's most abundant crops.

However, it may be that one day the extraction process may be made exceedingly cheap due to a technological breakthrough. Or perhaps a new type of engine is designed to efficiently extract energy from this fuel. In any of these cases the recent modern inundation of electric cars may just be followed by a surge of newly developed biofuel-powered vehicles, from which Malaysia may reap immense and immeasurable gains.

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