Palm oil biodiesel: a source of renewable fuel

The demand of increasing price in fossil fuel has prompted the global oil industry to look at the alternative sources of fuel from renewable energy source which is biodiesel. Biodiesel is considered as better option because of its environmental friendly characteristics while giving almost the same functional properties like fossil fuels.

This paper will focus on the biodiesel produced in Malaysia. Since Malaysia is one of the leading palm oil producers in the world with palm oil was chosen as the raw stock for the palm oil biodiesel production. There are many advantages and disadvantages in palm oil biodiesel industry in Malaysia from the economy, social and environmental aspect. The aim of this paper is to analyze the past, current and future of palm oil biodiesel industry in Malaysia.

This paper will include the technology aspect used in the palm oil biodiesel production and characteristics of pure palm oil biodiesel to meet the international market standard. Malaysia faces tough competition from other biodiesel producers like Indonesia and Brazil. The scope of this study covers the worldwide biodiesel development in brief in continuation with the challenges faced by Malaysia in becoming the top biodiesel exporter in the world with the advantages & disadvantage of using palm oil as the feedstock. .

Keywords: Alternative, renewable energy, palm oil biodiesel, technology, exporter

List of Abbreviations

ASTM American Society for Testing and Materials

CPO Crude Palm Oil

DBKL Dewan Bandaraya Kuala Lumpur

DNA Deoxyribonucleic acid

EU European Union

IFC International Finance Corporation

ISO International Standards Organization

MPOB Malaysian Palm Oil Board

MPOC Malaysian Palm Oil Council

MYR Malaysia Ringgits

NGO Non Government Organization

OSHA Occupational Safety and Health Administration

POIC Palm Oil Industrial Cluster

POME Palm Oil Methyl Ester

PRIME Rebuilding and Improving Malaysia’s Export of Palm Oil

RSPO Roundtable on Sustainable Palm Oil

UK United Kingdom

UNFCC United Natons Framework Convention on Climate Change

US United States

USA United States of America

List of Symbols

CO2 Carbon dioxide

ml milliliter

NOx Nitrogen Oxide

INTRODUCTION

All energy used by humans originates from one of the following sources: radiant energy emitted by the sun (solar energy); geothermal energy from the interior of the earth; tidal energy originating from the gravitational pull of the moon; and nuclear energy.

By far the largest source is solar energy, thousands of times larger than all the others and inexhaustible for as long the sun shines (approximately 4. 5 billion years). Present energy system, especially based on the use of fossil fuels (not renewable), cannot handle the problem of guaranteeing energy security and that increasing the share of renewable energies is one of the best ways to addressing them.

Increasingly, renewable energy in the form of biodiesel is getting attention from the world countries due to the environment friendly characteristics, while still be able to be used in diesel engine without any major modifications. Biodiesel also has its advantage of abundance of raw stock which confirms continuous raw material supply.

Biodiesel is an environmentally-friendly, renewable energy source that could also produce cost savings for taxpayers and private businesses which is produced from farmers that grow various fuel crops. Given high gasoline prices and the negative environmental effects of burning fossil fuels, there is intense research on the alternative energy sources, including biofuel.

Brazil and the US have been leading the way with ethanol production derived from sugar cane and corn. Recently, there has been increased interest in another biofuel (biodiesel) particularly in Europe (the leading producer). Biodiesel, a non-petroleum-based diesel fuel, can be produced from the transesterification of vegetable oils or animal fats. In the US, most biodiesel is made from rapeseed (canola) or soybeans.

Other producers have different biodiesel feedstock such as palm oil and jatropha that have great potential as renewable fuels. Malaysia is a leading palm oil producer, therefore Malaysia in the past have focused on palm oil as raw stock used for biodiesel production. This paper takes an in depth look at the palm oil used for the production of biodiesel.

2. 1 SCOPE OF THE PAPER

Biodiesel production is facing several issues and challenges like tough global competition, feedstock issue, food versus fuel war, sustainability, and limited land for use & deforestation.

The scope of this paper is to collect and analyze the data of palm oil biodiesel in Malaysia to determine their performance and their position in the world biodiesel industry, the advantage & disadvantage of using palm oil as the main feedstock for production, political & economic barriers which needs

to be overcome, competition between the major producers & technological aspects. This study covers the biodiesel technology that is currently being used in Malaysia to produce pure biodiesel that meets international criteria, suggestions for improvements in implementing better method and technologies to be used in Indonesia and Malaysia. Overall, this paper analyzes the past, current and future trend of the palm oil biodiesel industry in Malaysia among world biodiesel industry.

