

Utilization of Cow Manure Using Biogas Technology to Fuel The Community in Pucak Village, Tompobulu District, Maros Regency

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ABSTRACT

The conditions in Pucak Village, Tompobulu District, Maros Regency illustrate the enormous regional potential for managing natural resources in the era of regional autonomy, where the Diffusion and Utilization of Science and Technology Programs in remote villages have not been optimally studied. The desired impact of this program is the use of natural resources in the village to become an alternative energy source, namely renewable energy through the production of biogas from cow dung. The service is aimed at providing knowledge to residents about the use of new and renewable energy sources, namely energy produced with appropriate technology that is relatively simple and suitable for rural areas. Biogas processing provides many benefits for residents in managing livestock manure into biogas energy as an alternative fuel that is environmentally friendly, where processing livestock waste into biogas can reduce environmental pollution, where waste is managed into alternative fuels, where the results of waste management have disposal which is then reprocessed into solid or liquid organic fertilizer

Keywords: Biogas, Cow Manure, Fertilizer

1. INTRODUCTION

In Indonesia itself, the energy crisis has also begun to have a significant impact on the wheels of the country's economy. The current energy crisis is an international phenomenon so that many countries in the world are competing to develop new renewable energy or alternative energy in an effort to overcome the energy crisis. The energy crisis that has hit our country has another story in remote parts of the country, where remote villages have not experienced optimal energy distribution at all. This condition provides a worrying discourse when regional autonomy which has a Science and Technology Diffusion and Utilization Program in remote villages cannot be studied optimally. The desired impact of this program is the use of natural resources in the village to become an alternative energy source as well as a new culture for villagers by developing a culture of science and technology in the regional economic sector.

Utilization of new and renewable energy sources needs to be developed considering the role and price of fuel oil continues to increase and soar high as a substitute for providing sustainable energy resources, which are dominantly needed by the community. The community of Pucak Village, Tompobulu District, Maros Regency is one of the villages that has a livelihood as cattle breeders, is one of the relatively large meat supply areas to traditional markets and the capital of Maros Regency, even outside other Regencies. Livestock waste (livestock manure) produced by breeders in Pucak Village is a very appropriate alternative to overcome rising prices and scarcity of fuel oil. Livestock manure is solid waste from cattle farms and in the disposal process is often mixed with urine and gases, such as methane and ammonia. Cow dung is an alternative for making biogas, because it is available in sufficient quantities and has a balance of nutrients, which are easily soluble and easy to process.

Along with the development of science and technology, today's cow dung can be used as a raw material that can produce alternative energy as a substitute for fuel because it contains methane gas (CH₄) which can be used as fuel.

One of the most efficient and effective alternative energy sources is biogas, because it can reduce dependence on oil. And to be able to meet the needs of energy-efficient household-scale industries, many have taken the initiative to look for alternative energy as a replacement material, given the increasing shortage of fuel energy supplies in our beloved Indonesia. Therefore alternative energy as a substitute for fuel oil is biogas derived from cow dung. A cow can produce 1 m³ of biogas from 20 kg of cow manure, the amount of gas production per kg depends on the type of manure used. If there is a large production of manure every day, then the need for household gas for cooking for one family will be fulfilled.

The results of a survey conducted by a team of lecturers from the Faculty of Engineering, Mechanical Engineering Study Program at the Muslim University of Indonesia in February 2018, found some potential in the region, including:

1. The geographical location of Pucak, Tompobulu District, Maros Regency is a highland compared to other villages in the District.
2. From each sector of the population's livelihood, approximately 65% are plantations and rice fields as well as cattle breeders.
3. The production of livestock and fresh meat exceeds the consumption of the population in particular residents in Pucak Village, Tompobulu District, Maros Regency.

Currently, the local government of Tompobulu District, especially in Pucak Village, Maros Regency is still preoccupied with handling environmental sanitation. The community does not yet have an adequate Final Processing Site (TPA) of cattle waste (manure), so the cow waste (manure) is just left to be disposed of anywhere which has a negative impact on the environmental health of the villagers.

