Environmental effect of biodiesel mandatory policy

R Nurkhoiry1*, D H Azahari2, R Amelia1 and E Roosganda2

1Indonesian Oil Palm Research Institute, Jln. Brigjen Katamsono No. 51 Medan, North Sumatera, Indonesia
2Indonesian Center for Agricultural Socio Economic and Policy Studies, Jln. Tentara Pelajar No. 3B Bogor, West Java, Indonesia

*rn.nurkhoiry@gmail.com

Abstract. One major biofuel in Indonesia is biodiesel with palm oil constituting the predominant raw material. Over recent years, biodiesel has become the most rapidly developing and influential aspect for economic. Biodiesel mandatory policies aim to reduce import of diesel from fossil fuels, buffer for CPO price, reduce emissions and balancing supply demand of palm oil. The biodiesel policy is supported by the CPO fund mechanism managed by BPDPKS to overcome the price gap of diesel and biodiesel which is affected by volatile price of CPO and fossil fuels. About 8 million ton (5%) CPO production in Indonesia is allocated for biodiesel production to supply domestic and overseas markets. In the long term, palm oil-based biodiesel will become the focus of renewable energy development policy in Indonesia. National energy policy direction ensures an optimum energy mix, with renewables targeted to contribute up 31% of the energy mix by 2050. These are optimistic targets that hope to be achieved over various constraints, such as issues of land for feedstock, gap price between biodiesel prices and diesel fuels, dependence on imported technologies and equipment, and low market demand for biodiesel, particularly in sectors with no government intervention. There is a general assumption that biodiesel or bioenergy already fall in line with sustainability principles as they are sourced from the agriculture sector. The study aims to examine the impact of biodiesel development to economic and environment, also to review several challenges facing by biodiesel development in Indonesia.

1. Introduction

Indonesia is the largest palm oil producer country in the world since 2006. The palm oil industry is a proven driver for a country's economic growth, reducing poverty and uplifting the lives of people in the region. Today, oil palm plantations cover a total area of 16.4 million hectares, where 59% belongs to the private sector; 36% belongs to smallholders; and the remaining 5% is government estates. Total production of palm oil is 49.1 million ton in 2020 [1-3] Palm oil and its derivatives significantly contribute to export earnings, and it ranked first among industrial and agricultural products. Total export for palm oil products reached 12.1 million tons where 37% of it comes from crude palm oil. However, important to note that the area expansion will not be as fast as in the past. Indonesian palm-oil products mostly exported to China, India, the Netherlands and Pakistan. Indonesia’s domestic consumption of CPO reached 4.5 million tons in 2007. Such a high consumption rate causes Malaysia to remain the largest exporter of palm oil due to their little domestic consumption [4].
Indonesia have been numerous allegations made towards Indonesian oil palm industry in relations to deforestation, the use of peat-land and customary lands for plantations, wildlife killings, forest fire, unfair wage system, child labor occupation, and gender problems in plantations. Indonesia have been numerous allegations made towards Indonesian oil palm industry in relations to deforestation, the use of peat-land and customary lands for plantations, wildlife killings, forest fire, unfair wage system, child labor occupation, and gender problems in plantations.

Furthermore, palm oil provides a solution for the national energy strategy, namely "run out of oil below, replaced by oil above" [5]. The existence of abundant domestic palm oil production has opened opportunities for Indonesia to produce palm-based biodiesel which can substitute the use of fossil fuels (diesel). Since 2004, Indonesia has become a net importer of fossil fuels. Along with population growth and economic development, consumption of fossil fuels also increases every year. Meanwhile, domestic fossil fuel production tends to decrease, so the deficit between consumption and production is getting bigger [3]. This causes the import of fossil fuels to increase every year which causes a deficit in the oil and gas balance every year and becomes an inevitable economic burden.

Efforts to reduce dependence on imports of fossil fuels by utilizing palm oil biodiesel as an import substitution have become the spirit and target of biodiesel development policies in Indonesia since 2004. Substitution of fossil fuels with palm oil biodiesel that is guaranteed to come from 100% local content will create various benefits on social, economic and environment [6].