2. 2 BACKGROUND

2. 2. 1 Raw Stock for Biodiesel

There are several sources used as feedstock for biodiesel production such as rapeseed and soybean oil. However, compared with other vegetable oil, palm oil has far better advantage and potential as feedstock for biodiesel production. Palm oil is a perennial crop, unlike soybean and rapeseed. Perennial crop means the production of oil is continuous and uninterrupted, though annual production has its seasonal peak and down cycle [6]. In terms of oil production per hectare of plantation, palm oil is the most produced oil seed. The yield of palm oil from palm is a factor of ten higher than oil yields from soybeans, sunflower or rapeseeds [17]. Palm oil production has higher production yield compared to soybean, sunflower seed and rapeseed as shown in Figure 1. Palm oil imports from Malaysia into EU are equivalent to having 4. 9 million hectares of soybeans or 1. 7 million hectares of rapeseed [17].

2. 2. 2 Palm Oil as Raw Stock

Palm oil is the most prospective biodiesel feedstock compared to other oilseeds. As discussed earlier, palm oil has higher production yield, low fertilizer, water and pesticide needed for the plantation. Palm oil production takes less sunlight in terms of energy balance to produce a unit of oil as it produces more oil per hectare. However, in terms of the basis of palm oil yield per man in a day, it is not as competitive as other oilseeds because of the difficulty of labor plantation management and harvesting of the fruit. Comparatively in Indonesia, it is less an issue because the extensive labor market readily available in Indonesia compared to Malaysia.

Crude Palm Oil and Refined Palm Oil are the most traded vegetable oil in the world today [14]. Palm oils have been established as a dietary nutrient for nearly five thousand years. Palm oils are harvested from the mesocarp of the Elaeis Guineensis fruit, through a refining process that includes; cooking, mashing and pressing. In this process, the seeds are separated and after cracking and removing the shell, the kernel can be processed to yield palm kernel oil and palm kernel cake. Crude palm oil also referred as CPO comes from the mesocarp which is the fleshy portion of the fruit wall. Mesocarp is processed into CPO through refining and kernel processing in steps shown in Figure 2. CPO depends on the variety of the palm tree and the age of the palm. The CPO to bunch ratio is approximately 25 to 28 percentages.

2. 2. 3 Palm Oil Biodiesel

The palm oil harvested and produced from palm trees is referred to as CPO. The crude palm oil is the transported to palm oil refinery to be refined. The factory output is the Refined Palm Oil which is suitable to be used as

biodiesel fuel or blended with petroleum diesel. Palm oil converted into methyl ester which then can be used as fuel is called the bio diesel. Blending certain percentage of petroleum diesel with palm diesel is called Envo Diesel. Methyl ester from palm oil has low engine emissions, high oxidation stability apart from the high nitrogen oxide emission which is higher [2].

Refined palm oil; after crude palm oil is refined is referred as Refined Palm Oil and can be used for number of applications including as a substitute for petroleum diesel which is known as Palm Oil Biodiesel. Palm oil is processed into CPO, then into refined oil before being processed into palm oil biodiesel as shown in Figure 3.

Palm Oil biodiesel can be blended with petroleum diesel. This type of diesel is known as Envo Diesel. This paper will discuss in detail the Palm Oil Biodiesel.

3. Analysis

3. 1 Perspective on Indonesian versus Malaysian Palm Oil

A significant change took place in palm oil industry in the year 2006 when Indonesia surpassed Malaysia in production of the palm oil as shown in Figure 4. Malaysia is currently world’s second largest producer of palm oil [6]. Looking at the Indonesia’s palm oil production rate compared to Malaysia in Table 1, there are high chances of Indonesia surpassing Malaysia and continue to be leading producer for the foreseeable future.

In Malaysia, palm oil exports amount to 16. 5 million tonnes, representing an increase of near 11 percent in year 2007. The total palm oil planted area in

the country increased by 4. 3 percent to 4. 48 million hectares in 2008 [16]. The expansion in planted area in the country occurred mainly in Sabah and Sarawak with a combined growth of 7 percent compared to 2 percent in Peninsular Malaysia. Sabah remained as the largest palm oil planted state, accounting for 1. 33 million hectares of 30 percent of the total planted area in the country.

