



Analysis of Community Perspectives on the Sustainability of Household Biogas Utilization in Pinrang Distric

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Abstract. This study aims to analyze community perspectives on the sustainability of household biogas utilization in Pinrang District, South Sulawesi. Biogas is considered as one of the renewable energy solutions that can reduce dependence on fossil fuels and manage organic waste effectively. This study uses a descriptive quantitative approach, with data collection through questionnaires from 100 respondents who have used biogas for one to more than two years. The results showed that 80% of respondents had a good understanding of the benefits of biogas, both in terms of economy and environment. As many as 75% of respondents reported that they had easy access to biogas technology, although 25% still had difficulties in terms of equipment maintenance. Community participation in biogas management is also quite high, with 60% of respondents active in the maintenance and use of biogas. In addition, 85% of respondents stated that they believed that biogas utilization could be sustainable and provide long-term benefits. This study concludes that the sustainability of biogas utilization in Pinrang Regency is strongly supported by good understanding, sufficient access to technology, and active community participation. However, increased technical support and maintenance need to be improved to ensure that this biogas program runs optimally in the future.

Keywords: Biogas, sustainability, community perception, renewable energy.

1 Introduction

1.1 Background Research

Renewable energy management has become an increasingly important topic amidst the issues of global warming and energy crisis. One promising solution to overcome this problem is the utilization of biogas as an alternative energy source [1]. Biogas, produced from anaerobic fermentation of organic materials such as animal waste and agricultural waste, has great potential in providing environmentally friendly energy while reducing waste. In rural areas such as Pinrang Regency, the utilization of household biogas is one initiative that can reduce dependence on fossil fuels such as LPG[2].

However, the sustainability of household biogas utilization is highly dependent on how the community accepts and utilizes this technology. The community's perspective on the sustainability of biogas use needs to be considered because the

community is the main actor in this process. This is where the importance of integrating management science into biogas management lies. Good management will ensure that not only the technical aspects of biogas run smoothly, but also the social, economic, and environmental aspects that support the sustainability of the project [3], [4].

1.2 Management in Biogas Management

In management science, the success of a project or program is highly dependent on proper planning, implementation, monitoring, and evaluation. This also applies to household biogas management in Pinrang. Some relevant management aspects in this context include:

Strategic Planning: Strategic planning in biogas management includes determining the right location, identifying available resources, and preparing a long-term plan that takes into account household energy needs and the potential growth in the number of biogas users. Good planning also includes aspects of educating the community about the benefits of biogas and strategies to ensure that the program is widely accepted and used [5], [6].

Resource Management: One important element in the sustainability of biogas utilization is the availability of raw materials, such as animal waste and organic waste. Management of this resource involves efficient management of livestock waste, so that the waste can be optimally utilized to produce biogas. In addition, good management is needed for the tools used in biogas production, such as digesters, gas distribution lines, and household appliances that use biogas [7], [8].

Community Involvement and Participatory Management: In management science, community participation is often considered as one of the keys to success in implementing community-based programs. Community involvement in the biogas management process, from the planning stage to maintenance, will increase the sense of ownership of the project and ensure that the community has a good understanding of how to utilize and maintain the biogas infrastructure [9]. Thus, participatory management is the right approach to ensure the sustainability of biogas utilization in the Pinrang area.

Sustainability Management: Sustainability aspects are not only related to the technical operation of biogas, but also include economic, social, and environmental aspects. In the context of household biogas, sustainability management includes management that ensures that biogas production and utilization are not only profitable in terms of energy costs, but also have a positive impact on reducing waste and greenhouse gas emissions. From a social perspective, sustainability management must consider how this program can improve community welfare by providing cheaper and more environmentally friendly energy [10].

Monitoring and Evaluation: Continuous monitoring and evaluation are essential to ensure that biogas utilization runs according to plan and remains relevant to community needs. Through evaluation, we can identify the obstacles faced by the community in utilizing biogas, such as technical, economic, or social constraints [11], [12]. Thus, periodic evaluation will allow policy makers to make improvements and adjustments to the biogas program to make it more effective.