The impact of this problem is homework for the local government. To overcome the adverse effects of livestock waste (manure) pollution as well as to assist the government's program of converting kerosene stoves to gas fuel, it is necessary to study the utilization of livestock waste (manure) into gas fuel (biogas) for household scale by introducing waste utilization technology. (manure) livestock with a closed system.

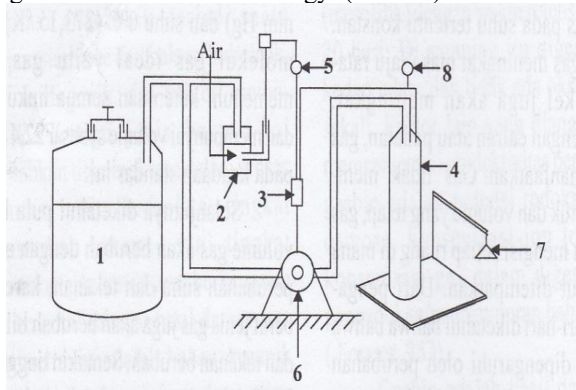


Figure 1. Biogas Production Distribution System

Information about the figure 1: (1) Digesters, (2) Level Control, (3) Pressure Control, (4) Gas Tank, (5) Kwh Meters, (6) Compressor, (7) Scales, (8) Manometers.

2. LITERATUR REVIEW

a. Definition of biogas

Biogas is one of the complex biochemical processes in the form of gas produced by the activity of microorganisms (anaerobic activity or fermentation) and one of the technologies that produces energy by utilizing waste, such as livestock waste, agricultural waste and human waste which includes organic materials (Wahyuni, 2011).

However, most organic materials, both solid and liquid, such as cow manure and cow urine, are usually used for simple biogas systems. In addition to being an alternative energy, biogas can also reduce environmental problems, such as air and soil pollution. For example, a beef cattle weighing 400-500 kg/head produces 20-29 kg/day of fresh manure. You can imagine how much waste is generated from a resident who manages dozens of cows, whereas we know that some of the residents of Pucak Village own cows. This condition is actually a business opportunity to be used as raw material for biogas production.

The results of making biogas can be used as a source of energy for the residents of Pucak Village and the remaining output in the form of sludge can be used as fertilizer for ready-to-use plants so that it can increase income for the cattle breeders themselves (Wahyuni, 2011)

b. Development of Biogas in Indonesia

Biogas technology was introduced in Indonesia in the 1970s. At first the waste treatment technique with biogas installations was developed in rural areas, but now this technology has begun to be applied in urban areas. In 1981, the development of biogas installations in Indonesia was developed through the Biogas Development Project with financial support from the Food and Agriculture Organization (FAO) by building examples of biogas installations in several provinces. Starting in the 2000s, small-scale (household) biogas reactors were developed with a simple construction made of ready-to-install plastic and at relatively low prices (Anonymous, 2010). Then biogas was built in the form of a demonstration plot by the government with a reactor in the form of a brick/concrete dome (fixed dome) and a floating form (floating) made of connected drums (Wahyuni, 2011).

In 2015, as many as 70 thousand households in Indonesia have utilized energy produced from livestock manure. All of these households are beneficiaries of the domestic biogas program (BIRU) developed by the Directorate General of New, Renewable Energy and Energy Conservation (Ditjen EBTKE) of the Ministry of Energy and Mineral Resources (ESDM).

c. Sources of Raw Materials for Making Biogas

As previously mentioned, biogas can be produced from organic materials, including livestock manure, household waste, urban waste, factory organic waste, and biomass. However, there are three main sectors that have the potential to develop biogas in Indonesia, namely the agricultural sector, liquid waste and urban waste.

