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BIOGAS AS PROMISING RENEWABLE ENERGY ON RURAL HOUSEHOLD IN KLATEN CENTRAL JAVA INDONESIA

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Abstract

The dependence of the world community on fossil fuels and the scarcity of energy reserves becomes a challenge that has not been resolved until now. Therefore, the development of renewable energy in the form of livestock waste which is processed into biogas becomes an effort to maintain the stability of energy supply. This study tried to investigate the technical and social capacity of the community in the development of renewable energy and the benefits obtained from using biogas technology for sustainable agriculture. This qualitative study was conducted by in-depth interviews using the snowball data collection technique. The results of this study the community's ability to develop renewable energy includes community governance, capacity building and engagement, technical design, ownership structures, operations maintenance and management, systems and project sustainability. The various benefits obtained from the use of biogas include maintaining health, utilizing bio-slurry for agriculture, reducing gas emissions to the environment and reducing air pollution, creating a sense of mutual cooperation and creating networking, increasing knowledge of biogas, reducing the cost of buying LPG gas and increasing community income. Contribution to provides knowledge and an overview of the implementation of community-based renewable energy development in rural areas, it is hoped that it can be an inspiration for policymakers to apply it to rural areas, especially in developing countries.

Keywords: Agriculture, Biogas, Community Capability, Community Renewable Energy, Sustainable.

INTRODUCTION

Energy scarcity is one of the causes that hinders progress in developing countries. The majority of people in developing countries live in rural areas. Developing countries experience limited sustainable livelihoods due to a lack of energy supply in rural areas (F. Li et al., 2016). Due to the increasing deficit of energy supplies, renewable energy has become a global concern in providing energy production (Mushtaq et al., 2016). Therefore, finding renewable energy sources becomes the main effort in overcoming the energy crisis in the world (Chang et al., 2014).

Indonesia with a population of nearly 280 million people (BPS, 2023) has not been able to meet the demand for domestic energy needs, and it causes the need for imports to continue to increase. In addition, limited access to electricity or other energy sources makes a dependency for about 69% of the rural population on the use of wood fuel and crop residues (Huboyo et al., 2014). This typical condition will certainly cause a negative impact on the environment.

The issue of the fact of energy supply in Indonesia has been in particular attention for a long time. The Indonesian government has committed to create various energy sources in 2025 by releasing Government Regulation Number 79 of 2014 about National Energy Policy, in order to encourage the use of renewable energy and put a brake on the use of fossil energy sources. In this policy, the spread target of renewable energy will be set in 2025 with at least 23% and in 2050 with at least 31% as long as the economy has been met (EBTKE, 2021). To encourage the spread of renewable

energy development, the President issues Presidential Regulation No. 112 of 2022 concerning the Acceleration of Renewable Energy Development for the Provision of Electricity.

Access to cheap and clean energy will help poverty alleviation and human development, this has been proven by various international programs that focus on the application of efficient energy (Martí-Herrero et al., 2015). One of the technologies used is a small-scale biogas power plant that converts organic matter into energy (biogas) and fertilizer (digest) (Roubík & Mazancová, 2020). The increasing demand for livestock products brings a lot of biodegradable waste in the form of livestock manure which is suitable for producing biogas in Indonesia.

The current condition of rural Indonesian households traditionally uses wood for cooking (Singh & Setiawan, 2013), which has a negative impact on the environment (deforestation), labor demand and health risks from burning indoor biomass (especially for children and women) (Huboyo et al., 2014). Therefore, it needs a sustainable energy source. The use of manure for biogas production appears to be the right way to supply sufficient energy at the household level as well as to contribute on waste management, and to protect the environment, as well as to produce organic fertilizers.