1.3 Problem Formulation

Although biogas has great potential in meeting household energy needs and reducing environmental impacts, community perceptions regarding the sustainability of its use are still not fully understood. Do communities in Pinrang have a positive view of biogas as a long-term energy solution? Are there management factors that need to be improved so that biogas use can be sustainable? How can good management play a role in increasing the acceptance and use of biogas among the community?

1.4 Research Objectives

This study aims to:

1. Identify community perceptions regarding the sustainability of household biogas use in the Pinrang area.
2. Explore how management elements, such as strategic planning, resource management, community involvement, and evaluation, affect the sustainability of biogas use.
3. Provide appropriate management recommendations to increase the acceptance and use of biogas in the Pinrang area.

By integrating management science into biogas management, it is hoped that this program will not only be successfully implemented but can also provide long-term benefits for the community and the environment

2 Research Methodology

2.1 Research Approach

This study uses a quantitative descriptive method. This approach aims to describe the public's perception of the sustainability of household biogas utilization in Pinrang Regency. The data collected are in the form of numbers that are analyzed statistically to produce information that describes the existing conditions related to the phenomenon being studied.

The quantitative descriptive approach allows researchers to provide a factual and accurate picture of the factors that influence the sustainability of biogas utilization from the community's perspective, as well as how management elements play a role in this sustainability.

2.2 Population and Sample

The population of this study was all people who use biogas as household energy in Pinrang Regency.

The sample was taken using a purposive sampling technique which aims to select people who have used household biogas for at least one year [13]. This is to ensure that respondents have adequate experience in biogas utilization. The sample size is

determined based on certain criteria, for example people in rural areas of Pinrang with sufficient livestock for biogas production.

The sample taken randomly consisted of 100 respondents to provide statistically adequate data. The selection of this number of samples considers a good representation of the population of biogas users in the area.

2.3 Data Collection Techniques

The data for this study were collected through a questionnaire compiled based on several predetermined research variables. This questionnaire uses a 5-point Likert scale to measure public perceptions of various aspects related to biogas utilization and management. Several aspects measured include:

1. Public understanding of the benefits of biogas.
2. Availability and ease of access to biogas technology.
3. Community participation in the biogas program.
4. Perceptions of the sustainability of biogas utilization in the long term.
5. Social, economic, and environmental impacts of biogas utilization.

The questionnaire will be distributed to respondents directly using a field survey method, or through online media if possible, to collect data from communities spread across various regions in Pinrang.

2.4 Research Variables

The variables to be measured in this study consist of:

1. Public perception of the sustainability of biogas utilization.
2. Factors that influence this perception, such as:
3. Knowledge of biogas.
4. Availability and access to biogas technology.
5. Participation in biogas management.
6. Economic, social, and environmental aspects of biogas.

2.5 Data Analysis Techniques

Data collected through questionnaires will be analyzed using descriptive statistical techniques. Descriptive analysis is used to describe the survey results in the form of frequency tables, percentages, averages, and standard deviations. In addition, a simple correlation test can be carried out to see the relationship between management factors and perceptions of biogas sustainability.

Statistical software such as SPSS will be used to facilitate data processing and analysis. The results of this analysis will provide an overview of public perception in general and allow researchers to make policy recommendations related to increasing the use and sustainability of biogas in the future.

3 Results

3.1 Respondent Characteristics

This study involved 100 respondents of household biogas users in Pinrang Regency. The questionnaire distributed to respondents consisted of questions that measured understanding, access, participation, and community views regarding the sustainability of biogas utilization. The results of the data analysis are presented as follows.

Table 1. Respondent Characteristics

Characteristic	Descriptions
Gender	60% Male 40% Female
Age	25 – 35 years (30%) 36 – 45 years (40%) ≥ 46 years (30%)
Occupation	Farmers (60%) Fishermen (15%) Housewives (25%)
Duration of Use Biogas	> 2 Years (70%) 1 to 2 Years (30%)

Source: Data Processed (2024)

In this study, the characteristics of respondents consisting of 100 household biogas users in Pinrang Regency showed variations in several aspects. Based on gender, the majority of respondents were male at 60%, while the remaining 40% were female. In terms of age, respondents were divided into three groups: 30% were in the age range of 25 to 35 years, 40% were in the age group of 36 to 45 years, and another 30% were 46 years and over.

