The success factor in developing an energy independent village in Klaten Central Java

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Abstract. The production of renewable energy source is urgently needed because of the serious problem associated with the supply of energy-based primarily on fossil and nuclear fuel. This phenomenon shows the increasing of importance of developing renewable energy. One of the villages in Klaten district, Central Java has been developing renewable energy to meet daily needs. Renewable energy comes from cow feces which are processed into biogas. This paper describes a qualitative interview analysis of success factor for bioenergy village implementation. This study used a qualitative method with data collection technique through in-depth interview. Interview was conducted with community who use biogas selected by the purposive sampling. We found the success factor in developing Renewable Energy those are support and cooperation with multiple institutions, the participation of an initiator, direct engagement in activities, the implementation of the principles of transparency and communication. Besides that, it is also driven by the increasingly expensive and scarce price of fuel oil. So for now, the inhibiting factors are public funding, unsupportive policies, and doubts from the public. However, the people are proud of the development of this renewable energy, and their quality of life is improving. Besides that, their village also received awards, so that many visitors from outside come to the village. The community wishes to expand it into a tourist village in the future.

1. Introduction
An increasingly advanced civilization has a significant influence on the development of a country. This development includes various aspects that are identical to human activities to meet the needs of life. Of course, these activities cannot be separated from the use of various types of energy such as fuel oil, coal and natural gas to meet needs in industrial, transportation, and household activities. Energy has a strategic role and is very important for the livelihoods of the people at large, especially in increasing economic activity, job opportunities and national security. Then, energy must be used for the greatest prosperity of the people as mandated in Article 33 of the 1945 Constitution of the Republic of Indonesia.

Nowadays, most countries use fossil resources to meet energy needs. It has already been known that the use of these fossil resources will have negative consequences that result in greenhouse gas emissions. This will cause environmental damage such as melting ice in the northern hemisphere and rising sea levels. If it is allowed to continue, it will make fossil energy increasingly scarce and disrupt the survival of living things.

Energy scarcity was highlighted by the international energy agency in 2019 which stated that the main problem in Asia was energy scarcity and dependence on fossil fuels. Indonesia is one of the fossil fuel producing countries which is currently unable to meet the national energy needs, so it must be
imported from other countries. It is proven that since 2003, Indonesia's petroleum consumption has exceeded production, making Indonesia an importer of petroleum [1]. High consumption of fossil fuels and scarce resource supply lead to dependence on import and increasing commodity price in most countries.

The continued exploitation of fossil fuel on a large scale will pose a great risk to the survival of human civilization, but maintaining and expanding a prosperous civilization requires a certain level of energy supply. The solution to deal with this serious problem is energy development. The development of energy is already available in nature by utilizing local energy. The use of local renewable energy is beneficial for energy independence and security. The use of renewable energy will save the use of fossil energy reserves and will become a stimulus for economic development. In addition, the use of renewable energy is also friendly for the environment.

In this context, the development of an energy independent village is an alternative in utilizing renewable energy to meet daily needs. Energy Independent Village is a form of government effort in developing energy in rural areas and making energy supply an entry point in rural economic development [2]. The concept of an energy independent village is a village that is able to fulfill its energy needs independently without depending on fossil energy sources. Developing an energy independent village is from livestock manure waste which is processed into biogas for cooking purposes. This article investigates what are the success factors in the development of an energy independent village, the obstacles experienced and the implications for developing an energy independent village. The results are expected to support the transfer of knowledge in the development of energy-independent village.

2. Method
This research is a qualitative research with a case study approach. It has a goal to investigate what are the success factor in developing an energy independent village. This research was conducted in Mundu Village, Tulung sub-district, Klaten Regency, Central Java, Indonesia. This village has been and is developing an energy-independent village since 2014 starting from the initiative of the community who then received support and assistance from several parties. According to Sugiyono, 2012 the indicators that need to be considered in the development of an Energy Independent Village include: 1) The potential for renewable energy in the local village, 2) The ability of service range (accessibility), 3) Community interest and the ability of the local community [3]. Tulung sub-district has great potential for renewable energy, namely the results of livestock manure from dairy cows. Even though the location is far from the city center, this Tulung district can still be accessed with good road infrastructure. In addition, there is also initiative and enthusiasm from the community to develop.

Data collection technique used in-depth interviews. Interview centered on a particular problem, namely digging up information about the success factors in developing an energy independent village. The interview guide is used as a guide. Interview guidelines are important for strengthening the interviewer's memory on research topic and will provide a framework that focuses on the topic of the interview [4]. Interview allow the interviewee to speak as freely as possible without pre-determining alternatives so that discussion can arise. The purpose of in-depth interview is to find problem more openly [5].

The technique of determining informant used purposive sampling of the parties who play a role and know about the development of an energy independent village. Purposive sampling with selection based on criteria” [6]. The selection of informants is based on Patton, 1990 that selecting informants must be considered the most knowledgeable so that the selection is balanced according to the needs and stability of the researcher [7]. The informants in this study include the village head, the head of the farmer, the management and members of the Farmer Group, Extension Officers, relevant government agency stakeholders and the assistant from the LPTP NGO.