This renewable energy development is managed in the basis of community. The initiative of community renewable energy (CRE) has the potential to mitigate several problems and has benefits including: (1) more community engagement and acceptance of renewable energy technologies, leading to better integration in society, adaptation of social design and organizational structures; (2) the emergence of a shared ownership sense, higher satisfaction with technology (3) the development and empowerment of local technical and managerial capabilities, which support long-term system operation (Madriz-Vargas et al., 2017). This paper aims to investigate community capabilities in technical and social aspects in the development of biogas energy and the benefits obtained from the use of biogas technology for sustainable agriculture. The contribution to be given from this research is to provides knowledge and an overview of the implementation of community-based renewable energy development in rural areas, it is hoped that it can be an inspiration for policy makers to apply it to rural areas, especially in developing countries.

METHOD

Research Location

This research was conducted in Mundu Village, Klaten Regency, Central Java, Indonesia. Geographically, Klaten Regency is located between 110 ° 30'-110 ° 45 'East Longitude and 7 ° 30'-7 ° 45' South Latitude. It is an area of 655.56 km². The Klaten Regency area is divided into three areas, namely the northern side is the slope of Mount Merapi, the eastern side is the lowlands, the south of the Mount is Kapur land. Tulung District is located on the slope of Mount Merapi which has the greatest potential in agriculture and livestock.

Research Design

To be able to reveal how the technical and social capabilities of the community is used a constructivist-interpretivist approach using qualitative research. In the constructivism paradigm, reality is understood socially from experience, then it has specific and local

and the result depends on the object that has the construction (Denzin & Lincoln, 2018). Constructivism develops the meanings of subjectivity on its experiences. These meanings are made through interactions with research objects (social constructivism) and through social and historical norms that apply in everyday life (Creswell, 2017).

The data in this study are primary data collected through in-depth interviews and direct observation. The interview conducted was a semi-structured interview using an interview guide. According to (Kvale & Brinkmann, 2009) semi-structured interview is designed to obtain the life description of the interviewee to interpret the meaning of the phenomena described. Direct observations by researchers observed social phenomena in the community including the process and impact of developing an energy-independent village. The collection of data was carried out in January - October 2021. Each interview took about 60-75 minutes. Interview was conducted with the biogas user community, and parties involved in the development of renewable energy. 9 participants are directly involved in community development. The nine people are TG, SP, SY, TT, NK, TY, HD, WD, and BD. These nine people have different education and family backgrounds. TG, SP, SY are breeders who use biogas for household needs. TG is the leader of the breeder's group, he is a mobilizing figure in the community. SP is a farmer and biogas installation expert. SY is an ordinary farmer using biogas. TT and NK are facilitators from the NGO who accompany the biogas program. TY, HD, WD, BD are government parties. The procedure for obtaining these participants is using the snowball sampling technique. Snowball sampling is a technique of determining a sample that is initially small, then gets bigger like a snowball that rolls over time to become large (Sugiyono, 2007). In additional semi-structured interview, passive observation was also carried out to enrich the data especially in the benefits of biogas. Passive observation researchers are not involved in activities carried out by the community. In this case there is no social interaction. Observations include direct observations on the use of technology and the benefits of biogas. This passive observation an important role in investigating the performance of the installed biogas and the management of the biogas reactor (Wahyudi, 2017).

Data Analysis

The data collection process to reduce the possibility of misinterpretation uses various procedures, including data collection reaching to the point of redundancy (redundancy of data gathering) and debating explanatory procedures. This procedure is called the triangulation technique (Denzin & Lincoln, 2018). This study used source and method triangulation. The data analysis process was carried out in five stages, namely compiling data, data disassembling, data reassembling, interpretation and concluding (Yin, 2015).