The use of palm oil biodiesel had been reduced dependence on diesel imports as the impact of the biodiesel mandatory policy. Furthermore, fossil diesel import foreign exchange savings as the Impact of Biodiesel Mandatory Policy in 2015-2020 [5,7,8]. The seriousness of the government in developing palm biodiesel can be seen from only within 10 years has succeeded in implementing B-10 into B-30. This is reflected in the increasing consumption of domestic palm oil biodiesel which continues to increase. This study aims to examine (i) Palm oil development related economic, social and environment issues; (ii) the impact of biodiesel development to economic and environment, and to review several challenges facing by biodiesel development in Indonesia.

2. Materials and methods

2.1. Materials
The data used is data sourced from secondary data and interviews with relevant stakeholders.

2.2. Methods
The method used in this paper is secondary data and analyzed by desk work using simple descriptive analysis. The sources material is obtained through a literature review by exploring and examining data and information obtained from various sources such as the Statistics Indonesia (BPS), the Indonesian Agency of Agricultural Research And Development (IAARD) of the Ministry of Agriculture, annual reports and performance reports of the Directorate General of Plantations, and relevant information from various studies published in various publications, such as books, journals, presentation materials from various webinars, virtual conferences, proceedings, and other publications, including print media and electronic media.

3. Results and Discussion

3.1. Oil Palm development and economic, social and environment challenges
3.1.1. Environmental issues. Indonesia has about 188 million hectares of land area of which 137 million hectares (70%) is registered as forest area. However, it is only about 94 million hectares (54%) covered with forest. On percentage basis, Indonesia is perhaps one of the counties in the world, which has the largest forest cover. Our forests are still suffering from illegal logging, seasonal forest fire and some illegal mining operations. This happens mostly because of the condition of structural poverty faced by our people living in and around forest. Indonesia government is really working hard in solving these problems. The government of Indonesia has proved its commitments to reduction on impact of global warming and to support all efforts in reducing carbon-dioxide emissions on earth. The commitments are
reflected on the initiatives to develop Bogor Road Map, which was adopted in the United Nations for Climate Change Conference (UNFCCC) held in Bali on December 2007 as a part of global action to tackle the impact of climate change.

In order to overcome the complicated problems faced by Indonesia, we need the international support through true actions as a part of achieving Sustainable Developing Goal’s (SDG’s), where oil palm contribute at least 13 out of 17 SDGs, which is one of the goals, for poverty alleviation through livelihood security and rural development [9].

In principle the government of Indonesia and all palm oil stakeholders are against any illegal practices destroying our natural rain forest. Indonesian rain forest is not only a treasury of the Indonesian people. It is also global treasury that should be preserved and maintained as a world respiratory system not only by Indonesia but also by all nations who live on this earth. The government and the people of Indonesia appreciated all the actions taken by friends of Indonesia to ban all types of products using Indonesian Illegal logging. Indonesia really need to strengthen law enforcement put in action in our friend countries to help Indonesia fight all illegal forms and consider it as a transnational crime.

Future growth of palm oil production in Indonesia will come mainly from increasing the productivity especially due to application of high yielding varieties of seeds and improving cultural practices. Thanks to the advancement of sciences and technologies in this field [5].

3.1.2. Economics issues
The Indonesian palm oil industry has developed very rapidly in the last couple of decades. At earlier stage of the development, plantations and CPO mills play the biggest part of the industry. Lately, upstream industry such as food, cosmetic, oleo-chemicals and bio-diesel has been catching up in the development. Oil palm industry has become one of the most important sources of Indonesian economic growth after the last monetary crisis of the late 90’s.

The palm oil industry has played a great role in reducing unemployment and alleviating poverty in Indonesia. There are currently of 5 million smallholders in total in Indonesia, and an additional of about 17 million people working in plantations. This number does not include the people whose life have been indirectly affected by the industry [2,3].

