Jurnal Peternakan Integratif
Journal homepage: https://talenta.usu.ac.id/jpi/workflow/index/16319/3

Biogas user perceptions of biogas development in Urutsewu Village, Ampel District, Boyolali Regency

Anisa Rahmawati Solikah[1], Rifo Nur Laksana Restu[2], Vivi Indriani[*3] 6869552

[1]*Livestock Product Technology, Faculty of Animal Science, Bogor Agricultural University, Dramaga, Bogor, 16680, Indonesia*
[2]*Mechanical Engineering, Faculty of Engineering, Universitas Sains Indonesia, Cibitung, Bekasi, 17530, Indonesia*
[3]*Animal Science Study Program, Faculty of Agriculture, Universitas Sumatera Utara, Padang Bulan, Medan, 20155, Indonesia*
*Corresponding Author: viviindriani@usu.ac.id

ARTICLE INFO

Article history:
Received May 8, 2025
Revised June 2, 2025
Accepted June 2, 2025
Available online June 2, 2025

E-ISSN: 2808-2753

How to cite:
Anisa Rahmawati Solikah, Rifo Nur Laksana Restu, Vivi Indriani. "Biogas user perceptions of biogas development in Urutsewu Village, Ampel District, Boyolali Regency". Jurnal Peternakan Integratif, Vol. 13, No. 01,pp.1-8 Mei .2025,doi: 10.32734/jpi.v13i01.20760.

ABSTRACT

Biogas is an innovation that is already known among livestock farmers. Urutsewu Village uses biogas in an effort to meet energy needs derived from cow dung, chicken dung, tofu liquid waste, and kitchen waste. The purpose of this study was to analyze the perceptions of biogas users towards the installation, economic impact, environmental impact, and social impact of biogas installation in Urutsewu Village. This research was a descriptive research with data collection conducted through direct interviews with biogas users. The source of information data was obtained from 48 respondents consisting of households that own biogas digesters and households that use non-owners of biogas digesters. The results of the study showed that 67% of biogas users knew about biogas before using it and 33% after using biogas. Respondents tended to say that biogas technology is easy to implement, easy and simple maintenance. The perception of biogas users regarding environmental impacts is that biogas technology can reduce pollution, reduce sources of disease and improve environmental quality. Biogas technology can relatively save fuel costs and is cheaper than other fuels but is not sufficient as cooking fuel. The community agrees to process waste into biogas and supports the government in biogas processing.

Keyword: Biogas, Farmer, Government, Perception, Urutsewu

http://doi.org/10.32734/jpi.v13i01.20760

1. Introduction

Energy is an important aspect of human life. The energy sources commonly used by humans are fossil fuels consisting of petroleum, coal, and natural gas. Fossil energy sources have the disadvantage of a long formation process. This causes the supply of fossil fuels to decline and will eventually run out. Based on the 2019 Indonesian Energy Outlook, it explains that petroleum production in Indonesia from 2009 to 2018 decreased by 18%. Alternative fuels are needed to replace fossil fuels.

Biogas is one of the alternative energies. Biogas is different from fossil fuels. Biogas comes from organic materials that are deposited. The existence of biogas raw materials will continue to exist as long as life continues. Based on this, biogas is classified as a renewable fuel. Biogas technology is one technology that has

been widely adopted by the community. The community utilizes waste in making biogas. The waste used is in the form of livestock, agricultural, industrial waste, household waste, and human waste. Biogas technology has broad benefits both economically, environmentally and socially. Biogas technology is widely used by livestock breeders on a household scale [1].

Urutsewu Village is one of the villages in Ampel District, Boyolali Regency. Urutsewu Village is included in one of the nominations for the 2020 Independent Energy Village (DME) competition held by the Energy and Mineral Resources Service of the Central Java Provincial Government. DME is one of the government programs regarding a village's ability to meet its energy needs. DME category villages have the criteria of being able to meet at least 60% of the total energy needs needed by using renewable energy. Urutsewu Village uses biogas as an effort to meet energy needs. The first biogas installation in Urutsewu Village was established in 1990. The first biogas used cow waste as biogas fuel. In 2014, 5 more biogas installations were built. 2014 was the year when biogas began to be developed again in Urutsewu Village. Until 2020, there were 38 biogas installations consisting of portable biogas and permanent or planted biogas in Urutsewu Village.

Innovation will not work if the target of the innovation has a negative response to the innovation. The target of biogas installation development is the community. The community is a direct user of biogas. The community's response to technology can be known by looking at the perception of the users of the technology. The perception process includes selection, interpretation and rounding of an object. The object is given an assessment, impression, opinion, felt, and interpreted. The perception of biogas users about biogas is needed in the sustainability, management and utilization of biogas. This study aims to determine public knowledge of biogas, biogas users' perceptions of biogas installations, biogas users' perceptions of the environmental impacts of biogas installations, biogas users' perceptions of the economic impacts of biogas installations, and biogas users' perceptions of the social impacts of biogas installations.

2. Method

The location of this research is in Urutsewu Village, Ampel District, Boyolali Regency with respondents from village communities who use biogas.

2.1 Tools and materials

The tools and materials used in this study were questionnaires, IBM SPSS Statistics 25 and Microsoft Excel 2010 for statistical data processing.

2.2 Respondent determination

Respondents in this study were biogas users from Urutsewu Village, Ampel District, Boyolali Regency, Central Java. The determination of respondents was carried out selectively (purposively). The purposive sampling technique as a technique for determining respondents with certain criteria [2]. The determination of respondents is based on the owners of biogas digesters, both embedded digesters and portable digesters, as well as non-owner users of biogas digesters.

2.3 Data collection

Interviews were conducted by visiting respondents' homes directly. The source of information data was obtained from 48 respondents consisting of households that own biogas digesters and households that use biogas that do not own digesters. This study was conducted using the primary data collection method. Primary data were obtained through direct interviews. The questionnaire was designed to obtain information on the characteristics of biogas use, knowledge of biogas, perceptions related to installation, economic, environmental and social impacts of biogas use. In-depth interviews were aimed at Village Heads, Environmental Service Employees of Boyolali Regency and respondents who handled biogas projects.

2.4 Data analysis

The data obtained are primary data. The data obtained are the results of questionnaires in the form of qualitative and quantitative data. User knowledge and perception are measured using the Likert scale. The Likert scale is often used to analyze the perception of biogas users in the form of quantitative data. The Likert scale is a measurement scale developed by Likert. The Likert scale has a combination of four or more statement items to form a score that indicates individual characteristics [3]. The Likert scale is used to determine perceptions of the installation of biogas installations carried out in Urutsewu Village, Ampel District. Qualitative data are described in the form of narrative text. Descriptive analysis (minimum and maximum values, average, and percentage) to identify respondents' perceptions regarding biogas. Quantitative data are processed using the

Microsoft Excel 2013 program. Data are presented in table form to see the relationship between the results of the processed data and the research objectives. Data are analyzed, interpreted and conclusions are drawn.

3. Result and Discussion

Characteristics are used to describe the knowledge received by respondents. Characteristics are properties or descriptions of elements. The elements in this study are respondents with characteristics of age, gender, last education, main job, and monthly income.

3.1 Respondent characteristics

Characteristics are used to describe the knowledge received by respondents. Characteristics are properties or descriptions of elements. The elements in this study are respondents with characteristics of age, gender, last education, main job, and monthly income (Table 1).

Table 1. Characteristics of biogas users in Urutsewu Village

User characteristics	Digester owner	Persentage (%)	Non-owner users of the digester	Persentage (%)
Age				
18-29	3	6	0	0
30-39	6	13	2	4
40-49	13	27	2	4
50-59	11	23	5	10
> 59	5	10	1	2
TOTAL	**38**	**100**	**10**	**100**
Gender				
Male	27	71	5	50
Female	11	29	5	50
TOTAL	**38**	**100**	**10**	**100**
Last study				
Nor school	1	3	0	0
Elementary	10	26	5	50
Junior high school	10	26	2	20
Senior high school	10	26	1	10
Bachelor	7	18	2	20
TOTAL	**38**	**100**	**10**	**100**
Work				
Farmer	10	26	0	0
Trader	3	8	3	30
Self-employed	4	11	1	10
Laborer	4	11	3	30
Civil servant	5	13	0	0
Housewife	8	21	3	30
Other	4	11	0	0
TOTAL	**38**	**100**	**10**	**100**
Income				
<IDR1.500.000,00	20	53	7	70
IDR1.500.000,00-2.500.000,00	7	18	1	10
IDR2.500.000,00-3.500.000,00	2	5	1	10
>IDR3.500.000,00	9	24	1	10
TOTAL	**38**	**100**	**10**	**100**

Age determines a person's experience and views. The age of respondents who own biogas digesters is dominated by the 40-49 age group with a percentage of 27%. The age of respondents who use non-owners of biogas digesters is dominated by the 50-59 age group with a percentage of 50%. Overall, respondents are in the middle adulthood phase. The adult phase into three, namely early adulthood at the age of 21-40 years, middle adulthood at the age of 40-60 years and old adulthood starting from 60 years [4].

The gender of the respondents who owned digesters was dominated by men at 71% and the respondents who were non-owners of digesters were equally male and female, at 50% each. Biogas installation is generally carried out by men. Several female farmers who were met were unwilling to be respondents because they were afraid and did not understand biogas. Education level is an indicator of someone gaining formal knowledge. Education also influences the mindset of farmers. Respondents who owned digesters had education levels ranging from elementary school (SD) to high school (SLTA) uniformly at 26% each. The education of non-owners of biogas digesters was dominated by elementary school at 50%.

A person's behavior is often influenced by the type of work they do. Certain jobs also influence the adoption of a product or innovation. The main job of digester owners is mostly livestock farmers at 26%. Non-owner users of biogas digesters are dominated by traders, laborers and housewives (IRT) at 30% each. Income is the income received by respondents in one month. Digester owners and non-owner users of biogas digesters are equally dominated by incomes of less than IDR1,500,000.00 as much as 57% and 70%. Respondents are predominantly classified as families.

3.2 Biogas user knowledge

Biogas is an innovation for livestock farmers in Urutsewu Village. Innovation can be accepted and adopted by the community requires several stages. The stages of innovation starting with the form of innovation, who created the innovation, the target of innovation dissemination, how to convey the innovation, and the community's response to the innovation [5]. The entry of biogas innovation in Urutsewu Village is slow and gradual. Technology with high complexity and high risk can cause slow technology diffusion for farmers who use it [1]. Farmers will adopt an innovation because they see the success of an innovation.

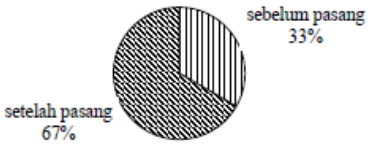

Figure 1. Comparison of when users know about biogas

The level of knowledge of farmers regarding innovation is positively and closely related to the level of adoption [6]. Knowledge related to biogas was mostly received by respondents after the biogas was installed. The comparison between after installation and before installation reached 2:1 (Figure 1). This shows that the community gained knowledge after adopting an innovation. Community knowledge related to biogas includes several statements. The Urutsewu Village community gained knowledge about biogas technology from training and direct use. Training on biogas technology was given to village officials. The knowledge was then executed by village officials and distributed to residents. Most biogas users learned about the biogas mechanism after using it directly. Community knowledge related to biogas technology can be seen in Table 2.

Table 2. Public knowledge of biogas

Description	Strongly disagree	Disagree	Agree	Strongly agree
Livestock manure can be processed into biogas and liquid fertilizer				
a) digester owner	0	0	61	39
b) non-digester owner user	0	10	60	30
Biogas is biogas that comes from organic materials				
a) digester owner	0	0	74	26
b) non-digester owner user	0	10	90	0
Organic biogas materials come from chicken manure, cows, organic market waste, food industry				
a) digester owner	0	0	63	37
b) non-digester owner user	0	0	90	10
Biogas can produce energy				
a) digester owner	0	0	74	26
b) non-digester owner user	0	10	50	40

Based on the interviews that have been conducted, it shows that community knowledge about biogas is good. The dominant community knows that the utilization of livestock waste can be processed into biogas and liquid fertilizer. The installation of a biogas digester in addition to producing biogas also produces liquid sludge that can be used as plant fertilizer [7].

The dominant community knows that biogas comes from organic materials. Organic materials according to the Big Indonesian Dictionary (KBBI) are defined as substances produced by living things. The use of biogas in Urutsewu Village comes from four sources of organic materials. These organic materials are cow dung, liquid tofu waste, chicken waste and kitchen waste. The dominant community knows that biogas can be used to produce energy. The principle of making biogas is the change of organic materials into methane gas. The formation of methane gas is assisted by methanogenesis bacteria. The biogas fermentation process actually occurs naturally but takes a relatively long time. Methane gas is a flammable gas. This methane gas is used to make energy [8].

3.3 Use of biogas related to biogas technology

Perception is a person's ability to organize an observation. Perception can be interpreted as an opinion in responding to a response. Perception is one of the psychological aspects that are important for humans in responding to the presence of various aspects and symptoms around them [9]. The factors that influence a person's perception are divided into two factors [10]. The factors that influence perception consist of personal and structural factors. Personal factors include experience, learning processes, needs, motives and knowledge of psychological objects. Structural factors include the social environment, applicable laws, values in society. The perception of biogas users in Urutsewu Village towards biogas installations can be seen in Table 3.

Table 3. Biogas technology knowledge

Description	Strongly disagree	Disagree	Agree	Strongly agree
Biogas technology is easy to implement				
a) digester owner	0	13	58	29
b) non-digester owner user	0	0	70	30
Maintenance/care of biogas equipment is easy to implement				
a) digester owner	5	26	58	11
b) non-digester owner user	0	10	80	10
Biogas installation uses simple technology				
a) digester owner	0	3	63	34
b) non-digester owner user	0	0	70	30
Biogas technology reduces pollution				
a) digester owner	3	16	55	26
b) non-digester owner user	0	20	50	30
Biogas technology reduces souces of disease				
a) digester owner	3	29	50	18
b) non-digester owner user	0	20	50	30
Biogas technology improves environmental quality				
a) digester owner	0	5	68	26
b) non-digester owner user	0	0	70	30
Biogas technology save fuel costs				
a) digester owner	0	3	68	29
b) non-digester owner user	0	10	60	30
Biogas is sufficient for cooking fuel				
a) digester owner	13	37	26	24
b) non-digester owner user	0	20	40	40
The price is relatively cheaper than LPG, kerosene and diesel				
a) digester owner	0	3	55	42
b) non-digester owner user	0	0	50	50
Biogas in the community is used for several houses				
a) digester owner	3	18	66	13
b) non-digester owner user	0	0	50	50
Livestock farmers work together to process waste into biogas				
a) digester owner	5	13	66	16
b) non-digester owner user	0	0	70	30
Government support biogas development				
a) digester owner	0	0	61	39
b) non-digester owner user	0	0	40	60

Digester owners and non-digester owners predominantly agree that biogas technology is easy to implement. Biogas technology applications are mostly used as fuel for biogas stoves. The operation of biogas stoves is like LPG stoves in general. Biogas users' perceptions of biogas maintenance or care are quite diverse. Biogas owners who disagree (26%) and strongly disagree (5%) say that damage to biogas installations cannot be repaired by themselves. Technicians and experts in the field of biogas are needed to repair damaged installations. Positive perceptions or overall agreement are given by non-owner users of biogas digesters regarding the ease of maintaining biogas installations. Non-owner users of digesters do not need to think about leaking or clogged digesters. Respondents also agree that biogas installations use simple technology, namely pipes, stoves and concrete buildings. Respondents' answers tend to be good and agree that biogas maintenance is easy to implement.

The operation of biogas technology is not only easy to use but also has a positive impact on the environment. A production process will produce waste. So is the case with livestock and tofu-making industries. Waste produced by an activity must be handled effectively and efficiently. Digester owners predominantly agree that biogas technology reduces pollution. Research conducted by Saputra (2017) on

dairy farms showed that groundwater around dairy farms had COD (Chemical Oxygen Demand) and TSS (Total Suspended Solid) values exceeding the established threshold. The distribution of groundwater quality is not suitable for use as raw water for drinking water because it has been polluted. Tofu waste can cause odor and pollute the quality of wastewater if not utilized or not processed properly [11]. Negative responses from digester owners (19%) related to biogas reducing pollution. The odor comes from biogas sludge. Biogas sludge is mud resulting from the fermentation of organic materials into biogas. Biogas sludge has the characteristics of a pungent odor, high water content and a compact texture [12].

Respondents' answers varied regarding the statement that biogas technology reduces sources of disease. Respondents who disagreed said that there had been no cases of people getting sick due to livestock waste or tofu industry waste. Respondents who agreed stated that the reason was because biogas technology makes waste well-organized and processed. Their research that domestic wastewater contains pathogens such as bacteria, viruses, worms and protozoa [13]. These pathogens result in the transmission of waterborne diseases to humans. An alternative to treating liquid waste so as not to pollute water is through the anaerobic-aerobic processing process. Biogas is one form of the natural anaerobic process. Respondents agreed that biogas technology improves environmental quality, is cleaner, more organized, and environmentally friendly. Livestock is cleaner because manure goes directly into the biogas digester. Aesthetically, livestock is more comfortable to look at and occupy. Biogas is environmentally friendly because it reduces CO2 emissions. Optimal use of biogas can reduce national emissions by 1.2 [14].

The environment will experience a decline in quality if waste is not managed properly. The purpose of making a biogas installation is basically to manage waste effectively and efficiently. Biogas digesters in Urutsewu Village are divided into two, namely embedded biogas and portable biogas. Embedded biogas digesters in Urutsewu Village have three sizes. The size of the biogas digester based on the base radius from smallest to largest is 1.6m, 1.9m, and 2.1m. A digester with a radius of 1.6m has a capacity of $9m^3$ used by cattle and chicken farmers for personal use. A digester with a radius of 1.9m has a capacity of $15m^3$ used by cattle farmers and distributed to 2-5 houses. A digester with a radius of 2.1m has a capacity of $18m^3$ used by the tofu industry and distributed to up to 10 houses.

That 0.35 m^3 of biogas for 45 minutes can be used to boil 1 kettle of water or a volume of 6 liters [15]. Cooking rice requires 0.5 m^3 of biogas for 58 minutes with a rice weight of 1.5 kg. The time needed to cook using biogas is around 150 minutes or close to 3 hours. The production of 3,334 m^3 of biogas can be sufficient for cooking needs for 4 people. The portable biogas digester in Urutsewu Village uses a blue drum with a capacity of 200 liters. The biogas produced is stored in car tires. Full portable biogas can be used to cook instant noodles until cooked. Portable biogas with a capacity of 200 liters can produce combustion for 181 minutes [1].

Cooking is a basic activity carried out by humans. Generally, the types of fuel used by rural communities for cooking are LPG and firewood. The use of biogas is generally used as cooking fuel. This is because the installation of biogas for cooking is easy. Biogas stoves have almost the same method of use as LPG stoves. Biogas users agree that the use of biogas can save on fuel requirements. The community will adopt alternative energy if the energy source is sufficient and has an affordable price. Biogas digesters with large capacities and sufficient fuel can meet cooking needs. The perception of biogas users regarding the adequacy of cooking fuel using biogas varies. People still spend money to buy LPG or need firewood. Spending money to buy fuel is done by the community because of the large cooking needs. Biogas users also still use LPG and firewood as reserves if the biogas installation is damaged.

The government has created several programs to increase the use of biogas such as training in operating digesters and demonstrations of biogas installations for the community. The Energy and Mineral Resources Agency (ESDM) of Central Java Province also collaborates with district/city governments and third parties to build biogas installations in areas with the potential for biogas. Social impact is a social consequence for a group due to actions that change the system of interaction with each other, life, work, fulfillment of life needs, and efforts to become a sufficient society [16].

Digester owners said that non-digester owners misunderstood the digester owners because they did not want to share biogas, which was the reason why people did not agree that biogas could bring people closer together. On the contrary, what actually happened was insufficient waste materials and leaks in the biogas installation. Digester owners said that there were neighbors who did not like the construction of biogas because the construction was uneven.

Planning the construction of a biogas installation required four factors [17]. First, the availability of organic waste as biogas filler. Second, the availability of building materials that can be used to build a biogas installation. Third, the type of needs and fourth, basic needs. The village official explained that the construction of a biogas installation required a house that had cattle or chickens, a tofu industry, and sufficient land. In the

future, people who do not have livestock and land can use a portable biogas installation with a small capacity. Respondents who answered in agreement explained that biogas can bring people closer together because they get the benefit of free cooking fuel. People have various perceptions about waste management into biogas. The dominant community has a positive perception about waste management into biogas together. The use of biogas technology as an effort to control waste is successful so that the community becomes comfortable. While for negative perceptions or disagreement from the community has the reason that waste is the responsibility of producers to manage waste. The community as a whole agrees with the government's support in the procurement of biogas. Government support is in the form of providing construction costs. Management and training related to biogas are also carried out by the government. Another form of support from the government is in the form of an independent energy competition.

4. Conclusion

Biogas users in Urutsewu Village predominantly learned about biogas after adopting biogas. Community knowledge of biogas is quite good. The community agrees that biogas is easy to implement and uses simple technology. Biogas installation maintenance is quite difficult for biogas users. The community perceives that biogas has an impact on the environment because it reduces pollution and improves environmental quality. The community has not felt the direct impact of biogas installation in reducing sources of disease. Biogas brings communities closer together by using one digester together.

References

[1] Putra RARS, Liu Z, Lund M. (2017). The impact of biogas technology adoption for farm households–Empirical evidence from mixed crop and livestock farming systems in Indonesia. Renewable and Sustainable Energy Reviews. 74(1):1371-1378
[2] Winarno. (2013). Metodologi Penelitian dalam Pendidikan Jasmani. Malang: UM Press
[3] Budiaji W. (2013). Skala pengukuran dan jumlah respon skala likert. Jurnal Ilmu Pertanian dan Perikanan. 2(2): 125-131
[4] Hurlock EB. (1980). Development Psychology: A Life Span Approach. New York: Mc Graw Hill Book
[5] Hanafi A. 2009. Memasyarakatkan Ide-ide Baru. Surabaya: Usaha Nasional
[6] Astuti UP, Sugandi D, Hamdan. (2016). Faktor-faktor yang mempengaruhi adopsi petani terhadap inovasi teknologi jeruk gerga lebong di Provinsi Bengkulu. Seminar Nasional Perlindungan dan Pemberdayaan Pertanian dalam Rangka Pencapaian Kemandirian Pangan Nasional dan Peningkatan Kesejahteraan Petani. 1(1): 79-85.
[7] Amaranti R, Satori M, Rejeki YS. (2012). Pemanfaatan kotoran ternak menjadi sumber energi alternatif dan pupuk organik. Buana Sains. 12(1):7-32.
[8] Pertiwiningrum A. (2016). Instalasi Biogas.Yogyakarta: CV. Kolom Cetak.
[9] Jayanti F, Arista NT. (2018). Persepsi mahasiswa terhadap pelayanan perpustakaan Universitas Trunojoyo Madura. Competence: Journal of Management Studies. 12(2):205-223.
[10] Cepriadi, Yulida R. (2012). Persepsi petani terhadap usahatani lahan pekarangan (studi kasus usahatani lahan pekarangan di Kecamatan Kerinci Kabupaten Pelalawan). IJAE (Jurnal Ilmu Ekonomi Pertanian Indonesia). 3(2):177-194.
[11] Subekti S. (2011). Pengolahan limbah cair tahu menjadi biogas sebagai bahan bakar alternatif. Seminar Nasional Sains dan Teknologi 2: B61-B66.
[12] Marlina ET. (2013). Analisis kualitas kompos dari sludge biogas feses kerbau. Jurnal Ilmu Ternak Universitas Padjadjaran.13(1):31-34
[13] Said NI, Marsid R. (2005). Mikroorganisme patogen dan parasit di dalam air limbah domestik serta alternatif teknologi pengolahan. Jurnal Air Indonesia. 1(1). 65-81.
[14] Juraida A, Prambudia Y, Rahman A, Saragih INI. (2018). