

The Program Implementation of Energy Self-Sufficient Village based on *Calophyllum Inophyllum* in Purworejo, Central Java, Indonesia

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Abstract—This research-based article aims at understanding the implementation of energy self-sufficient village program in Purworejo and its impediment factors. The method used in this research is qualitative with the strategy of action research. The data of this research is collected through observation, in-depth interviews, document analysis and Focus Group Discussion. The result of this research reveals that the program implementation of energy self-sufficient village based on *calophyllum inophyllum* in the Patutrejo village of Purworejo is still in the form of pilot project on the basis of the potential consideration of *calophyllum inophyllum* in the region as well as the political consideration. The top-down implementation is marked by a very big role of central government as a "commander" but without assigning the rules of the game. The determination of the implementation by the central government is done without any implementation and technical guidelines as well as the lack clear distribution of authority (in the form of policy) among the implementors from the central government to the village society. With such implementation, the local people are still capable to produce crude oil and biodiesel but with the low degree of efficiency because the production cost is high and not sustainable. The hindering factors of the implementation are: 1) the inefficient processing-machines of *calophyllum inophyllum*; 2) the high cost of production and difficult to sell; 3) the village institutions which are not participative.

Keywords—program implementation, energy self-sufficient village, *calophyllum inophyllum*

I. INTRODUCTION

The energy crisis has become an important issue, not only in Indonesia but also in the whole world. Indonesian government has responded to the issue by formulating a number of policies, including Law No. 30/2007 concerning Energy, Presidential Decree No. 5/2006 on National Energy Policy and Ministerial Decree of Energy and Mineral Resources No. 32/2008 on mandatory utilization of biofuel as an alternative fuel. The legislation states that central and local government should increase the supply of new energy and renewable energy in accordance with their authority. These policies release a program of energy self-sufficient village or what is so-called *Desa Mandiri Energi (DME)*.

DME is a village that can produce energy based on new energy and renewable energy to fulfill and provide

minimally 60 percent of the energy needs for the village itself. The *DME* program aims at: 1) increasing the productivity of the community's economy, creating jobs, and improving social welfare through the provision of affordable and sustainable renewable energy; 2) reducing the use of fuel oil; and 3) developing the rural economy through the activities of energy provision (Directorate of Renewable Energy and Energy Conservation, 2009). The *DME* program is the governmental activities of developing energy in the rural areas of Indonesia as well as the activities of energy provision as an important point for strengthening rural economic activities.

Based on the definition and the purpose of *DME*, there are three spheres subjecting to the program, i.e. the environmental sphere, economic sphere, and political sphere. The environmental sphere covers the management of energy crisis undertaken through developing new energy and renewable energy. The economic sphere covers the increase of social welfare through developing rural economy. The political sphere covers the policies and institutional support capability in the village as the locus of implementing the *DME* program. Implementing the principles of decentralization and democratization for more than a decade makes the institutions in the village become more important to support the goal achievement as well as the implementation sustainability of the development programs. Developing the aspects of the village institutions which ensure the goal achievement and the implementation sustainability of the development programs leads to democratic governance. (Dwipayana, 2003; Carter, 2007, Doyle & McEachern, 2008)

The *DME* program was first launched by the President of Indonesian Republic in 2007 in the village of Grobogan, Central Java. In 2008, the number of *DME* all over Indonesia reached 424 units; whereas in 2009, the number had grown to 612 units. In 2014, the government set a target of the *DME* number as many as 3,000 units. Some of *DME* are based on biofuel including *jatropha*, coconut, oil palm, sugarcane/ sweet sorghum, cassava, and some other biofuel sources in accordance with the potentials of each region. Some other *DME* are based on non-biofuel energy including micro-hydro, wind power, solar power, biogas, biomass, and other new and renewable energy. (Aisha and Sembiring, 2009)

The areas used as pilot projects of implementing the *calophyllum inophyllum*-based DME program are the Patutrejo village in Purworejo and the Ambal village in Kebumen (Central Java) as well as Banyuwangi (East Java). The fuel of alternative energy developed to utilize the fruit of *nyamplung* (*calophyllum inophyllum*) as the raw material to then be converted into biofuel. However in the two areas –namely Ambal, Kebumen, and Banyuwangi–the DME program can no longer run, while it is still running in Patutrejo but less continuously.