3. 2 Palm Oil Biodiesel vs. Other Feedstock

In the year 2008, the government of Malaysia was looking at the possibility of using jatropha oil the raw material for the production of biodiesel in the future. However, this was still at the research and development stage and it has not reached the commercialization stage [2].

The government looked at other potential feedstock for biodiesel production due to the competition on the use of the palm oil either as food sources as fuel. Around the world biodiesel producers are now focusing on using non food based raw materials for the biofuel production. Currently, all the biodiesel projects in Malaysia are based on the use of palm oil as the raw material.

During the surface of the reports indicating that EU might ban biofuel derived from crops grown on some sensitive ecosystems, Malaysian palm oil industry feared the worst. Malaysia; as the second largest palm oil producer in the world after Indonesia is the potentially largest palm oil biodiesel producer. Countries like Brazil and the US; biodiesel producer from ethanol are eyeing the EU market giving heavy competition to palm oil biodiesel producers. Biodiesel market are having large market competition after the

27 nation bloc suggested for biofuel to be used at least 10 percentage in transportation by year 2020 [17].

Jatropha is a promising second generation biodiesel feedstock. The government publicity on Jatropha as next potential biodiesel feedstock at the Sabah Development Corridor launch in the year 2008 gave competition to existing palm oil biodiesel. However, the use of Jatropha as biodiesel feedstock requires more research to develop its properties to acceptable level for mass commercial usage [2]. And currently, the research is still ongoing.

3. 3 Palm Oil and Malaysia

The palm oil industry is an important pillar of Malaysia economy. The palm oil sector have contributed significantly towards providing a continuous flow of foreign investments and earnings through the export of palm oil and its value added products to the global market. In the year 2008, palm oil industry contributed MYR 65. 2 billion or equivalent USD 18. 1 billion in the export earnings which proves to be a significant contribution from the palm oil industry to the economy [16]. The contribution of Malaysian palm oil to the world’s oils and fats market was very significant in the year 2008, where the palm oil production of 17. 73 million tonnes was 11. 1 percent of the global production of 160 million tonnes of oils and fats. The sustainable production of palm oil in Malaysia is overseen by the Malaysian Palm Oil Association. Malaysia palm oil production is estimated 18. 3 million tonnes in 2009 compared to 17. 73 million tonnes in year 2008 [17].

The global demand for palm oil has increased significantly over the last two decades, first for the use in food industry, consumer products and the most recent application for biodiesel. The growing market in India and China; which is the top two important nations, increases the demand for edible vegetable oil [14]. Another major factor in growth of palm oil production is its role in sustainable energy campaign around the world [14]. European countries have promoted the use of palm oil by investing hundreds of millions dollars into the national subsidies towards biodiesel. European countries are major importer of palm oil; subsidization of biodiesels by the European governments has accelerated the demand for the palm oil in Europe and as a consequence, this has increased the conversion of large areas of rainforest in South East Asia. Palm oil plantations are often built after clearing large area of forest land and draining peat swamps.

As of the year 2009, the Malaysia palm oil had 26 percent share in the export of oils and fats. The palm oil also comprised 46 percent share of global palm oil and is being consumed in more than 150 countries worldwide [16]. All these were achieved by using 4. 5 million hectares of land which is far more less than 1. 9 percent of total area in the world utilized for oilseeds. The total area in the world used for oilseeds is 233 million hectares. Malaysia is currently focusing on increasing the productivity by increasing the oil yields from the current average of four tonnes per hectare to eight tonnes per hectare by using genome sequencing. Genome sequencing is a laboratory process that determines the complete DNA sequence of an organism [16]. Using this technique, scientific process and procedures can be done to the palm oil plant to produce more outputs. Using this technique, Malaysia is

hoping to continue as the major supplier to global palm oil needs without the necessity to open new areas for plantation.

The EU need a company to be legally certified to produce palm oil that can be used as an alternative fuel in a sustainable manner before the commodity can be shipped and used in the 27 member bloc countries. Restrictive policies implemented by EU created differences in the marketing of vegetables and grains ‘ oil that caused the decrease of the palm oil prices compared to soybean and rapeseed oil. Indonesia and Malaysia, the world’s two biggest producers of palm oil teamed up in November 2008 to reduce the output of the edible oil after he prices slumped. The two countries agreed to replant old plantation, cutting yearly production of approximately 800000 tonnes.