At the compilation stage, data obtained from in-depth interviews and group interviews were recorded in the form of an interview transcript. The analysis was carried out by coding the technical and social skills of the community and providing reflective notes for developing further interview guides that focused on the problems and solutions studied. In the data unloading stage, the data was broken down into five main parts based on technical and social capabilities. There are (1) Community Governance (2) Capacity Improvement and Involvement (3) Ownership Structure (4) Technical Design, Maintenance and Management Operation (5) Follow-up on Sustainability Program. After that the data were organized into five main categories, data re-assembly was carried out to see if there were conflicting problems and cause and

effect. After that the interpretation that is done is explanatory interpretation - interpretation designed to explain how or why something happened. The final step in this analysis is to draw conclusions based on the results of the four-stage interpretation

RESULT AND DISCUSSION

Biogas Technology

Biogas is included in a clean renewable energy because it does not produce smoke residues such as wood or charcoal. Biogas is a mixture of methane gas (CH_4) and carbon dioxide (CO_2) which is used as fuel derived from organic materials with the help of bacteria in oxygen-free (anaerobic) conditions or commonly called the fermentation process(IEA, 2019). Biogas is flammable and has a methane gas content of around 50-70%. Organic materials that can be processed to produce biogas are livestock manure and urine. This type of organic material will affect the progress of the biogas system productivity process in addition to other parameters such as digester temperature, pH, air pressure and humidity. In general, manure and water are needed as raw materials to operate biogas installations, therefore the available amount must be sufficient to be processed and in accordance with the size of the digester (Wahyudi et al., 2015).

The main components in the manufacture of biogas are the storage for raw biogas materials, a digester, a slurry tank, a gas storage, a gas outlet pipe and a slurry exit pipe. The biogas reactor used by the community has a capacity of $6m^3$. The function of this biogas reactor is to convert organic material (feces and urine) into biogas. The biogas in the research location was used for cooking fuel. The biogas digester design at the research location used a fixed domed plant design. In the beginning of the development of biogas, there was a pilot project from the NGO in 2014 which has since grown to 40 biogas reactors. The construction of the biogas reactor was done independently by the community. Then there was donor funding from Private companies, which was distributed through NGO in the form of a stimulus to help build a biogas reactor. The community still contributes to spend money and manpower with the “arisan” system to gather several people to build together for the biogas reactors in the terms of turn for all members. Arisan is a mutual cooperation activity that is carried out by collecting money in one group for a certain period of time depending on the value of the joint agreement in the construction of a biogas reactor. This activity is carried out in rotation to reduce the cost of building a biogas reactor. TG said that "arisan" was an initiative initiated by the community, the amount of money in arisan was determined based on a mutual agreement.

Technical Ability and Social Community

In this study, it tried to see what abilities the community needs to have in developing energy, using a community capability approach to integrate community-based technical and social factors.

Community Governance

The community that uses biogas is part of a livestock group called "Margo Mulyo". Margo Mulyo Farmer Group is a socially active community with four areas: Public Relations, silage feed production, Fertilizer and Cultivation. This group was formed on September 27, 2012, engaged in dairy cattle. This group focuses on: a) exploring and developing the science of dairy cattle b) developing a business in the field of dairy

farming. The community often holds a regular monthly meeting every 15th of the month.

Biogas development is one of the efforts in developing livestock business units. In implementing this biogas, the community is directly assisted by the NGO. In the field, there should be a team which can recognize various concerns that arise in the community (Perlaviciute et al., 2018). This role is mostly supported by the NGO. This NGO has been assisting the community in the field of livestock and agricultural waste processing since 2014. In the first time, the community was given a pilot project. Starting from this project, the community was encouraged to want to develop biogas in their area. Many parties who took part in the development of this biogas, those were Private companies which was a fund donor, provincial government, district government, village government and community leaders, universities, and private sector. They worked together to be able to develop this biogas. The community needs to integrate with external networks and good communicate with various stakeholders to get support (Budiarto et al., 2019).