The analysis technique of this research used the Miles and Huberman model, which is carried out interactively and continuously until it is completed and produces saturated data. The principle in data analysis is to perform data reduction, display data, and conclusion drawing / verification [5].
3. Result and Discussion

3.1 The Success of Energy Independent Village Development

An energy independent village is formed from a community initiative in desiring to go forward and develop the potential surrounding. In the implementation process, there are several factors that support the successful development of this independent village.

3.1.1 There is support and cooperation with various parties

Village development cannot run smoothly without support from various related parties. The parties that help in this program are the LPTP NGOs, district office, provincial office, and the private sector. Cooperation at various sector levels is very important to support the success of the process. The community assesses that there is support in the form of assistance from the LPTP NGO, assistance support and training from the government to encourage the implementation of village development. The community has become more enthusiastic to develop their village.

"The support from the government and various parties for our village makes us even more enthusiastic to move forward. We are more aware of our natural potential and now we can use biogas" (Pak Teguh, Head of the livestock group).

The support from the LPTP NGO is in the form of assistance done to the community. This assistance is done in various trainings ranging from livestock management to biogas and livestock product processing. LPTP is also the mediator who introduces the village to outsider. The support from local and provincial government in the form of financial assistance and in the form of goods and cattle as well as training to support breeders skill. In addition, there is also support from the village. The village has made plan for the development of this biogas. Each year, it is planned to build 10 biogas digester points, the goal is to support the development of an energy independent village. The private sector which plays a role among others comes from PT. Tirta Investama, which provides financial support realized by the LPTP NGO in the form of activity and training. Cooperation has been established between the community and various parties. This is in line with research conducted by Mussal and Kuik, 2011 which states that the support and involvement of a mayor in a small town in East Germany has contributed to the success of the program [8]. Building a village is a multi-dimensional process and involves all stakeholders who work together for the process of responding to the three village environments (natural, cultural and socio-economic) in an appropriate manner [9].

3.1.2 Society that has an open mindset

The openness of the mindset possessed by this community can be seen from their enthusiasm to keep going and developing. Although, at first, there were some communities who still refused to develop biogas, as time went by, the community began to open up and participate. The community begins to understand the potential of the natural surroundings. The results of routine meeting and training with LPTP have increasingly opened their mind and increased their knowledge of the potential and opportunity they have. This open attitude is one of the keys in forging closer interaction [10]. It starts to grow a new paradigm in society to develop the village into an energy independent village.

3.1.3 Gas price fluctuation and gas supply scarcity

LPG gas is the solution to the increase in fuel price, but now it is becoming scarce, causing price to fluctuate. Biogas plays an important role in replacing fuel oil and LPG, especially for small and domestic scale. In addition, biogas is also economical and environmental friendly.

Mr. Suyat said “Livestock has been using biogas since 2014. Now they no longer need LPG gas, because they already have a biogas reactor, which converts cow feces into gas for the
needs of the kitchen at home. Before owning this biogas reactor, I usually had to buy LPG gas every month. Now we can meet the gas needs for free”

The development of biogas energy from livestock waste helps the community reduce the cost of purchasing LPG gas every month. The community is greatly helped by the presence of biogas. Now, the public is no longer worried about the increasing price and the scarcity of LPG gas.

3.1.4 Direct involvement in plan, implementation and evaluation of activity
The implementation of energy independent village development cannot be separated from the active participation of the community. This community involvement starts from plan, implementation and evaluation. The plan was carried out at the beginning, in 2014. It was started with the socialization of biogas by the LPTP NGO, then gathered together with several parties to plan the development of the energy independent village. This plan involved various elements of the village community. Whitmarsh et al 2011 stated that socialization and participation process can increase community acceptance of renewable energy development [11]

The production of biogas in the process of building a biogas digester is carried out mutually by the community. The community built this biogas digester on the principle of arisan. Initially, there were 5 people in one group who contributed funds to buy building materials and contributed their labor together in making the digester. The LPTP NGO assisted in providing experts to install the biogas plant.

Many training activities have been carried out with the community to support skill and competency in developing energy independent village. The training activity that have been provided so far, those are cow stable management, started from keeping the stable and livestock clean organized by LPTP and the NGO IDEA New Zealand. LPTP conducted training on processing livestock waste into biogas and slurry fertilizer. Training on making animal feed and training for processing milk product into processed food product was held by the Central Java Provincial Government. LPTP provides tour guide training. The training is carried out to increase community knowledge and skill and is expected to be able to support the development process of an Energy Independent Village. In addition, it is also to support the sustainability of the village so that its potential can be utilized and processed to produce additional value. Then, evaluating each activity carried out. Community involvement started from the beginning of the plan and implementation process increases the chance of success, and the community can contribute their competence and knowledge to the implementation process [12].