The development of a new plantation creates a multiple effect. A rural area has developed into a more modern town with the creation of an oil palm plantation. In most situations, once a plantation is setup, a village will follow along with infrastructure and basic amenities. This creates employment and opportunities to many people including medical doctors, teachers, bankers, traders, contractors and many more. Not only will the plantation workers and smallholders benefit from it but also the surrounding community and indigenous people. Big plantations have also engaged themselves in corporate social responsibilities through community development. They build or renovate schools, hospitals, and infrastructures for the local community.

The welfare of smallholders has been also a top priority factor in the sustainable production of palm oil. There are two types of smallholders in Indonesia, independent and plasma. Independent smallholders set their own plantations and are allowed to sell their fresh fruit bunches to the highest bidder. This free market mechanism improves smallholders’ conditions. Smallholders under the nucleus-plasma program, at the end of the program, will be able to own their land with its land certificate. Smallholders earnings have increased by more than 250 times since they started planting oil palm in the early 80’s [2,3]. Oil palm industry has become not only a source of economic growth but also an important mechanism of economic equity of the country [10].
3.1.3. Social issues

Despite its contribution to the national economy and to international demand, the Indonesian palm oil industry faces great amount of resistance from various parties such in Europe and some part of the world. Some of this, relate to economic competition and genuine environmental concerns. Actually, Indonesia thanks for all critics (even sometime negative campaign) to Indonesian Palm Oil industry, for we take those critics as an input to improve the quality of Indonesian Palm Oil. We also put it as a pressure to push our palm oil production with environmental friendly approach and work hard to fulfil the international standard and regulation.

As a member of global village, Indonesia believes on the market mechanism in order to obtain national level of welfare. As a member of the World Trade Organization (WTO), Indonesia supports the position of opening substantial market access for agricultural products as long as it is implemented through fair treatment mechanism and taken into account of Special and Differential Treatment for developing countries.

Furthermore, Indonesia has established many regulations related to sustainable production of plantation commodities including palm oil. Indonesian palm oil producers are very active in Roundtable on Sustainable Palm Oil (RSPO). Indonesian is one of the initiator in establishing RSPO. Although some companies are not the member of RSPO, they will voluntarily implement the Principles and Criteria of the RSPO and will follow certification scheme [11]. Indonesian government supports the implementation of sustainable palm oil and puts forward new regulations to support the efforts in implementing sustainable palm oil. With more than half of the 2019 RSPO certified palm oil originating from Indonesia [12], it leads in setting the bar towards deforestation-free and responsible management practices in oil palm cultivation. On the other hand, the demand for the responsible production of oil palm (ISPO and RSPO) significantly lags behind the production, with only half of the certified sustainable palm oil (RSPO) produced being traded as such [13].

3.2. Palm oil biodiesel mandatory policy implementation

With regards to Bio fuel, the Indonesian government had already established a blue print on The National Energy Policy known as Energy Mix Policy by 2010, including the road map on bio-fuel industry development trough Presidential Decree No. 5 Year 2006. Furthermore, the Presidential decree No. 10 Year 2006 established the National Team for Renewable Energy consisting all representatives from related ministries, institutions and organizations. The Energy Mix policy covers energy for household commercial or industry needs and transportation needs. The objectives of the Energy Mix policy among others are to reduce the consumption on diesel and gasoline for transportation fuel and on kerosene and gas and electricity for households, commercial or industry, reduce the oil subsidy and to save foreign exchange for oil import. In addition, the policy also recognizes the potency of Indonesia on building renewable energy development as the largest producer of palm oil in the world and as country which has abundant source of feedstock for bioenergy. The development of the bioenergy industry will also open job opportunities especially in the rural area [7]. The target of the energy mix policy is at least 10% reduction on fossil oil consumption, which is accounted of 52 % of national energy consumption, through renewable energy including bioethanol (from sugarcane, cassava and corn) and Bio-diesel (from palm oil, castor-oil and other feedstock) by 2010.