The sectors mentioned above are considered suitable for biogas development in Indonesia both in terms of their characteristics and availability as well as technically and economically (Wahyuni, 2011). Examples of livestock and aquatic wastes that can be put to good use are one of them for utilization as an environmentally friendly alternative energy

d. Biogas Energy Processing

Processing cow dung into biogas alternative energy which is environmentally friendly is a very profitable way, because it is able to utilize nature without destroying it so that the ecological cycle is maintained. In addition to obtaining alternative energy to replace fuel, biogas production can support farming businesses providing organic fertilizers thereby reducing dependence on chemical fertilizers, so that there is independence in the supply of fertilizers. Cow manure for two cows is able to produce biogas which can be used for cooking, equal to two liters of kerosene. So that when totaled in one year, people can save up to millions of rupiah. Biogas is a gas mixture produced by methanogenic bacteria that occurs in materials that can decompose naturally under anaerobic conditions.

Some of the interesting things about biogas technology is its ability to form biogas from organic waste which is abundant and freely available and inexpensive. Variation of biochemical properties causes biogas production to also vary. A number of organic materials can be used together with some requirements of gas production or normal growth of methane batteries accordingly.

e. Biogas Energy Installation Biogas installation

The biogas energy installation consists of several parts as follows:

- 1) Digester is a place for organic matter and where the process of digestion of organic matter by anaerobic microbes occurs. Digester which functions to accommodate methane gas resulting from the decomposition of organic materials by bacteria. The most widely used type of digester is the continuous feeding model where organic matter is filled continuously every day. The size of the digester depends on the manure produced and the amount of biogas desired. Besides the digester, a sludge container must also be built where the sludge can later be separated and used as solid organic fertilizer and liquid organic fertilizer.
- 2) Water Trap is a tube that functions to capture water vapor produced from the digester so that the flow of biogas is not obstructed, and functions as a safety device.
- 3) Gas Holder is also known as a gas holder, as the name implies its function is to accommodate the gas produced by the digester which is channeled through a pipeline/hose.
- 4) The gas harvester can be a biogas stove or generator.

f. Completeness of Biogas Energy Installation

Inlet (organic material inlet) as a place to enter organic matter. It is better if it is equipped with a plastic funnel or control tub. Gas outlet (gas outlet) serves as a place for gas to escape before entering into the gas holder. Mud outlet (sludge outlet) is a channel to remove organic waste from the digester. Sludge Reservoir Serves to temporarily store sludge or organic waste from the digester before being used to fertilize plants. Gas distribution hose Serves to distribute gas from the digester to the water trap, gas holder and to the gas harvester (biogas stove or generator).

g. Steps to Make Biogas Energy

After the digester work is complete, the process of making biogas begins with the following steps:

- 1) Mixing cow manure, waste from plant residues with water until sludge is formed with a ratio of 1:1 in a temporary storage tank. The shape of the sludge will make it easier to enter into the digester.
- 2) Flowing the sludge into the digester through the intake hole. During the first filling, the gas valve above the digester is opened so that the intake is easier and the air inside the digester is pushed out. In this first filling, a large amount of cow dung sludge is needed until the digester is full.
- 3) Add 1 liter of starter (many sold in the market) and 5 sacks of fresh rumen from the slaughterhouse (RPH) for a digester capacity of 3.5 - 5.0 m². After the digester is full, the gas valve is closed so that the fermentation process occurs.
- 4) Discard the first gas produced on day 1 to 8 because what is formed is CO₂ gas. Meanwhile, on day 10 to day 14, methane gas (CH₄) and CO₂ began to decrease.
- 5) On the 14th day the gas that is formed can be used to light a fire on a gas stove or other needs. Starting from the 14th day, we can produce biogas energy which is always renewable. This biogas does not smell like the smell of cow dung. Furthermore, the digester is continuously filled with cow dung sludge to produce optimal biogas.

g. Biogas from Cattle Farm Waste

Livestock waste, namely faeces, urine and cattle feed residue is one source of material that can be used to produce biogas. But on the other hand the development or growth of the livestock industry creates problems for the environment such as the accumulation of livestock waste including cattle farm waste. This waste becomes a pollutant due to the decomposition of livestock manure in the form of BOD and COD (Biological/Chemical Oxygen Demand), pathogenic bacteria that cause water pollution (contamination of groundwater and surface water), air pollution with dust and the odor it causes.

