Root cause analysis fulfillment upon the implication of Fatty Acid Methyl Ester (FAME) as biofuel for sustainable energy in Eastern Java and Bali Nusa Tenggara (MOR V)

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ABSTRACT: This study will determine the root cause analysis of implementing FAME as a source of renewable energy. Although the governmental policy has been established and a higher increase in demand has been fulfilled, no sanctions have been implemented. Four root causes were analyzed to have an effect on the implementation of renewable energy, method, machine, environment (in terms of policy), and material. Supply and distribution patterns implemented by Pertamina have heaped upon the optimization of the distribution of energy across the region, although the exquisite infrastructure was dedicated to the operations. Besides that, the importance of a policy to have a well-balanced supply and demand of FAME will be a great factor since a higher gap of PPI for FAME as well as gasoil products was observed throughout the past year. Hopefully, a well-balanced composition will maintain a challenge for maintaining provisions in facing challenges of the energy trilemma, as to limiting shortage of energy as well as having extensive value for its consumers.

1 INTRODUCTION

1.1 Background

Commodity trading depends not only upon the existence of the product itself but also upon how to meet the number of production and its distribution. (Karya et al., 2020) To ensure that the national energy security will be fulfilled, the government is obliged to organize activity provision, exploitation, and utilization of energy as well as strategic reserves for the conservation of energy resources to provide enough amount. As Sa'adah (2017) pointed out, the growth of fuel production in Indonesia increased only by 1%, but the level of fuel consumption grew to an estimated 7.93% per year. The energy sector still has an important as well as a very strategic factor for the national economic cycle. Over time, the energy demand continues to grow, while non-renewable energy resources are increasingly depleting. Thus, energy management has become one of the "performance indicators", packaged in a term called "energy trilemma" to promote regulations of safeness, affordability, and good use of its systems. (Song et al. 2017). Energy challenges are defined as "energy trilemma" to maintain energy equity, environmental sustainability, and energy security. The main challenge is to maintain the security demand of energy, mitigating climate change that can affect stock resilience, so that energy poverty does not occur. The price of petroleum is influenced by political conditions, weather-related factors, and market prices, which play a key role in the wheel of the world economy, even though the trend changes from time to time (Karya et al., 2020).

The focus of the research subject of biofuels will mainly be on the use of fatty acid methyl ester (known as FAME), which were to be mandatorily used by all types of consumers, as stated in the Minister of ESDM Regulations (PerMen) No. 12/2015: Stages of Gasoil Mix Obligation to Use FAME. In general, the total production of FAME had met the composition stated within PerMen

ESDM No. 12/2015, which is illustrated in Figure 1 (consumption of FAME vs. demand and actual distribution of FAME). The gap has increasingly improved between 2016 and 2019, amounting only up to -8.93% . The security of energy availability has become one of the main concerns of all countries due to the limited energy sources, increasing population, fluctuating energy prices, and limited energy supply (Zhu et al., 2020).

2 LITERATURE REVIEW

The root cause analysis method is one of the most important elements of problem solving because it will help identify and organize the causative factors which may lead to an event, separating the root causes, so it will not occur again. Several tools can be used in the process, and this research will focus on the use of the fishbone diagram. According to Barraza-Suarez (2017) and Jacobs (2018), the fishbone diagram is a method/tool known to improve quality.

There are several stages of achievements for sustainable energy according to Ramadhanie (2017). It includes having energy security, that is, having sufficient energy availability, at an affordable price, with the protection of infrastructure, social issues, environment, efficiency, demand, governance/public policy, and quantification, and emphasis on social, environmental, political and social issues, which must be adapted to climate change and the importance of biodiversity. Energy equity is the access to energy, often discussed in the rubric of the wealth/availability of energy resources, especially the topic of the availability of fuel (Pliousis et al., 2017). It is usually related to the lack of distribution of energy sources, poor infrastructure, and conditions of high energy costs relative to the income level of the local communities. Song et al. (2017) also explained that energy equity is the accessibility and affordability of energy supplies by all the people. Thus, the importance of the availability and distribution of energy sources to meet community needs is one of the important focuses that must be implemented to maintain the availability of energy supplies for the country. To achieve energy efficiency, a balanced demand and supply of energy sources will be needed for the development of provision in a sustainable energy supply (Ramadhanie, 2017). There are long-term benefits of the investment in renewable energy. (Busu, 2019) As described by Pliousis (2019), technology innovation continues to increase energy efficiency, so that less CO_2 energy is wasted to lead to a higher level of people's gross income (GDP).

Key factors for sustainable economic development are securing energy supplies at "acceptable" prices, while being environmentally friendly. According to Plisousis et al. (2019), there are seven dimensions of energy security, namely, energy availability, infrastructure, energy prices, social effects, environment, governance, and energy efficiency.

Successful implementation of FAME for gasoil products from 2009 to 2012 only reached to maximum compliance of 27.66% (Sadewo, 2012). Research conducted by both Sadewo (2012) and ESDM (2015) revealed several dominant factors that had influenced the optimization of FAME mixing as renewable energy. The facts that conveyed the role of FAME blending as a gasoil product include the following:

1. The availability of FAME in Indonesia, mostly influenced by prices of crude palm oil (CPO), FAME domestic prices, and previous FAME product offerings.
2. The main drivers of the FAME demand in Indonesia are largely the implementation of policies, the FAME market price, the price of BBM (gasoil), the availability of infrastructure, and the distribution of FAME across Indonesia.