The processing plant of *calophyllum inophyllum* in Patutrejo was inaugurated by the Minister of Forestry, Zulkifli Hasan, on December 6, 2009. In 2011-2012, however the plant stopped operating. To support the implementation of the DME program, then the cooperation with PT Cahaya Katulistiwa (a limited company) was made in 2012. In fact, it did not last long; it only run until the year of 2013. Unfortunately, the *calophyllum inophyllum*-based DME program has no guarantee of continuity.

II. PROGRAM IMPLEMENTATION

Biofuel is a source of renewable as well as friendly-to-environment alternative energy. In this case, Indonesia is a country that has the natural resources for such a potential biofuel that is able to ensure the continuity of its raw material. There are at least 60 types of plants that can be used as the raw material of biofuel, including *calophyllum inophyllum* (DJLP, 2007). The research on *calophyllum inophyllum* as a raw material that is potentially processed into biodiesel has been started in the middle of 2000s. (Sudrajat, 2009) *Calophyllum inophyllum* included in the genus of *calophyllum* has wide distribution all over the world. *Calophyllum* spreads in Madagascar, East Africa, Southeast Asia, the Pacific Islands, West Indies and South Asia. (Bustomi et.al, 2009) In Indonesia, *calophyllum* spread in the islands of Sumatra, Java, Central Kalimantan, Sulawesi, Maluku, Nusa Tenggara and Papua. The total area of the land to plant *calophyllum inophyllum* is 480,000 ha. According to Leksono & Widyatmoko (2010), the source of energy produced from processing *calophyllum inophyllum* seeds can produce *calophyllum inophyllum* oil, bio-kerosene and biodiesel. Since the *calophyllum inophyllum* oil produced is still in the form of crude oil, then the energy source that can be used as biofuel is in the form of bio-kerosene (the alternative of kerosene) and biodiesel (the alternative of diesel oil). The analysis of biofuel quality produced from *calophyllum inophyllum* is done based on the quality standard of biodiesel quality determined by SNI 04-7128-2006.

In addition to the widespread in Indonesia, as a raw material of biofuel, *calophyllum inophyllum* has some advantages as follows: 1) the oil-bath of *calophyllum inophyllum* is quite high up to 74%; 2) the utilization does not compete with food interests; 3) the regeneration as well as the survival is high and bears fruit throughout the year; 4) the cultivation is relatively easy; 5) the whole

parts of *calophyllum inophyllum* have economic values; 6) the utilization of as *calophyllum inophyllum* as biofuel can prevent the rate of felling forest trees for firewood; 7) *Calophyllum inophyllum* is particularly useful as a wind breaker, especially as a disaster reduction in the coastal areas. Based on such various advantages, the government considered at that time that the development of *calophyllum inophyllum* would be socially and economically beneficial for the society as well as ensure continuously the ease of biofuel production in Indonesia.

In addition to the advantages of *calophyllum inophyllum*, the government has drawn up a pilot project of the *calophyllum inophyllum*-based DME program in three regions –namely Kebumen, Purworejo, and Banyuwangi– with the aim of becoming a pilot model for other regions in Indonesia. In this case, Purworejo is included in the six locations of non-timber forest products as the *calophyllum inophyllum*-based national seeds with the number of *calophyllum inophyllum* as many as 10,814 stands in the area of 132.2 ha.