In the year of 2009, during the global economic slowdown, Malaysia palm oil industry was facing issue of oversupply. To reduce the oversupply of palm oil and at the same time to support the palm oil prices, Malaysia launched the Palm Oil Replanting Incentive Scheme worth of MYR 200 million to reduce the nation’s high palm oil stock to ensure the stability of palm oil prices. The objective of this scheme is to chop 200000 hectare of palm oil trees aged 25 years and above, which will reduce the palm oil supply by 700000 tonnes per year in the short term. The government had approved 63000 hectare under this scheme which was closed in June 2009 [16].

Strategies like replanting palm oil tree schemes and impose of the mandate for the palm oil biodiesel use reduces the CPO inventory and helped to sustain its price at MYR 1400 per tonne in the year 2009 [14]. It is important

to reduce the oversupply and maintain the CPO price above RM 1400 tonne as the producers will not be profitable in the trade below this price. In March 2008, the CPO prices soared up till MYR 4180 but the price plummeted to low MYR 1403 per tonne in November 2008 [16]. The inventory for palm oil rose to significantly high amount of 2. 3 million in November 2008 but reduced to slightly more than 1. 8 million tonnes in January 2009 as shown in the Figure 5. Palm oil is the major oil produced in the world; this indirectly helps to lower price of palm oil biodiesel but not significantly.

The CPO price range between MYR 1400 and MYR 1900 per tonne in year 2009 was sufficient to sustain the export earnings. However, the earnings from palm oil exports in the year 2009 dropped compared to MYR 65. 8 billion in the year 2008 because of the lower prices as well as lower exports.

Late in the year 2008, MPOC launched PRIME program. This program is one of the MPOC’s palm oil export promotion strategies to encourage exporters to explore new markets and introduce new products in order to develop new areas of business [22].

3. 4 Biodiesel Production Technology

Before analyzing the infrastructure and technology required in converting Palm oil into biodiesel, the production process must be understood first. There are three general ways to convert vegetable oils and fats into biodiesel; base catalyzed transesterification of the oil, direct acid catalyzed transesterification of the oil or conversion of the oil to its fatty acid then to biodiesel [12]. Biodiesel producers opt for the option 1 which is the base catalyzed reaction because it is a low temperature and pressure. This

method also yields high conversion ration of almost 98 percentages with minimal side effects and reaction time. Another advantage of this method is that it is a direct conversion to biodiesel with no intermediate compounds required and no exotic materials of construction are needed [18]. The chemical reaction for base catalyzed palm oil biodiesel production is shown in the chemical equation shown in Figure 6.

Chemical Equation above shows transformation of palm oil into biodiesel which also gives another output; glycerin. The conclusion from the above chemical equation is that when one hundred pounds of fat or palm oil reacted with 10 pounds of short chain alcohol in the presence of a catalyst that has already been mixed with methanol, 10 pounds of glycerin and 100 pounds of biodiesel produced as output. The short alcohol chain is represented by ROH which means methanol or in some cases, ethanol that is used to quicken the conversion process. The catalysts usually are mixed with the methanol. R', R" and R"' represents the fatty acid chains of the palmitic oil or fat [12].

The catalyst mixed with alcohol. The catalyst usually dissolved in the alcohol using a standard mixing machine.

The mix is then put into a closed reaction vessel and the palm oil or fat is added. A closed system is done in the process to prevent the loss of alcohol to the atmosphere.

The mix is kept at the temperature above the boiling point of alcohol at about 70 degree Celsius so that the reaction takes place. The reaction time

varies from 1 to 8 hours and excess alcohol usually used to ensure complete conversion of palm oil into methyl esters.

Once the reaction have completed, there will be two outputs which are glycerin and biodiesel.

Glycerin and biodiesel output will not be in their purest form. Each has significant amount of excess methanol that was used earlier in the reaction. This is where the neutralization step takes place. The glycerin has more density compared to biodiesel and the two outputs can be separated using gravity by drawing off the bottom of the settling vessel.

After the glycerin and biodiesel have been separated, the excess alcohol in each of them will be removed and the mix will be neutralized. The alcohol will be recovered in methanol recovery step using distillation equipment and it will be re-used.

After separation from the glycerin, the biodiesel is purified by washing gently with warm water to remove the residual catalyst or soaps, dried and sent to storage. This step may be skipped when the output of the production process is a clear amber yellow liquid with viscosity similar to petrodiesel. Colorless biodiesel is obtained in an additional step of distillation to remove small amount of color bodies.