The timeline of mandatory palm oil biofuel can be seen in Figure 1. The blending rate was increased to B-2.5 during the period 2010-2012 and then again increased to B-10 in the 2013-2014 period. In August December 2015, the biodiesel blending rate was again increased to B-15. Although the blending rate continues to increase and is mandatory, the realization is still far from the expected target due to Pertamina's lack of support in implementing mandatory biodiesel [5,14]. The mandatory biodiesel policy in Indonesia made significant progress when the mandatory biodiesel B-20 was implemented in 2016, where the utilization of B-20 was limited to the PSO sector in 2018 and then expanded to the non PSO sector in 2019. The commitment of the Indonesian Government getting stronger in implementing the mandatory biodiesel B-30 in the PSO and non PSO sectors by 2020. The seriousness of the government in developing palm biodiesel can be seen from only within 10 years has succeeded in
implementing B-1 into B-30. This is reflected in the increasing consumption of domestic palm oil biodiesel which continues to increase [7,15,16]. The data also shows evidence that the mandatory biodiesel policy program established by the government is an important instrument in the success of biodiesel development in Indonesia. Meanwhile, Indonesia also exports biodiesel, but only if the mandatory domestic biodiesel needs are met.

![Timeline Mandatory Biodiesel in Indonesia 2008-2021](Figure 1. Timeline Mandatory Biodiesel in Indonesia 2008-2021. [14])

3.3. The Economics and environment effects of biodiesel mandatory policy

Biodiesel production increased from 3.75 kiloliters in 2010 to 9.59 million kiloliters in 2020. This means that in 10 years, biodiesel production has increased by around 250%. Meanwhile, domestic biodiesel consumption also increased from 223 thousand kiloliters in 2010 to 8.4 million kiloliters in 2020 or an increase of around 400% in the same period. The policy of mandatory B30 was implemented in early 2020, and it is estimated that the biodiesel needs for the policy will reach 9.6 million kiloliters. But in this year, the world also faced Covid-19 pandemic. This pandemic had an impact on reducing the absorption of domestic biodiesel, due to a decrease in transportation activities because of policies to restrict social and economic activities. Even though it has decreased, the total biodiesel production in the B30 has accumulated to reach 5.73 million kiloliters or about 60% of the target.

### Table 1. The Benefit of Indonesia mandatory palm oil biodiesel program.

| Benefits                           | Value of Program Benefit |
|------------------------------------|--------------------------|
| Volume being used                  |                          |
| B20 in 2018                        | B20 in 2019              | B20 in 2020 |
| 3.75 million KL                    | 6.62 million KL          | 9.59 million KL |
| = 23.59 barrel/year                | = 41.48 barrel/year      | = 60.31 barrel/year |
| = 64.62 barrel/day                 | = 114.21 barrel/day      | = 165.24 barrel/day |
| Foreign exchange saving            |                          |
| USD 1.89 billion                   | USD 3.54 billion         | USD 5.13 billion |
| = IDR 26.67 trillion               | = IDR 43.81 trillion     | = IDR 63.39 trillion |
| Increasing value added             |                          |
| IDR 5.78 trillion                  | IDR 9.68 trillion        | IDR 13.82 trillion |
| Maintaining oil palm workers       |                          |
| On farm: 478.325 peoples           | On farm: 828.488 peoples |
| Off farm: 3.609 peoples            | Off farm: 6.252 peoples  |
| Decreasing GHG emission and increasing Environmental quality |
| 5.61 million tons CO2               | 9.91 million tons CO2    | 14.27 million tons CO2 |
| ~ 20.317 small bus                 | ~ 35.918 small bus       | ~ 52.010 small bus   |

Source: [7,14,17]
Based on data from the Ministry of Energy and Mineral Resources (2021), the impact of biodiesel mandatory can increase the added value from palm oil (CPO) to biodiesel by IDR 5.78 trillion (2018), increasing to IDR 9.68 trillion (2019) and IDR 13.82 trillion (2020). Furthermore, mandatory biodiesel success in avoiding unemployment both on and off farm. In 2020 the mandatory biodiesel contribute in maintain 11.2 million peoples on farm and 9 thousand peoples off farm. This policy also significantly reduce GHG emission and environmental quality by 5.61; 9.91; and 14.27 million tonCO₂. This policy of mandatory biofuel significantly contribute on net trade balanced as presented on Table 2. The Net trade balance without palm oil and B 30 has been deficit USD - 3.881 million, while with palm oil and B 30 has been surplus of USD 21.738.

However, the challenge faces in the implementation of this policy including (i) inconsistency on government supports, especially in maintaining of fossil fuel subsidy on site, (ii) providing consistent quality supply which comply with international standard; (iii) limited sufficient technology which will reduce economic cost efficiently; and (iv) understanding the role of government and transferring responsibility between central government and local government.

**Table 2. The Impact of biodiesel mandatory on Indonesia’s net trade balance in 2020.**

|                      | Net exports of oil and gas (USD million) | Net exports of non-oil and gas (USD million) | Net trade (USD million) |
|----------------------|------------------------------------------|---------------------------------------------|-------------------------|
|                      | - Without B-30                           | (8,608)                                     | - Without palm oil      |
|                      | - With B-30                              | (5,948)                                     | - With palm oil         |
|                      |                                          |                                             | 4,727                   |
|                      |                                          |                                             | 27,686                  |
|                      |                                          |                                             |                         |
|                      | - Without palm oil and B30               | (3,881)                                     | - With palm oil and B30 |
|                      | - With palm oil and B30                  | 21,738                                      |                         |

Source: BPS, Aprobi, processed data

The increase in biodiesel production also has a large multiplier effect. The study of Jafar et al. (17) also revealed that the biodiesel output multiplier was 2.8, while the petro-diesel output multiplier was only 1.61. This means that for every IDR 10 trillion of biodiesel consumed, it will create an economic output of IDR 20.8 trillion. If we compared it with petro diesel (diesel) which only able to creates economic output only of IDR 16 trillion.

However, with this price trends, the B30 mandatory policy is considered by certain parties to be less efficient because the difference between the price of the fossil diesel price and the Market Index Price of biodiesel is too large and it closes the opportunity for producers to enjoy greater profits from exporting palm oil, so this policy is considered to be losses in business (financial).

4. **Conclusions**

Implementing the policy of mandatory B30 will generate greater economic benefits and emission reductions. Even in its realization, which has only been implemented for a few months, this policy has been able to reduce the amount of Indonesia's oil and gas balance deficit net trade and save total trade balance during a pandemic and the threat of a global economic recession. The implementation of biodiesel mandatory policy in Indonesia has been proven to provide economic, social, and environmental benefits.

The mandatory of biodiesel has created various economic benefits, namely reducing dependence on imports of fossil diesel which has implications for reducing imported foreign exchange, creating added value and economic growth. The benefits of B30 can also be seen from a broader (macro) point of view, there is in addition to saving foreign exchange, reducing emissions and creating a large multiplier effect for the economy, this policy can create), stabilizing CPO prices and FFB prices, opportunities to become
price-makers at the global market level, solutions to trade barriers and policies that discriminate against palm oil, the achievement of the SDGs, and in order to achieve national energy security and independent.

In fact, the biodiesel (B30) mandatory policy is designed as an instrument of economic policy that aims to produce greater economic and social benefits with a larger scale/coverage of the population that enjoys these benefits in the long term, not a financial policy that profitable only for industry actor. The B30 program can reduce the oil and gas net trade deficit, creating a large multiplier effect (added value, labor, income, and output) which will have implications for increasing Indonesia's economic growth (GDP), stabilizing CPO prices and FFB prices, opportunities to become price makers at the global market level, solutions to trade barriers and policies that discriminate against palm oil, the achievement of the SDGs, and in order to achieve national energy security and independence.

No country can stand alone on his/her point of view. In the era of Globalization, the win win approach is the word of the day. Let’s start building strong synergy to save our earth and living in harmony among human beings, wildlife, and nature to gain mutual-benefits from it. This is also the right time and the right moment to start achieving Sustainable Development Goals related to palm oil.

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