NON-FINANCIAL FEASIBILITY ANALYSIS ON THE UTILIZATION OF CATTLE LIVESTOCK WASTE AS A BIOGAS

Andi Sitti Halimah[1]*, Darma[2], Akhnaniyanti[3]

[1)] Agribusiness Masters Program, Muhammadiyah University of Parepare, Indonesia
[2)] Departement of Agrotechnology, STIP Yapi Bone, Indonesia
[3)] Pinrang Regency Livestock and Plantation Service, Indonesia

Abstract

This research aims to analyze the non-financial feasibility of using livestock waste as raw material for biogas. Qualitative data was obtained to provide an overview of the cattle farming business, the implementation of waste processing with a biogas installation, where the final result is biogas which can be utilized by livestock breeder groups and the community around the installation. The feasibility of this activity is determined using the differential semantic scale formula. The results of the non-financial feasibility analysis show that the business of using livestock waste as raw material for biogas is feasible to develop in terms of market aspects, technical aspects, management aspects, as well as social and environmental aspects. The two biogas installations granted by the regional government were able to help the community save energy.

Keywords: *biogas, non-financial feasibility, cattle waste*

Introduction

Indonesia as an agricultural country has quite large potential in producing renewable energy raw materials. Various types of existing waste, whether originating from agriculture, animal husbandry, fisheries and other waste, can be used as an alternative source of raw materials for generating energy. One thing that can be utilized is household scale biogas technology (Sutrianto et al, 2016).

Waste generated from human activities in the form of waste from cattle farming in the form of feces, urine, gas and livestock food waste. This waste is the main raw material in livestock centers for making biogas, especially in large-scale farms which produce large amounts of waste regularly. However, according to Dewi and Kholik (2018) the gas production potential for each type of livestock manure is different, for example cows/buffalo produce gas production of around 0.023-0.040 m3/kg, and chicken manure produces gas production of around 0.065-0.116 m3/kg. The cow feces is known to be more efficiently used as a biogas producer because every 1025 kg of cow dung per day can produce 2 m3 of biogas (Heriyanti et al., 2020).

Cattle waste processing into biogas as alternative energy for the community is considered very profitable, because it is able to utilize the waste around them (Ratna et al., 2014). This potential has a great opportunity to be developed because it only costs a little, taking into account that: 1. Animal manure whose production levels never run out, 2. Energy

*)Corresponding Author:
E-mail: ashalimagaansil1@gmail.com

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regulations, including increases in the price of LPG and several other oil fuels, have encouraged the development of cheap alternative energy sources, sustainable and environmentally friendly, 3. Poor marketing distribution resulting in an increase in fertilizer prices on the market triggers farmers to use organic fertilizer (Putri et al., 2019). Biogas contains methane gas (± 60%), carbon dioxide (± 38%), and others such as N2, O2, H2 and H2S (± 2%) so it is easy to burn and can be used as a substitute for kerosene or LPG for cooking and lighting activities. (Ningrum et al., 2019). Rachmawati et al. (2017) explained that apart from the results of the biogas processing process, it can be used as an alternative energy source for electricity and fuel, the remaining biogas is known to be able to become fertilizer which can be reused for community farming.

The scale of the cattle farming business in Duampanua District, Pinrang Regency, South Sulawesi is quite possible for the use of cattle waste into biogas, not only as renewable energy which is an alternative for households but from an economic aspect it increases the income of farmers. This region has adequate land with a livestock population spread across all sub-districts with a total cattle population of 29 663 head (BPS, 2021). Biogas on a household scale with 2 – 4 livestock or a manure supply of approximately 25 kg/day is sufficient to use a reactor tube with a capacity of 2500 – 5000 liters which can produce biogas equivalent to 2 liters of kerosene/day and is able to meet the cooking energy needs of one household. rural area with 6 family members (Ulva et al., 2022). According to Andriani and Idawanni (2020), biogas is the right choice for utilizing cattle waste into energy and fertilizer so as to obtain double profits (multi margins) both socio-economically and in terms of environmental sustainability. In line with this, it study will analyze several non-financial aspects related to the utilization of cattle waste.