The design of implementing the policy of DME program drawn by the central government is based on the main four principles as follows:

1. Cross-sectoral in nature, i.e. involving the elements of central government, local government (of provinces as well as regencies), and private sectors. By then, the goal achievement of the program depends on the planning that combines the aspect of energy provision with the aspect of social economy, coordination, the clear division of authority among the sectors, and the good synergy among the relevant institutions, especially with the community itself as the vanguard of implementation;
2. The funding can be from one source or many sources. For the initiation of the DME development, the funding is covered by the central government including: the seeding center, the plantation development, the processing unit, the distribution management unit, and the institutional as well as individual capacity building;
3. To reach the goal, the DME program uses participative approach. The participation of the society is needed since the beginning of the implementation. Such participation is based on the social solidarity, i.e. social relation (institutional as well as individual) based on the common moral sense, belief, and common aspiration;
4. The DME criteria include the utilization of local energy, the establishment of productive activities as the impact of the local energy utilization, and the employment of new workers in the unit of energy plant and productive activities. For the biofuel-based DME program, the quick access is used, i.e. the access that can create jobs in the short run and reduce the poverty in the rural areas, whereas it can fulfill the energy needs in the long run.

The *calophyllum inophyllum*-based *DME* implementation in Purworejo does not run in accordance with the main four principles in its design, so that the program has not reached the goals automatically. The *DME* implementation in Patutrejo village is as follows:

1. The plan audience of the *DME* implementation in Patutrejo village was done on April 2, 2009 in the regent's official residence between the head of Plant Forest Research and Development Center of the Forestry Ministry with the regent of Purworejo;
2. The coordination meeting of *DME* in the River Basin Area Management Office (*BPDAS*) Serayu Opak Progo in Yogyakarta on April 3, 2009;
3. The socialization undertaken by the Forestry Research and Development Board of the Forestry Ministry toward the local government and the society on the superiority of *calophyllum inophyllum* as biofuel for biodiesel. In this event, the simulation of utilizing the biodiesel of *calophyllum inophyllum* was applied to cars and farming tractors;
4. The coordination meeting of developing *DME* between the Forestry Research and Development Board with the Forestry and Agriculture Office as well as the Water Resource Mineral Resources Energy of Purworejo on June 4, 2009;
5. The socialization on the social-economy aspect of *calophyllum inophyllum* by the Forestry Research and Development Board on June 6, 2009;
6. The meeting of developing non-commodity timber biofuel-based *DME* in the Province of Central Java on September 30, 2009;
7. Building the processing plant of *calophyllum inophyllum* and planting the seeds of *calophyllum inophyllum* in Patutrejo village in October – December, 2009;
8. The official announcement of the *calophyllum inophyllum*-based *DME* pilot project by the Minister of Forestry on December 6, 2009;
9. The operationalization of biodiesel production;
10. The coordination meeting of the *DME* program sustainability in Patutrejo village between the Forest Village Community Institute (*LMDH*) as a production organizing institute and the state-owned forestry company *Perum Perhutani* of the forest management office (*KPH*) Kedu Selatan incidentally in its function as the advisor of *LMDH*.

Those various meetings undertaken by the initiative of the central government aimed at generating the division of authority among the concerned sectors such as the central government, the local government and the society, as well as doing the coordination for preparing and undertaking the production of biodiesel. As a matter of fact, those meetings did not generate the clear rule of the game, for example, in the form of regulation as well as the operational and technical guidance as the guidance for the actors to reach the *DME* implementation goals itself. The other important result of the meetings was that the appointment of *LMDH* Patutrejo by the Minister of Forestry as a vanguard of the program implementation or

as the business actor producing biodiesel whether in the household scale or industrial scale. The appointment of *LMDH* by the central government was based on the consideration that it was already in accordance with the mission of *Perhutani*, i.e. to develop the forest village community. The two important result of the meetings pointed out that the *DME* program was top-down in nature on account of neglecting the initiatives of the local government and the society as well. The other *DME* program implementation tending to be top-down in nature –the *jatropha*-based *DME*, for example– cannot reach the goal and can no longer run.