Biogas is a renewable energy that can be used as an alternative fuel to replace fossil fuels such as kerosene and natural gas. Biogas is also a type of bioenergy which is defined as the gas released when organic materials such as livestock manure, human waste, straw, husks and leaves from sorting vegetables are fermented or undergo a methanization process.

h. Biogas as an Alternative Energy Source

Processing cow dung into biogas alternative energy which is environmentally friendly is a very profitable way, because it is able to utilize nature without destroying it so that the ecological cycle is maintained. Another benefit of processing cow dung into biogas alternative energy is the production of organic fertilizer for plants, so the benefits that can be obtained are:

- 1) Increased income by reducing the cost of purchasing fertilizers and pesticides.
- 2) Saving energy, reducing energy costs for cooking and reducing consumption of non-renewable energy, namely fuel.
- 3) Able to do sustainable agriculture.

Biogas is produced by bacteria from organic matter in conditions without oxygen (anaerobic process). This process takes place during processing or fermentation. The gas produced consists mostly of CH₄ and CO₂. If the CH₄ gas content is more than 50%, then this gas mixture is flammable, the CH₄ gas content in biogas derived from cow manure is approximately 60%. The ideal temperature for the fermentation process for the formation of biogas is around 30°C (Sasse, L., 1992). Biogas can be an alternative energy source as a substitute for conventional fuels which still depend on petroleum. The application of biogas technology innovation itself is not too difficult considering the tools needed are quite simple, but here it may be constrained by the difficulty of making gas cylinders because this technological innovation is relatively new in Indonesia.

3. RESEARCH METHOD

Sampling techniques in this community service researcher use the research informant method, namely research subjects from whom research data can be obtained, have broad and in-depth knowledge of research issues so as to provide useful information, informants also function as givers of feedback on research. (Burhan Bungin 2010).

In this study, the key informants and informants were researchers from the Faculty of Engineering Mechanical Engineering who were members of the community service in Pucak Village, Tompobulu District, Maros Regency. While the key informants here are residents who are involved in the processing of livestock waste or cow manure, who are in areas where the biogas processing is and can be directly involved in the process of making biogas.

4. RESULTS AND ANALYSIS

Biogas is a gas mixture of methane (CH₄), carbon dioxide (CO₂) and other gases obtained from the decomposition of organic materials such as livestock manure, human waste, plants by methanogenic decomposing bacteria in a biodigester. So, to produce biogas, you need a biogas generator called a biodigester. The process of decomposing organic matter occurs anaerobically (without oxygen). Biogas is formed on day 4 – 5 after the biodigester is fully filled, and reaches a peak on day 20 – 25. Biogas produced by the biodigester mostly consists of 50 – 70% methane (CH₄), 30 – 40% carbon dioxide (CO₂), and other gases in small quantities.

Where the process of forming gas is considered complicated, but how to get it is not as complicated as the process of its formation. With technology that can be used by rural residents, gas production can be carried out properly and produce gas.

Biogas produced from cow manure contains energy or power. Biogas is a fuel that replaces diesel oil, firewood or charcoal. For example, biogas that has been produced from utilizing cow dung is channeled to a gas stove, where the gas stove used is in accordance with a special stove, namely a biogas gas stove. And what needs to be considered is the suitability of the mixture of biogas and air so that it produces a blue flame and has a high heat, so a special gas stove is used that can balance the air so that the resulting flame is blue and gets high heat.

In the process of processing cow dung to produce biogas, there is disposal of the results of the processing of cow dung. This disposal can be used as fertilizer for plants, where this disposal can be in the form of solid and liquid. In addition, this disposal has added value because after leaving the digester tube it automatically undergoes a process of maturation and decomposition so that the waste can be directly processed into compost and liquid fertilizer.

Human resources, in this case the residents around Pucak Village, need to be given training to know the biogas processing process, in which case the villagers will carry out the digester manufacturing process to produce biogas that can be used for daily needs. natural resources and human resources as we know that natural resources are all elements of the biophysical environment that can actually or potentially meet human needs.

According to Ireland in Soerianegara, natural resources are conditions in the natural environment that have value to meet 49 human needs. According to Isard in Soerianegara, natural resources can be interpreted as environmental conditions and raw materials used by humans to meet their needs and improve their welfare. From these various definitions it can be concluded that natural resources are a statement or opinion extracted from other sources by not changing anything that exists or what it is. Human resources (Human Resources).

Processing cow dung into biogas provides many benefits for the residents of Pucak Village, namely:

- The biogas produced can reduce the burden on the community to buy fuel, because residents can produce their own gas with cow dung produced by their livestock, and can reduce residents' dependence on the use of oil, which is limited in quantity and quite expensive.
- If noticed by residents around Pucak Village who use a lot of firewood as a cooking tool, it is expected to reduce logging so that forest sustainability is maintained.
- Can reduce environmental pollution and air pollution as a result of using firewood and cow dung which are commonly found around the streets which will pollute the environment, can be used for something useful. Thus the cleanliness of the population's environment will be maintained.
- Utilization of cow manure not only produces gas but also disposes of the results of processing cow manure into biogas. The waste energy from this biogas-producing device can also be used as organic compost fertilizer, which residents can use to fertilize their plants.

From an economic point of view, by utilizing cow dung owned by residents into biogas energy, it can save almost scarce natural resources such as petroleum, electricity, and logging to be used as fuel which is quite expensive which residents have to spend to buy it, in the case of It can also be proven that using biogas is more economical for household life which utilizes waste as fuel which can then be used as compost (organic) fertilizer. Meanwhile, from a social perspective, processing cow dung into biogas can reduce environmental pollution and reduce the use of petroleum and reduce illegal logging used as fuel, where the use of biogas can preserve nature while also balancing the ecological processes of living things and natural disasters.

The socio-cultural aspect of biogas processing, by implementing a new processing strategy for the villagers is a challenge in itself for the residents due to their low educational background, knowledge and insight, especially in the application of biogas processing, they do not imagine that cow or cow dung can produce gas that they can carry out household activities every day so that biogas can affect the population, especially Indonesia, which is one of the countries whose residents work as farmers and breeders in the world's best agricultural areas.

The processing of cow dung by residents does not interfere with household activities at all where processing does not result in disturbing noise, besides that the waste generated from the processing does not pollute the surrounding environment and does not cause odor even though the processing is from cow dung because the waste produced is carried out reprocessing into liquid and solid fertilizers. Where in the fermentation process there is an automatic release of odor from cow dung where the process of making biogas is only done 2 times a day, namely in the morning and evening so that the processing does not take so long and does not interfere with household activities. The process of processing biogas can provide so many benefits because processing livestock waste into biogas can reduce air pollution and global warming.

5. CONCLUSION

In accordance with the results of the dedication which was carried out for approximately 3 months, the researcher can provide conclusions regarding the processing of cow manure into biogas energy in Pucak Village, Tompobulu Regency, Maros District, namely biogas processing provides many benefits because it processes livestock manure into biogas energy as an alternative material. environmentally friendly fuel, where biogas processing can reduce environmental pollution and air pollution because it processes waste into something that can be useful and useful, such as becoming biogas.

Where in the processing of biogas has waste products that can be reprocessed into solid and liquid organic fertilizers. Pucak Village, Tompobulu District, Maros Regency is one of the villages that processes waste into biogas energy as well as a forum that introduces the community to agriculture based on organic farming.

Suggestions to maximize the processing of cow manure into biogas energy in Pucak Village, Tompobulu District, Maros District has sufficient natural resources (SDA) and human resources (HR) so that the processing process runs continuously. In addition, the government's role is needed to introduce to the outside community about the processing of cow dung and the benefits to be gained in processing cow dung into biogas, besides that the government's role is also very much needed in providing various facilities related to the processing of livestock dung, especially cow dung into biogas energy.

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