In terms of occupation, the majority of respondents (60%) worked as farmers, reflecting a strong link between the livestock sector and biogas use in this area. As many as 15% of respondents worked as fishermen, and the other 25% were housewives who used biogas for their daily needs.

Based on the length of biogas use, 70% of respondents had used biogas for more than two years, while the other 30% had used biogas for between one and two years. These data indicate that the majority of respondents have sufficient experience in the use of household biogas, which contributes to their views on the sustainability of this technology.

3.2 Results of Community Understanding of Biogas

Based on the results of the questionnaire, 80% of respondents have a good understanding of the benefits of biogas, both in terms of economy and environment.

They realize that biogas helps reduce dependence on LPG, as well as reducing livestock waste that can pollute the environment.

Table 2. Understanding of the Benefits of Biogas.

Scale	Frequency	Percentage
Very Good	40	40%
Good	40	40%
Enough	15	15%
Poor	5	5%

Source: Data Processed (2024)

From the table above, it can be concluded that most respondents (80%) have a good or very good understanding of the benefits of biogas.

3.3 Results of Community Access to Biogas technology

Based on the results of the questionnaire, 75% of respondents have easy to access biogas technology, both in terms of economy and environment. Table 3.3 provides an overview of respondents' perceptions regarding the accessibility of biogas technology. The data highlights varying degrees of ease, ranging from those who find it very easy to access, to others who experience significant challenges in obtaining and maintaining this technology.

Table 3. Access to Biogas technology.

Access Category	Frequency	Percentage
Very Easy	30	30%
Easy	45	45%
Enough	15	15%
Difficult	10	10%

Source: Data Processed (2024)

These results show that although most respondents feel that access to biogas technology is quite easy, there are still a number of people who experience difficulties, especially in technical and maintenance matters.

3.4 Community Participation in Biogas Program

Based on the research results, community participation in biogas management is relatively high. As many as 60% of respondents are actively involved in the maintenance and management of biogas digesters in their homes, while 40% stated that they only use biogas without being directly involved in the maintenance process.

Table 4. Level of Community Participation.

Participate	Frequency	Percentage
Very Active	30	30%
Active	30	30%

Passive	30	40%
Not Involved	10	10%

Source: Data Processed (2024)

The level of community participation in biogas management shows quite good involvement, but there are still 40% of people who are not very active in maintenance.

3.5 Public Perception of Biogas Sustainability

The majority of respondents (85%) stated that they see biogas as a sustainable long-term solution. They believe that biogas can help reduce dependence on fossil fuels and provide significant economic benefits in the long term. However, 15% of respondents are still doubtful about the sustainability of biogas, especially related to the maintenance and repair costs of biogas equipment which are sometimes difficult to afford.

Table 5. Public Perception of Biogas Sustainability.

Perception	Frequency	Percentage
Very Positive	40	40%
Positive	45	45%
Neutral	10	10%
Negative	5	5%

Source: Data Processed (2024)

These results show that the majority of people have a positive view of the sustainability of biogas utilization in their area. The level of community participation in biogas management shows quite good involvement, but there are still 40% of people who are not very active in maintenance.

3.6 Economic, Social, and Environmental Impacts

From an economic aspect, 70% of respondents stated that the use of biogas helped reduce their monthly expenses for purchasing LPG. From a social aspect, respondents felt an increase in the cleanliness of the surrounding environment because livestock waste can be processed into energy. From an environmental perspective, 80% of respondents stated that biogas helped reduce the unpleasant odor of livestock waste and reduce air pollution.

Table 6. Economic and Environmental Impacts of Biogas Utilization.

Aspect	Frequency	Percentage
Economic Impact	70	70%
Environmental Impact	80	80%
Social Impact	75	75%

Source: Data Processed (2024)

These results show that the use of biogas in Pinrang has provided positive economic, social and environmental impacts for the communities involved.

4 Discussion

The results of this study provide a comprehensive picture of community perceptions of the sustainability of household biogas utilization in Pinrang Regency. Based on data obtained from 100 respondents, this study revealed several important findings related to understanding, accessibility, participation, and community views on the sustainability of biogas utilization. The following discussion will describe these results in more depth.