"This biogas pilot project was initially funded by private companies as a form of responsibility towards society. We as NGOs as executors in the field that help the community"
(TT)

Mundu village has obtained several awards, including an award from the Village Technology Development Institution LPTP as an independent village for biogas energy in June 2019. In 2018, Mundu Village won the 3rd place in the Independent Energy Village at the level of Central Java Province. Then, it also received an award from ISDA (Indonesian Sustainable Development Goals Awards) in 2018 to Private companies, for its program entitled Energy Independent Village Initiative through Biogas Technology Intervention in Mundu Village. Furthermore, an award from the Coordinating Ministry for Human Development and Culture of the Republic of Indonesia in 2014 to Private companies, for its program entitled Community-based Biogas Development (Biogas Arisan System) in Mundu Village, Tulung District.

Capacity Improvement and Involvement

Capacity improvement and community involvement are benchmarks for community mobility and empowerment. Through this capacity improvement, the community gets the knowledge and skills needed for biogas development. The improvement of an adequate human resources capacity in the technical and social fields will ensure the sustainability of renewable energy system technology in providing benefits, besides, it will also reduce failure in operations (Budiarto et al., 2019).

Development at research location builds the ability to own and operate rural biogas from scratch using a variety of approaches. Creating and maintaining skills can be focused in key areas such as biogas management and maintenance. Technical knowledge for biogas design and construction is obtained from experts from the Program BIRU. The Program BIRU is a program of the Ministry of Energy and Mineral Resources (ESDM) in 2009 and was later implemented by the Rumah Energi Foundation in 2012. The goal is to disseminate renewable energy programs through the use of biogas as a clean energy source for cooking and the use of bio-slurry (biogas waste) as a source of energy. Natural fertilizer. Capacity improvement also aims to build community participation in exploiting its potential. (Budiarto et al., 2019). Increase community participation, interest and the acceptability of consumers to adopt

biogas, especially in rural communities, and accept all socio-cultural challenges (Situmeang et al., 2022).

In its implementation in the community field, it has been assisted by other parties who are committed to rural development in Klaten. For example, Private companies supports as an advisor and fund donor, this company makes collaboration with the NGO as field implementer. NGOs are partners that assist private companies in distributing aid funds in the form of training and mentoring.The task of the NGO is to assist the community and facilitate activity and training. The government provides financial assistance in the form of assistance in purchasing building materials. The company provides funds as a stimulant to the community. Funds for the construction of the biogas reactor were obtained from company donor funds and the social gathering system carried out by the community. In addition, the contribution of the community can be seen in the manpower in the development which is mutual cooperation and free land rent for the construction of the main reactor and dairy cattle.

In general, the capacity improvement that has been implemented at the research location is divided into 3 parts:

Increase in Technical Capacity

This technical improvement includes the introduction of household energy management according to the potential of the surrounding community, namely livestock manure waste. Household energy management introduces the community about the concept of calculation about LPG gas consumption. Then, there are also the introduction of biogas renewable energy, the way to operate and to maintain it, troubleshooting of common problems that can arise, and operational costs.

Social-Institutional Capacity Improvement

The social-institutional improvement contains about the renewable energy financing model, group institutions and the management of the biogas system.

“We from NGOs try to educate the community about group management and provide motivation” (NK).

The increase in institutional capacity can be seen from the improvement of the financing system for the construction of biogas reactors. Initially the community got full funding from private companies and the government. Now the community is utilizing the arisan system independently in funding the construction of the biogas reactor. The Mundu village community and community members are involved in this biogas gathering. The community holds meetings which are held regularly every month to discuss biogas gathering and collect money from members for the cost of building a biogas reactor. In one biogas development takes about 3 months. The role of NGOs is to assist in implementation, the government and private companies provide stimulant aid funds in the form of tools and building materials. This system is proven to be able to increase public enthusiasm for the application of biogas.

Productivity Improvement

Productivity improvement includes exploitation activities as the results of energy. These activities are the use of biogas for cooking fuel, slurry fertilizer to fertilize crops.

"In the construction of the pilot project, we worked corporately in the construction, starting from digging the soil to casting the digester and setting the installation. We

*already have one expert. The land for constructing the communal stable was also given voluntarily from one of the group members. "(*TG).

Each of these activities asked directly the participation of community. Participation was given in the form of thoughts, energy and costs. Direct community involvement in activities is essential, besides, the community are able to implement the knowledge gained from capacity improvement, it can also open job opportunities (Budiarto et al., 2019).

Additional training that the community has received includes: training on livestock and stable management, animal feed manufacturing training, livestock waste processing training, house yard utilization training, post-harvest processing training for milk into processed food material such as candy, soap, crackers and ice cream. All of these trainings were carried out to support village development so that it can be more advanced and it can develop business unit from livestock.

Ownership Structure

Ownership of the biogas system is privately owned and there is a parallel system. This paribadi system is one digester used for one household. While the parallel system, one digester is used for 2 households. Although there is a grant for the biogas construction process, the ownership of this digester is fully owned by the community.

"*This privately owned biogas makes me happy and proud. Many visits have come to see this biogas. Apart from not having to buy LPG for the past 5 years, the fire produced is even bluer than if using LPG*. "(PN).

Full ownership of biogas creates a sense of satisfaction for the community and saves from spending on buying LPG gas every month. So that, sooner or later, it has emerged the community's responsibility to maintain and use biogas technology. This independence can be seen from the use of biogas for cooking and lighting lamps. Independence in the application of biogas can be seen from the use of biogas to replace LPG, independence in the installation of maintenance of biogas installations, as well as the ownership and management of biogas (Silaen et al., 2020)

Technical Design, Maintenance and Management Operation

In general, the technical design of the biogas at the research location uses a fixed domed plant design. This design was chosen during the biogas development planning discussion by considering the location conditions to build the digester. Determining the technical design needs to pay attention to the type of energy source to be applied, because each type of energy has different characteristics and requires adjustments to the variety of substances (Budiarto et al., 2019). Then for the size of the capacity of the digester is around 6-8 m^3 for a household scale. Various types of materials and sizes of biogas equipment can be developed according to the characteristics of the area, type, amount and management of livestock manure.

The operating system of the digester at the research location used continuous feeding. The continuous type of digester is a type of biodigester which is designed in which the ingredients are added continuously every day according to the availability of the material in the drum (Pertiwiningrum, 2016). The anaerobic digestion process of cow manure takes about 8 hours in warm temperatures (35°C). One-third of the biogas will be produced in the first week, one-fourth in the second week and the rest will be produced in the third to eighth week.

The process of forming biogas goes through the following stages: (1) Preparation of fresh cow feces between two and three days and it has mixed with water. The comparison between water and feces is 1:1. (2) Flowing cow feces into the reactor. (3) Wasting the first gas produced. Utilization of finished biogas. The gas that has begun to form can be used for cooking fuel. Some things that need to be considered in the operation of the digester include the stirring process, temperature control, gas collection, position of the digester and retention time (Haryati, 2006).

Maintenance of the biogas installation includes cleaning and lubricating the main gas valve and gas tap, cleaning the water drain and overflow, checking pipe joints, repairing pipe joints to stop leaks, cleaning stoves and replacing rubber hoses. This maintenance is carried out regularly by the community.

Follow-up on Program Sustainability

Biogas development uses various strategies to maintain its sustainability, including maintaining biogas installations, setting aside a budget for biogas development. The village government has planned a special fund that plans to build 10 biogas points every year. And now, there are also plans to develop the village into an energy independent tourism village. An integrated location consisting of communal stable, biogas processing, fertilizer waste processing, animal feed manufacturing, processing of milk products into food products such as candy, crackers, soap, ice cream from cow's milk as raw material. Furthermore, they can also market the processed products to cooperatives and Bumdes (village-owned enterprises).

The main aspects that support the sustainability of the application of biogas start from the technical aspects of biogas which use a fixed dome. The advantages of fixed domed plants are that there are no moving parts, they are durable (long-lived), they are made in the ground so they are protected from various weather or other disturbances and do not require space (above the ground). The financial aspect, according to NK, is the main driver for the implementation of biogas. The high cost of building a biogas reactor makes people need stimulants and financial assistance. The “arisan” system is carried out by the community as an effort to provide sufficient funding. TG further stated that aspects of government regulations and financial assistance from private companies were the driving force for sustainability.

The Benefit of Biogas Technology

Many people have seen the benefits of biogas adaptation in rural communities, as the number of factories being built is on the increase, especially in the moment of environmental awareness and financial constraints. Previous research on biogas in rural areas has been carried out in Bangladesh (Biswas et al., 2001); Taktse (Tibet) (Liu et al., 2008); and other parts of China (Chen et al., 2010); (Z. Li et al., 2005), (Zhang et al., 2009) discussing about energy in rural areas and organic fertilizers, environmental protection and health improvement.

Health

The majority of households in rural areas still use firewood as fuel for cooking. Meanwhile, it is known that the smoke produced causes the sore eyes. The use of traditional fuels like wood produces smoke and particulates that pollute kitchens and cause several respiratory diseases. Indoor air pollution causes exposure to biomass fumes thereby increasing the risk of respiratory diseases such as respiratory infections (Katuwal & Bohara, 2009).

Apart from that it increases the risk of asthma, bronchitis, ear infections, lung cancer, etc. (Bruce et al., 2000). Biogas produces clean and smoke-free energy unlike firewood.

"*After using biogas, my eyes did not feel bad and had bad breath because the biogas did not produce smoke*" (SY).

Thus the installation of biogas helps reduce indoor air pollution and reduces the incidence of respiratory disease. When using biogas, the community does not have complaints to say. In fact, they said that the fire produced is bluer than the use of LPG gas. Burning biogas produces a blue flame without emitting smoke and is CO2 neutral (Katuwal & Bohara, 2009). Biogas can be used to replace traditional fuels such as firewood and kerosene such as those in Bangladesh (Kabir et al., 2013).

Agriculture

Most of the population in the research location works as farmers and cannot be separated from fertilizers to fertilize their plants. One of the products of biogas which is beneficial for agriculture is bio-slurry. This by-product of biogas has proven to be the best fertilizer for agriculture. Bioslurry is used to fertilize the community's own plants and sell it to other regions. The use of this slury fertilizer has helped reduce the use of chemical fertilizers. In the research of Silaen et al., (2020) that the benefits of the biogas program provide organic fertilizer and are financially profitable. Now, the community and the NGO are starting to use bioslury for their home gardens. The by-product of this fertilizer contains fewer pathogenic bacteria so it is safe for fertilizing vegetables / fruit, especially for fresh consumption (Widodo et al., 2006). The slurry from the biogas product can be used as compost for plants (Haryanto et al., 2017). The use of slury has replaced the use of raw manure and chemical fertilizers and has helped increase agricultural production (Katuwal & Bohara, 2009).

Environment

The use of biogas in rural areas makes the community reduce the use of wood for fuel, this is definitely beneficial for environmental sustainability. It can reduce deforestation and reduce greenhouse gas emissions. The use of firewood as fuel can cause an increase in greenhouse gases emissions which will have an impact on the environment locally and globally, biogas helps improve environmental conditions by conserving forests (Katuwal & Bohara, 2009). According to (Mendis, 1999), the emission coefficient for unsustainable fuelwood and kerosene is 1.5 tonnes of CO_2 per tonne and 2.5 tonnes of CO_2 per 1000 liters of kerosene. Based on these emission factors, rural households with biogas reduce about 4.5 tonnes of CO_2 released into the atmosphere each year. Utilization of livestock manure into biogas also pollutes the environment during the rainy season. The research location is still included in the pusur sub-basin conservation area, the utilization of this biogas directly reduces pollution to the river environment. In terms of air pollution, it has also decreased. Usually, livestock manure accumulates and emits an unpleasant aroma, and now livestock manure is directly fed into the biogas digester.