In fact, the existence of *calophyllum inophyllum* and its development in Purworejo has generally got a good response from the local people. Muslihudin *et al* (2011) describes that 100% of the society knows the existence of *calophyllum inophyllum* which has naturally spreaded out since a long time ago. it is planted by government as well as the community in relation with the *DME* program implementation. In this case, the community has already understood the technic of its cultivation. In addition, most of the society (88.24%) positively respond to the *calophyllum inophyllum* utilization because it is considered economically to have a good prospect. The positive response from the society gives a chance to themselves to be involved in the implementation proses. The community's involvement will support them to have a feeling of possession and responsibility on the goal achievement of the program. It will not be impossible if the community's involvement support the continuity of the *calophyllum inophyllum*-based *DME* prior to the potential preservation, the processing machine maintenance, and being self-reliant in operating the machines. In this case, the division of authority among the relevant institutions is described in Table 1.

TABLE I. THE AUTHORITY DIVISION OF RELEVANT ACTORS

Institution	Authority
Central Government	initiator and program development
<i>Perum Perhutani</i>	1. forest area manager 2. <i>LMDH</i> advisor 3. raw material provider 4. land provider
Local Government (the Agriculture and Forest Office)	1. facilitator, mediator, stimulator, negotiator 2. regional coordination 3. development management to <i>LMDH</i>
Local Government (the Industry and Commerce Office and Energy and Mineral Resources Office)	1. product standardization 2. product marketing 3. facilitation and coordination to the province level
<i>LMDH</i>	1. business actor 2. outer-area land provider 3. raw material provider
NGO <i>Relung CV Cahaya Katulistiwa</i>	1. technology provider 2. technology development management

Source: primary data.

In the implementation, such authority division do not fully run prior to the time when the production activity is started to begin by *LMDH*. The obstacles coming up from the production process to the production marketing are overcome only in the framework of consultation between *LMDH* and the local government, but it is not followed-up by the central government as the authority holder of the *DME* program. By then, although *LMDH* has already been able to process *calophyllum inophyllum* to be crude oil or biodiesel, there is no solution for the inefficiency problem of biodiesel production and its marketing until now.

The third result of the meetings is the establishment of biodiesel processing plant in Patutrejo village. The buildings and the biodiesel processing machines are from the Ministry of Energy and Mineral Resources which are 680 million rupiahs in price. Before the production process begins, there has been an operational training of the machines by *PT Tracon* (a limited company). However, the training itself is not finished so that the machines operation does not optimally produce biodiesel. In addition, the power generator cannot drive all of the machine components. After being officially announced, *LMDH* has got an opportunity to produce crude oil and biodiesel. Unfortunately, they are produced with such a lot of catalyst that needs high cost production up to 28,000 rupiahs.

The fourth result of the meetings was the formation of action plan 2011-2015 including the tasks undertaken by the central government, the local government of province and regency, as well as the local offices. The action plan was made while the processing plant was having a problem with the machines. So, the action plan has not been fully realized. The most important aspect supporting the program prior to the institutional as well as the individual capacity building in the form of training and mentoring the plant operators (*LMDH*) was not done for 5 years continuously by the central government as well as the local government with its offices. In fact, the production process of biofuel from *calophyllum inophyllum* was not so simple that needed a technology mentoring and human resources who knew the process and had a dedication to their work. The activities of capacity building in the form of training and the operation of *calophyllum inophyllum* processing machines were only done once by *PT Tracon* just before the plant official announcement. If there was a problem of hampering the production, then it would be overcome by doing the consultation to those who were considered by the plant operators as the problem solvers. As the result, the institutional as well as the individual capacity did not increase and support the biodiesel production either. This pointed out that the plant operators depended only on one person who was able to operate the machines until it could produce up to 23 liters/hour, whereas the other persons could only produce 5 liters/hour. This number did not support the government target, i.e. having 250 liters of biodiesel of *calophyllum inophyllum* oil per day. If the production number determined by the government was fulfilled and the *calophyllum inophyllum* plants in the areas of *Perhutani* were managed well, then the

government would be able to give substantial contribution to the national production plan of biofuel as well as to give contribution to the economic increase of the village society living around the forest area (*LMDH*) who involved in the process of *Perhutani calophyllum inophyllum* plants.