Research Methodology

This study was conducted in Duampanua District, Pinrang Regency, South Sulawesi in November 2022. This location was chosen because it represents an area that actively utilizes livestock waste, especially cattle into biogas. Moreover, this area is also equipped with four quite active biogas installations out of a total of which exists eight installations. A total of 20 informants were involved in this research.

The aspect in the business feasibility analysis are flexible so they can be added according to research needs (Fadoli et al., 2019). The aspects include financial aspects, technical aspects, market aspects, management aspects, social aspects and environmental aspects (Arianton et al., 2019). To assess the questions on non-financial aspects of respondents' answers in this study, researchers used a Likert scale to convert qualitative data into quantitative data on the questionnaire. The highest score in this study for informants' answers that strongly agreed is 4 and the lowest score for answers that strongly disagreed is 1. The average of the total scores on the questionnaire will determine whether the business is feasible or not. As for determining whether it is feasible or not, researchers use a differential semantic measurement scale (Simamora, 2004), with the formula:

$$\textbf{\textit{Semantic}}\ \textbf{Scale} = \frac{a(m-n)}{b} \qquad (1)$$

where a is Number of attributes, m is Highest score, n is Lowest score and b is Number of semantic scales.

Results and Discussion

The development of the business of using cattle waste as raw material for biogas really supports the development of alternative energy, so there are several aspects that must be analyzed apart from the financial aspect. These aspects support the assessment of business feasibility which includes technical, market, management, social and environmental aspects. The results of interviews with informants after data processing

showed that there was support for the existence of a biogas installation in their area.

The data obtained shows that all non-financial aspects are feasible in the business of utilizing livestock waste as raw material for biogas at this research location. By semantic differential measurement scale formula, an effort is said to be feasible if the cumulative score is between 10.1 to 16. Conversely, an effort is said to be not feasible if the cumulative score is between 4 to 10 (Simamora, 2004).

Market Aspect

Biogas is not pure gas, because it still contains other elements besides methane, which is 70%, such as carbon dioxide, hydrogen, nitrogen and hydrogen sulfide (Insam et al., 2015; Hidayati et al., 2019; Pratiwi et al., 2019) . LPG gas is pure gas which does not contain any other elements besides methane (Wahyuni et al., 2009). Even though it is different from LPG gas, biogas also has a function like other gases, it has a methane content of 54% and can be used for cooking, namely by connecting the installation tool directly to a gas stove and it will produce a blue flame. At the same time, POC will also be produced which is useful as a source of nutrition for agricultural plants (Paulus et al., 2022). The marketing channels in livestock waste management are very simple. The gas produced in waste processing is not sold, but is used by yourself.

The demand for alternative energy sources will increase, so various alternative energy sources are being developed, one of which is biogas. The development of alternative energy sources is very high currently and in the future, so the market potential for alternative energy will be very promising. Biogas is an alternative energy that has been developed and not only produces gas, but environmentally friendly organic fertilizer, which can be marketed as organic fertilizer. The research results show the feasibility of the market aspect (14.30) which is felt by respondents that farmers not only get biogas as a substitute for fuel, but environmentally friendly fertilizer that can be marketed.

The use of cattle livestock waste to produce biogas can be utilized or marketed as a cheaper alternative source although the price for biogas cannot be ascertained except by converting it to LPG prices. The composition of cow manure is greater than that of other livestock, so it is very possible to develop biogas installations, especially because the main feed for cows is forage which has a higher composition (BPTP, 2016).

The existence of efforts to develop alternative energy opens up great opportunities for farmers to try their own biogas to save energy sources such as kerosene and LPG. It can be seen that the development potential of this biogas business is very high, especially for livestock farmers. The gas produced is not sold but is used by the livestock farmers themselves.

In the financial analysis, the selling price of biogas will be calculated based on the results of the conversion to LPG used by farmers before using biogas, namely 1 m^3 is equivalent to 0.46 kg of LPG gas. LPG for 3 kg is IDR 20,000 so that per kg LPG is priced at IDR 6,666 so the price of 1 m^3 of biogas = 0.46 kg LPG @ IDR 6,666 = IDR 3,066. On the other hand, biogas can not only be used as a substitute for fuel oil but has the potential to be used as lighting, namely electrical energy. This can reduce dependence on fuel, so this can be an incentive for every household.