For usage as an automotive fuel, the end product of biodiesel must be analyzed using international standard analytical equipment to ensure it meets specifications. For global biodiesel marketing, it is important for a

biodiesel manufacturer to register the biodiesel product with the United Stated Environmental Protection Agency under 40 CFR Part 79 [18].

3. 5 Pure palm oil biodiesel characteristics

Biodiesel is a biodegradable and non toxic fuel; free from sulfur. It is produced by transesterification reaction of vegetable oil with low molecular weight alcohol, such as ethanol or methanol. In the industry, biodiesel is produced using homogeneous reaction [10].

Important characteristic of oil to be used as fuel is the solubility of the oil in petroleum. Another way is to emulsify the oil or fat with the ethanol. Most of the vegetable oils are a mixture of different esters such as oleic acid (main portion from olive oil), ricinoeleic (main portion from castor oil) , linoleic acid)main portion from linseed oil), palmitic acid (main portion from the palm oil kernel) and many other oils. Palm crude oil is refined to make a useable automotive fuel that is useable in unmodified diesel engines.

As discussed in earlier topics, biodiesel is a clean burning alternative to petroleum based fuel made from renewable energy source which is biodegradable and non-toxic. In recent times, biodiesel issues have drawn lot of interest as increase of depletion of petroleum source in near future is predicted. Biodiesel market is booming in Europe as fuel or fuel additive for most of the diesel internal combustion engines and turbine in Europe as fuel or fuel additive for most diesel internal combustion engines and turbine engines, and it is also available in the US and Asia, as well as in Canada, where it is in its early stages of development.

Biodiesel is derived mainly from the byproducts of soybean and other oils, such virgin and recycled vegetable oils derived from crops such as canola, corn and sunflowers and animal fats or spent cooking greases, although it may be obtained from ethanol. Soy-based fuel is the most common used biodiesel in its pure form or mixed with a petroleum-based diesel as an additive to improve the otherwise low lubricity of pure ultra low sulfur petrodiesel fuel.

Research was done in Bangkok where palm biodiesel was used for a motorcycle, the emission and engine performance was tested. Research found there was no significant difference in emissions between the biodegradable and the fossil fuel. Comparison of the engine performance and fuel consumption for both lubricants showed no significant difference either [8]. However, since palm biodiesel is a renewable source, it is a lower carbon source and that it offers superior tribological properties (wear scar, viscosity index, etc.) [8]. This is a promising alternative to fossil fuels.

This fuel is also important from the economic point of view, considered as one of the possible candidates to replace petrodiesel as the world’s primary transport energy source thanks to its renewable condition and the fact that it can be transported and sold using today’s infrastructure instead of old fossil fuels ducts. In fact, it is available to consumers in a growing number of fuel stations, but still makes up a small percentage of fuel sold.

Biodiesel has been classified as a non-flammable liquid by the OSHA, although as with most fuels, it may burn if heated to a high enough

temperature, but significantly reduced in toxic and other emissions when burned as a fuel. [20]

4. DISCUSSION

4. 1. Past and Current Market trend of Palm oil Biodiesel

The production of palm oil biodiesel in Malaysia is overwhelming. There are initial researches conducted for the production of biodiesel from waste materials including palm oil. However, this is still in early stage of research and development and so far; the researches shows that the production of biodiesel from waste materials is still very high and not viable for commercial use.

Till the year 2008, Malaysia had about 91 percent of palm oil biodiesel projects approved with a total production capacity of 10. 2 million tonnes a year [16]. Total of 12 biodiesel plants have been fully completed and are in operation with production capacity of one million tonnes a year [16]. Another two biodiesel plants have been also completed but the operations have not started. These two plants have production capacity of 160000 tonnes a year. According to MPOB, the existing biodiesel plants produces approximately 196363 tonnes for the period of August 2006 till March 2008 while 154791 tonnes were valued at MYR 411 million for the export to US, Europe, Singapore and Australia.

Recently, the production cost at biodiesel plants have increased with the rising price of crude palm oil. The average cost of CPO in the year 2006 was MYR 1502. 50 per tonne. This price has increased significantly within two years; in the year 2007, the price was MYR 2516. 50 per tonne while in the

early of 2008, the price was MYR 3433. 50 per tonne. This has caused the cost to exceed the profit margin.

In March 2008, production cost for palm oil biodiesel was MYR 4330 per tonne; whereas the market price for the palm oil biodiesel was MYR 3632 per tonne. The CPO prices are increasing rapidly as shown in Figure 8.