4.1 Community Understanding of Biogas

Most respondents (80%) have a good or very good understanding of the benefits of biogas. This shows that the outreach and education program regarding biogas in Pinrang Regency has been running quite effectively. The community, especially those who work as farmers and housewives, realize that biogas can be an environmentally friendly and economical solution to replace LPG. This good understanding is important to encourage the sustainability of biogas utilization, because the community tends to be more willing to maintain technology whose benefits they understand [3], [11].

This high level of understanding can also be associated with the duration of biogas use by most respondents. As many as 70% of respondents have used biogas for more than two years, which means they have had quite a long experience in using this technology. This experience provides them with practical knowledge on how to manage biogas, overcome technical problems, and maximize its benefits in everyday life [4], [15].

4.2 Accessibility to Biogas Technology

As many as 75% of respondents reported that they have easy access to biogas technology, either through government assistance or related institutions. However, there are still 25% of respondents who find it difficult, especially in terms of care and maintenance of biogas equipment, such as digesters. Easy access to biogas technology is very important for the sustainability of this program. If the community does not have adequate access to obtain the technology or to maintain it, it is likely that they will return to using LPG or other less environmentally friendly energy sources.

These results indicate that, although in general accessibility to biogas technology is quite good, there still needs to be improvement in terms of technical assistance and provision of maintenance services. Thus, the biogas program in Pinrang Regency can be more sustainable in the long term [7], [10].

4.3 Community Participation in Biogas Management

Active community participation in biogas management is one of the important factors supporting the sustainability of this technology. From the research results, it can be seen that 60% of respondents are actively involved in the process of managing and maintaining biogas in their homes. This reflects the high level of public awareness of

the importance of maintaining the sustainability of this technology. However, 40% of respondents reported that they only use biogas without being involved in its maintenance. This less than optimal level of participation can be an obstacle in the long term, especially if there are technical problems that require direct attention from users. Therefore, increasing community participation in biogas management must be the main focus in efforts to encourage the sustainability of this program. The participatory management approach can be further applied, where the community is more deeply involved, both in equipment maintenance and in biogas-based community development efforts. Thus, the community is not only a user of technology, but also an active manager who is responsible for the sustainability of their energy source [4], [11].

4.4 Community Perception of Biogas Sustainability

The majority of respondents (85%) have a positive view of the sustainability of biogas utilization. They believe that biogas can be a long-term solution that can reduce dependence on fossil fuels and provide significant economic benefits. This positive perception is an indication that the community has felt the direct benefits of using biogas, such as saving energy costs and reducing livestock waste.

However, there are 15% of respondents who are still doubtful about the sustainability of biogas, especially related to the cost of maintaining and repairing biogas equipment. This doubt shows that there are still obstacles that need to be overcome so that the biogas program can be fully sustainable. For example, more affordable subsidy or technical assistance programs can be provided to help communities who have difficulty maintaining this technology[12].

4.5 Economic, Social, and Environmental Impacts

Economically, most respondents (70%) reported that biogas helped reduce their spending on LPG purchases. This is one of the main positive impacts of biogas utilization, which also supports household economic sustainability. The costs saved from using biogas can be allocated to other more urgent needs for the family.

The environmental impact was also felt by most respondents, where 80% stated that biogas helped reduce the unpleasant odor of livestock waste and prevent air pollution. These benefits are not only felt by biogas users, but also by the surrounding community, thus creating a cleaner and healthier environment [14].

Socially, the use of biogas also provides benefits, especially in terms of improving the quality of life of rural communities. With environmentally friendly and cheaper technology, people feel more independent in meeting their daily energy needs.

5 Conclusion

Overall, the results of this study indicate that most people in Pinrang Regency have a positive perception of the sustainability of household biogas utilization. Factors such as a good understanding of biogas, fairly easy access to technology, active community participation, and direct economic, social, and environmental benefits contribute to

this positive view. However, there are still challenges in terms of maintaining and increasing community participation that need to be addressed so that the biogas program can continue and develop in the future.

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