Technical Aspects

Technical aspects were analyzed descriptively to obtain an overview of the location, biogas pipe installation, and operational processes carried out to produce biogas. Even though there is not yet a large effort to use cow dung into biogas in this area, the technical aspects of the installation

being built have met the feasibility aspect of 14.05.

a. Location

Location determines whether a business runs smoothly or not. The barn should be far from residential areas, so that the business process runs smoothly without disturbing the surrounding community. This location is also supported by important components such as the availability of abundant water around the cage, the availability of food that is easily accessible, and supporting labor.

The location for making biogas is determined by paying attention to where the resources are available, so that it is more practical and economical. The placement of the biogas installation will be better if it is close to the cage. This is intended so that the distribution of the materials that form the biogas process is not too far away. It is hoped that the ease of placing biogas installations will save energy and costs. The biogas installation is located close to the cowshed, to facilitate the processing of biogas and compost fertilizer, where the required inputs can be easily obtained, widely available and sustainable. The availability of other supporting facilities such as electricity, water, roads and telecommunications is adequate. The biogas installation project was built in a location oriented towards farmer households.

b. Making Gas Pipe Installations

Cattle farming turns out to be very helpful in developing alternative energy. Cattle waste, which was previously very disturbing, can be used to produce gas, or biogas. The biogas installation itself consists of a digester dome (sludge storage dome), intake and exhaust channels, slurry storage tank and fermentation gas distribution pipe. The biogas installation in Duampanua District has a capacity of 10 m^3 and 13 m^3.

The location of the installation is not far from the barn, this makes it easier for waste to enter the installation without any obstacles. The waste referred to is not only feces (cattle waste), but including cow urine, bath water, hooves and cow blood goes into the biogas installation, the ratio of liquid waste to solid waste is 1: 1. The biogas installation can be seen in Figure 1. The faucet on top of the dome is connected to a pipe (can be paralon or ½ inch iron pipe) to channel gas to the stove. Try to install the pipes tight and strong so that gas does not leak. The type of stove used is a gas stove which is usually used for LPG gas. Before entering the stove, the gas pipe is connected first with a plastic hose (like the hose for LPG gas) with a size smaller than ½ inch. This plastic hose can be directly connected to the stove, a tap must be installed at the connection.

c. Biogas Operations

The process of forming biogas in a continuous model digester will go through the following stages:

1. Storage of cattle livestock waste in a tank from the barn, mixed with washing water in a temporary storage tank. The tank it functions to homogenize input materials. It waste used as filling material must be adequate, and must not be too thick so it needs to be stirred, so that the ratio of water to cattle waste is 1: 1. Stirring is done evenly so that the shape becomes waste mud. The rate of biogas production depends on the dilution of the fill material. Filling material that is too dense will speed up production because it takes relatively less time than if it is too thin.
2. Flowing cattle waste into the digester. Cattle waste sludge flows into the digester through the intake hole. During the first filling, the gas outlet valve at the top of the dome should not be connected to the pipe first. The tap is opened so that the air in the digester is forced out so that the process of entering the cattle waste slurry is easier.