The rising cost of biodiesel have prompted several palm oil biodiesel producers to temporarily stop producing biodiesel as the high producton cost has left an negative impat on their profit margin and the development and growth of the biodiesel industry.

Till to date, the Malaysian government has given more than 90 biodiesel licences to various organization and companies which has production capacity of 10 million tonnes per year. However, it is reported in the Reuters' survey that on seven biodiesel plants are currently running and most of them are operating well below the capacity. The survey also showed that there were 14 projects with their combined biodiesel production capacity of more than two million tonnes were shelved or delayed.

The main reason for the delay is the high CPO prices, which encourages the palm oil industry to produce palm oil for more profitable business or industries instead of the biodiesel which has higher production cost compared to profit. The high cost of investment to setup the biodiesel facilities does not encourage the palm oil industry. It is said that for the priceof biodiesel at MYR 4000 per tonne, even conglomerates in Malaysia such as Sime Darby is not keen to plunge into the biodiesel industry currently [16]. Currently, the company is focusing on the palm oil

downstream activities such as bulking and refinery process to be exported [16].

A report by Frost and Sullivan regarding biodiesel showed that the demand for biodiesel has increased in the Asia region over the past few years. For Malaysia, the demand for palm oil biodiesel would increase from current 110000 tonnes to 563000 tonnes in the year 2013. Asia region has a booming market for biodiesel as there are several strong drivers of growth; increased supply and increased demand. Many countries in the Asia region developed domestic markets and at the same time, producers like Malaysia and Indonesia targeted export markets. In several countries in the Asia region, the government introduced mandates for biofuels to develop the domestic market.

On March 22, 2006, Malaysia Prime Minister Datuk Seri Abdullah Ahmad Badawi launched biodiesel called Envo Diesel. This type of biodiesel blends 5 percent of proccessed palm oil with 95 percent petrodiesel. In EU, there are B5 type of biodiesel that blends 5 percent methyl ester with 95 percent petrodesel. The manufacturers for diesel engine prefer the use of palm oil methyl ester blends as diesel engines are designed to handle 5 percent methyl ester meeting the EN14214 biodiesel standard [16].

In the year 2009, the Malaysian government reassured that there are no plans to remove the current biodiesel mandate of five percent despite high CPO cost. The government encourages the use of biodiesel in the country, although it is not have been mandatory use [5]. Malaysian government are encouraging the use of palm oil biodiesel as they are obliging to Kyoto

Protocol. The use of palm oil biodiesel have not been made mandatory due to the fact that at the present, the raw material price is very high .

Kyoto Protocol is a protocol of the UNFCC , an international environmental organization. This organization is trying to achieve the stabilisation of the greenhouse gas concentrations in the atmosphere at a level that would prevent the degradation caused by human that would disturb the ecosystem and the climate system. In October 2008, Malaysia put into practice the mandate of five percent biodiesel will be used in vehicles starting with the government vehicles in the year 2009 and planning to implement extensively to industrial and transportation sector in the year 2010.

By early 2010, Malaysia is expected to consume 500000 tonnes of palm oil which is 3 percent of national CPO production. This will happen when Malaysia fully implements the blended biodiesel programme where B5 diesel will be made available througout the country through 36 depots [5]. The use of blended biodiesel has started with government agencies and will be extended to industrial and transportation industry in the future. The Malaysian government is working with nation’s biggest petroleum company; Petronas to enable some retail station to supply B5 to the agencies. I February 2009, Malaysia started the biodiesel programme with Kuala Lumpur City Council and the Armed Forces in the country [5].

The biodiesel producers and the petroleum companies are currently discussing the important aspects and critical issues to the implementation such as logistics and finance. As of the year 2009, the main challenges facing the biodiesel industry in Malaysia are the exports of subsidised US

biodiesel to EU that is distrubing the prices and trade, the EU energy directive and overall global economic slowdown.

The global economic crisis have caused a sharp drop in the CPO prices, together with global financial crisis had led the develoment of the biodiesel industry to slow down or to be exact halt new investments. The Malaysian biodiesel industry has the production capacity of 1. 67 million and feedstock available to satisfy the demand in the domestic and world market.

Malaysia and Indonesia has expressed concern over a plan by the EU countries to impose taxes on US biodiesel which potentially might slowdown the outlook for alternative fuels made from vegetable oils and grains. Almost half of Europe’s biodiesel