3.1.5 The principle of information transparency and communication
Transparency will reduce the level of uncertainty in the decision making process. Besides that, it has an important role in maintaining the trust of the community. Information is usually provided by the LPTP NGO through the head of the farmer group. Then, by the head of the breeder group, this was distributed to the community. The existence of communication between community also makes it more solid and growing. This finding is in line with Whitmarsh's, 2012 two-way exchange of information makes people learn about renewable energy development and form social forces through technology and innovation [11].

Then, a routine meeting is held once a month to maintain communication between farmer group and for information sharing. In line with the findings of Eigner-Thiel 2005, face-to-face contact and private conversation can convince a skeptical public and to share a variety of information [13]. The principle of transparency and communication are very important in accordance with the findings of Walker at al 2008, which showed the importance of trust between local community and those who carried the project [14]. A similar idea was conveyed by Zoellner et al. 2008 that transparency is a relevant process, therefore there will be people who oppose when not involved in the plan and decision-making process [15].

3.2 Barrier in Energy Independent Village Development
The construction of this biogas installation requires a lot of money. In the beginning, the community was given a pilot project by LPTP which was funded by Pt. Tirta Investama. After the project was
completed, the community began to build their own funded biogas digester with an arisan system. Until now, there are 40 biogas digesters. Lack of funds owned by the community becomes an obstacle to the equitable distribution of biogas development. This is also because people have low income. The high enthusiasm of the community towards biogas has not been realized due to limited costs so they choose another alternative using firewood.

Some people have doubts about the development of this energy-independent village because they feel pessimistic about their potential. Some of these people think that the village cannot develop because of the remote village location and lack of access to information. In addition, they also did not follow the socialization from the start, so they did not understand how to plan for developing an energy independent village. These findings are similar to Wuste 2012, public doubts about costs, economic efficiency, safety of energy supply, odor disturbance and the risk of accident becomes obstacles to the implementation of communal bioenergy in Germany [12].

3.3 Implications and Expectations in Energy Independent Village Development

As the time goes by, there have been many advances and developments in the village. The increasing popularity of the village in the wider community makes people feel satisfied and proud of what they have done. A feeling of pride arises because he have been able to pioneer the development of an energy independent village.

The more well-known Mundu village in the wider community, the more visitors come from various elements of society. A visit comes from other groups, other villages, government agencies, students, police and tourists. They want to see and study the implementation of biogas and integrated livestock management, from stable to processing dairy products and livestock manure. The existence of this energy independent village development adds knowledge and experience in the field of renewable energy. This makes people's quality of life better. One of the villagers, Mr. Pono, is now proficient in installing biogas installation. Several times, he installed in other places and even outside Java. Furthermore, energy supply is also safe, environmentally preserved and saves in a long-term economic side.

Some of the awards that had been obtained include, in June 2019, receiving an award from the Village Technology Development Institute LPTP Award as an independent village of biogas energy. In 2018, he won the 3rd place in the Independent Energy Village at the Central Java Province level. Received an award from the 2018 ISDA (Indonesian Sustainable Development Goals Awards) to PT Tirta Investama Klaten, for its program entitled Energy Independent Village Initiative through Biogas Technology Intervention in Mundu Village. An award from the Coordinating Ministry for Human Development and Culture of the Republic of Indonesia in 2014 to PT Tirta Investama Klaten, for its program entitled Community-based Biogas Development (Biogas Arisan System) in Mundu Village, Tulung District.

Furthermore, the new goal that the community wants to achieve is to develop into an energy independent tourism village. A tourism village with an integrated concept in one area, namely communal stable, animal feed processing, biogas production, fertilizer processing and milk processing. So that, it is hoped that it can help the local community's economy and open up new jobs for the community.

4. Conclusion

The success factors in developing an energy independent village in Klaten 1) the support from various parties in the form of assistance and training that motivates the community. 2) people who have open mindset are the key to build closer interaction in realizing and developing their potential. 3) Price fluctuation and the scarcity of LPG gas encourage people to utilize biogas that is economical and environmental friendly. 4) direct community involvement in plan, implementation and evaluation can increase community knowledge, skill and competency so that they are able to support the development process of an Energy Independent Village. 5) transparency of information and communication has an important role in maintaining public trust.

There are obstacles in developing an energy independent village, that is limited funds to build a biogas digester, so there is no certainty. And then, the rising of doubts from several parties regarding
the sustainability of energy independent village development. This doubt is caused by pessimism and not understanding the program plan.

Implication and hope that arise with the existence of this energy independent village are the sense of pride felt by the community who has been able to carry out this program. It can be seen from many visits from various regions and elements of society, a better quality of life with a safe energy supply, several awards that have been obtained and a new goal for developing the village into an energy independent tourism village.

5. Suggestion
The implementation of energy independent village development can improve the quality of life of the community and maintain environmental sustainability through communication and cooperation with various parties.

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