Social

The biogas production in this research location adheres to the "arisan" system. The community collects money to buy biogas construction tools and materials. Then, when it comes the building process, it is carried out together.

All members contribute their energy in making the biogas digester. This definitely creates a very strong atmosphere of mutual cooperation.

Then, it is also formed a communication network with parties outside the region such as provincial government agency, district agency, village governments, NGOs and the private sector. These parties have an important role in developing biogas in the research location. There have been a lot of assistance, activities and training held by them. The community feels very helpful and motivated to continue to develop biogas and make their area becomes an energy-independent tourism village. The use of biogas makes the community more familiar with new technology and increases their knowledge. Indirectly, the existence of this biogas changes people's mindset. At first, the community just lets their livestock manure waste, but now they start to use it to fulfill their cooking needs.

Economic

From an economic point of view, the community has also been helped, by reason of using this biogas, the community does not have to pay for buying LPG gas every month. In every month, they have to pay around 50,000 rupiah to buy LPG gas, and now it is no longer available. Then, from the sale of slurry fertilizer, it can also increase people's income.

According to TG *"The use of biogas is very beneficial, besides reducing environmental pollution, it is also not necessary to buy LPG gas nowadays. I can also sell slurry fertilizer and generate income for me"*

"*My income has increased with this biogas, I have received a certificate from the NGO as a biogas expert. I have also been sent to Sulawesi, Sumatra, East Java to make a biogas project. I feel happy to get to these areas and of course I get additional income too. "(*PN)

CONCLUSION

Community Renewable Energy Biogas has an important role in the development of renewable energy. However, the limitation in development is the lack of economic support and education from the Community who motivates them to advance the biogas in their village. This research found that Community Renewable Energy in Indonesia already exists and they change their new face of energy development by helping to reduce dependence on fossil fuels and preserve environmental sustainability.

This research broadens our understanding of developing community renewable energy. What abilities are needed by a community to be able to continue to develop energy. Technical and social skills are needed in the process of developing Community renewable energy Biogas. Community governance that is open to information and outside parties increases their knowledge and has many networks collaboration with outside parties. Capacity improvement is crucial to support the sustainable use of biogas. This capacity improvement includes technical, institutional and productivity capacities. Accompanied by community participation. The ownership structure of the biogas system in the research location has become private property, this raises the attitude of the community and responsibility to continue to care for it. The technical design of the biogas digester is made into a fixed domed plant according to the environment of the research location. This design was chosen because it is easy to maintain and durable, made in the ground so that it is avoided from outside

disturbances. Maintenance operation with continuous feeding that is, regularly inserting feces every day. Maintenance is done by frequently cleaning the stove so that the flame remains blue and opening the water drain tap once a week. As a follow-up to this biogas program, the plan is that this program will continue to be developed by targeting 10 points for making new gas systems every year. It is continued to lead in the making of the development of an energy independent tourism village.

The benefit felt by the community with the presence of biogas in terms of health, it is more preserved because biogas does not emit smoke and odors. In terms of agriculture, it is useful as a plant fertilizer. In terms of the environment, it helps to preserve the environment by not having livestock waste washed away when it rains and pollutes the environment; reduce air pollution from the smell of livestock waste; reduce the number of people looking for wood and it has kept the garden everlasting. In terms of social, there is an increase in mutual cooperation in the community; the formation of cooperation networks with outside parties; as well as increasing community knowledge and skills on biogas technology. In terms of economy, reduce the cost of buying LPG gas; there is additional income when selling slurry fertilizer and becoming a biogas expert.

This research wants to contribute in two ways, first to the world of research, the study of community renewable energy is very interesting and many things can be studied in it and add to the literature on the formation of Community Renewable Energy. Second, from our research, we hope that it can help provide understanding for policy makers in the development of renewable energy, they need to consider several technical and social matters as above to give a different touch to the renewable energy and community renewable energy development program in rural area in Southeast Asia and the world.

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