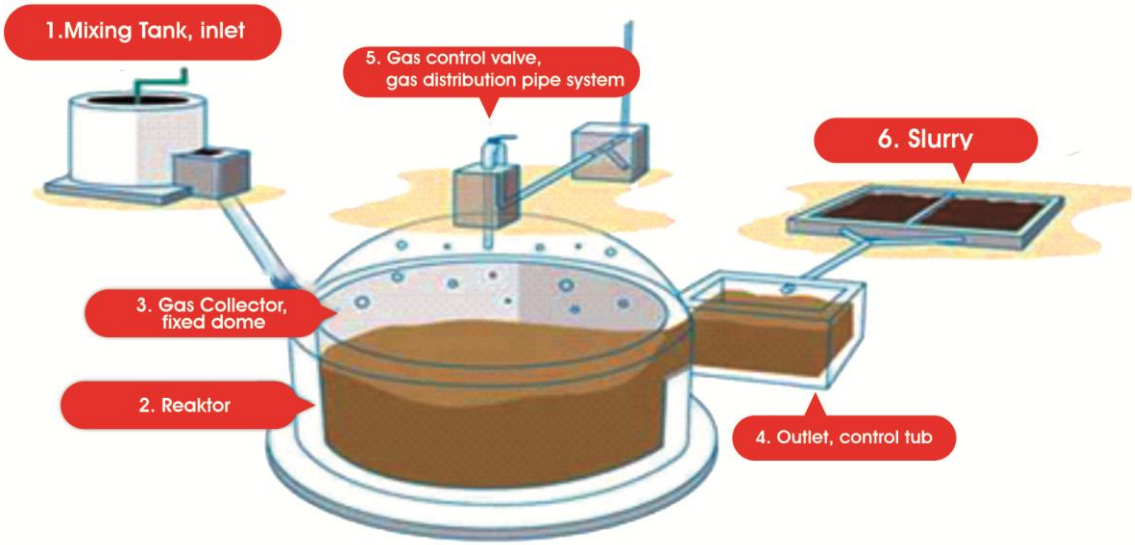

Figure 1. The Biogas Digester

3. The first gas produced have to discarding, the valve on top of the dome is opened and the gas is released. This gas discharge is caused by the initial gas formed being predominantly CO2. On days 10 to 14, the formation of CH4 gas increases and CO2 decreases. When the composition of CH4 is 54% and CO2 is 27%, the biogas will ignite. Furthermore, biogas can be used to light the gas stove.
4. Utilizing the biogas that has begun to form can be used to light a fire on the stove. Furthermore, the installation can produce biogas energy which is always renewable. The digester can be continuously filled with cattle waste sludge so that optimal biogas is produced. Continuous biogas production can occur if waste sludge is available.

Management Aspect

This aspect can be seen based on the structure, duties and responsibilities of the livestock farmer group at this research location as business managers. Based on information from the managers of the two biogas installations at the research location, the head of the livestock farmer group is fully responsible for the business. The feasibility value for this aspect is 14.50, which means that organizationally, the management of this business is running relatively smoothly. This can be seen where the chairman divides the members of the management group who work according to shifts or in rotation every day in controlling activities at the installation. The chairman divides the members of the management group who work according to shifts or in rotation every day in controlling activities at the installation. The group leader and his wife even become permanent workers and are responsible for coordinating and supervising all business activities and production processes.

Social and Environmental Aspects

The construction of this biogas installation can provide employment opportunities for people. According to the informants, the feasibility value for this aspect was 14.85. It means that social and environmental aspects are the main factors they consider before developing a biogas business in this area. The presence of a biogas installation can reduce discomfort with cattle livestock waste. Biogas sludge can also be processed into fertilizer which can be bought and sold, making it very profitable for farmers. Farming households can replace the fuel that used to be LPG with biogas produced from

biogas installations, thereby greatly saving farmers' expenses on buying gas.

The development of cattle farming has great potential for obtaining biogas. Biogas has several advantages for the environment compared to fuel derived from fossil fuels. The environmentally friendly and renewable nature of biogas is an advantage of biogas compared to fossil fuels (BPTP, 2016). The presence of biogas can help reduce environmental pollution due to cow dung with its annoying odor, but it can be processed in a biogas installation as an incentive for households, especially livestock farmers. The existence of biogas reduces the dependence of farmer households on fuel oil, so they can save on fuel costs.

Analysis of the social and environmental aspects of the business of processing cattle livestock waste as raw material for biogas in Duampanua District shows that there are no detrimental impacts. From a social aspect, it can create new jobs for the local community, while from an environmental aspect it can actually help reduce environmental pollution. In accordance with Adnyana (2020) opinion, social considerations must be considered carefully in order to determine that a proposed project is responsive to social or environmental conditions. Analysis of this aspect also concerns the contribution of a business or project to economic benefits, such as: employment absorption, income distribution, and increasing community welfare and sustainability of the surrounding environment.

Conclusions

Based on a non-financial feasibility analysis, the two biogas installations donated by the local government met the feasibility requirements for developing a business to utilize cattle waste into biogas in Duampanua District, Pinrang Regency. If there is an increase in energy needs, additional biogas installations can be implemented as an energy saving policy, especially in livestock farming environments. Knowledge or empowerment of alternative energy needs to be carried out, considering that biogas can be produced from all organic waste, and this biogas business can be carried out by households themselves, without having to incur large costs. The community as the beneficiary is expected to be proactive in supporting the biogas development program by disseminating positive information regarding aspects of using cattle waste so that the current installation can become an example for the development of future installations.

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