The program monitoring as well as the evaluation was not done every year, except in Mei 2013 when the central government undertook the monitoring of the *DME* implementation. Such condition made the relevant actors in the region did not understand the root of biodiesel production discontinuity problem. In 2014, a work group of *calophyllum inophyllum* was already established in which the group had a task of evaluating the implementation as well as indicating the *DME* problems coming up so far. Unfortunately, *LMDH* had never got the result. Besides, the operational cost facility to *LMDH* was also hampered. Based on the information from the informant, the operational cost in the form of fresh fund injection was only given twice from the Forest Ministry and the local government. Such operational aid was used to repair the damage screws of *calophyllum inophyllum* breaker, whereas the machines aid was given by the local government of the province but they have not been operated yet because the old ones are still able to produce biodiesel.

III. THE HINDERING FACTORS OF IMPLEMENTATION

A brief description of the *DME* program implementation in Purworejo points out that the program goals have not been reached after 6 years running. The main factors of hindering the implementation are: 1) technical obstacle; 2) economic obstacle; 3) institutional obstacle and the operator capacity. First, the technical obstacle is related to the processing machines that can efficiently produce crude oil and biodiesel. Since the beginning of the *DME* program implementation in Patutrejo village, the processing machines can only be operated for three months because there is a damage on the power machines, the tools of *calophyllum inophyllum* breaker, the blowers, pressure machines, and the esterification machines (the ester formation from carbohydrates acid and alcohol) in which some of them are still made from iron so that the quality of *calophyllum inophyllum* oil is nonstandard with a very low bath. The effort of repairing the machines is still done but cannot get the satisfying result. As a matter of fact, the machines did not function well. After having cooperation with CV Cahaya Katulistiwa in 2012 and using the machines from the company, the machines could finally function and produce the oil. The production of biodiesel is used for road-test by driving three local-government cars of Purworejo with a route of Purworejo – Kebumen – Cilacap – Yogyakarta. After the road-test, the cooperation with CV Cahaya Katulistiwa is over. That is why the cooperation with CV Cahaya Katulistiwa is more on the political nuance because the road-test itself is an effort of giving the image that the *calophyllum inophyllum*-based *DME* program has already succeed in Purworejo in accordance with the action plan.

Second, the economic obstacle that is prior to the product marketing affecting the obstacles of costing the plant operation. As the consequences of having the low bath as well as the lack of technology mastering from the operators, then the production cost becomes very high. According to the explanation of the plant operators, the cost of producing *calophyllum inophyllum* oil to be biodiesel is estimated up to 29,500 rupiahs so that it cannot compete with the fossil diesel oil and have no possibility to be consumed for the household scale. The variable influencing the high production cost is the low quality of *calophyllum inophyllum* and the use of very expensive catalyst, so that the action needed to be undertaken by the government for pressing the production cost is the *calophyllum inophyllum* cultivation as well as the type determination of efficient and effective catalyzer; or the difficult thing to be realized is giving subsidy to *calophyllum inophyllum* biodiesel. This marketing obstacle leads finally to the stuck of costing the plant operation so that the machines cannot be operated anymore. Another consequence of the obstacle is that the unused fruits of *calophyllum inophyllum* are finally sold by the local people in the form of raw material to Waterland in Grobogan or made as the handicraft products in the form of key chains as souvenirs sold for the tourism needs in Yogyakarta and the surrounded areas.

Third, the institutional obstacle is the disfunction of *LMDH Wana Lestari* as the institution in charge of the DME program operation in the local level. Although the DME program in Purworejo can produce biodiesel, however it still depends on the plant operators. In this case, LMDH is not responsive to the problems until now. Various problems delivered by the plant operators to LMDH are not responded and not followed-up either. The existence of LMDH is only for the formality. The program development coordination from the central government as well as the local government is not done through the LMDH leader but directly to the plant operators.

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