3 RESULTS AND DISCUSSIONS

Biofuels are one of the potential solutions to address the challenges of sustainable energy management, especially in the fields of industry, power generation, and transportation (Silalahi, 2020). Indonesia is the second largest producer of palm oil in the world. Strategically, it has decreased

imported fuel oil up to USD 4.8 billion or equivalent to Rp. 67.2 Trillion in 2019 (CNBC, 2020). It had suppressed gasoil imports since the mandatory B20 program was implemented. Based on the data in 2019, the decline in imports reached up to 94%. The consumption of FAME had decreased in 2020, giving a larger reserve of energy. However, stockout of inventory of FAME still occurred in the middle of 2020. As shown in Figure 2, there had been consistency in the implementation of the demand and supply of FAME in the market. As shown in Figure 3, the availability of FAME as biofuel had also increased significantly due to a large decrease in consumption in the market. The success rate of implementing FAME for the MOR V only reached up to 73.60%. Several factors explained why the achievement cannot be higher throughout 2019–2020: the relaxation policies of the government for consumers of power plants and users of Alutsista, machine performance, delay of FAME supply to several supply point terminals in the MOR V, and a sudden increase in gasoil sales during certain periods (Task Force period).

Based on the data from 2019 and 2020 obtained from Pertamina on the implementation of B0 (pure gasoil without FAME), it was quite large in early 2019, amounting to 7.5% of the total gasoil distribution, and by QIV 2019, the total was 6.63%. The deliverance was for special services of power plants and the National Army Weapon System (Alutsista). A major problem that conducted non-compliance implications of renewable energy obligations was due to the transition period when Pertamina decreased the number of supply points for FAME. To uniformly implement the policy, there was a cut-off period agreement for consignments of fuel oil due to the ending period of contracts. The supply points in the East Java region decreased from 6 points to only 3 points. This was done to optimize transportation costs that must be borne by the Fund Management Agency (BPDPKS). This policy may reduce the distribution cost of up to Rp. 473 million/month.

Based on the focus group discussion held by the researcher, the main discussion of the root cause analysis on the level of success in distributing FAME as a renewable energy source was more dominated by constraints in Pertamina's terminal infrastructure that did not meet the specific handling of FAME. Moreover, the lack of FAME stock inventory in Kupang is still the dominant root cause of B0 consumption in 2020, and the implementation growth of B20/B30 had improved. Kupang experienced stockout consumptions of FAME in July 2020 because of the lack of supply chain management by suppliers. To support this condition, there should also be specific facilities dedicated to the product since there were more varieties of products being handled. However, policies had not led to the inconsistency of sanctions addressed by the government (Migas). No real administration sanctions were being imposed; the reports clarified the conditions.

4 CONCLUSION

Based on the research results that have been carried out, as mentioned in the previous chapter, several factors dominated the level of achievement of FAME's consumption as a renewable energy source, including the following:

- a. Monitoring the policies implemented between suppliers, the government, and also BU BBM (Pertamina) needs to be consistently done.
- b. The price discrepancy between bio gasoil and non-bio fuel tends to be huge for biofuel products. However, single pricing policies have already been implemented in the form of price compensation for domestic purchases. Such funding is being managed by the BPDPKS. As a result, it was very vulnerable. Strict findings and supervision were due to the quality of FAME mixing and accepting the product to all types of consumers. The price gap between renewable and non-renewable fuel products is so high that the government agreed to make a single pricing policy. However, it is important to consider the total material balance due to such a policy. Other countries should also consider a similar policy of renewable mixing to increase the role of renewable energy widely.
- c. The FAME specification material greatly determines the consumer's willingness to consume B20/B30 products. The water content of FAME's specification has been reduced to 350 ppm,

minimizing the absorption of excess oxygen throughout its handling process. The hygroscopic nature of FAME (susceptible to oxidation) affects the quality of B20/B30 composed of mono-glycerides. Due to such conditions, it is important for fuel suppliers to periodically check the quality of B20/B30.

- d. Environmentally, the use of fuel oil that is more acceptable by the environment and that provides enough energy is still much expected.

For a continuous source of energy to exist, it is important to manage energy challenges as stipulated in the energy trilemma. Supply chain management must also meet the security criteria by paying attention to the safety stock level of fuel inventory, both for producers and consumers, so that FAME and gasoil prices are stable. Policies which are to be extended are as follows:

1. Optimizing a safety stock policy for FAME, avoiding stockout of inventory.
2. In line with supply chain management, it is important to have the flexibility of supply points, as long as it is within one regional area.
3. There is a clear monitoring system for the suitability of the distribution of B20/B30, which has been running so far, but with balanced rewards and consequences under Permen No. 41/2015.

To meet the next composition stage for biofuel in Indonesia, it was stipulated by the government to implement B40, which consists of a consistent composition of B30, and increasing it to B100 (pure biofuel), which will be produced by Pertamina's refineries (up to 10% from the existing target of 12 million kiloliters of biofuel); it will still support higher production of biofuel energy to maintain the energy source, preventing it from becoming extinct.

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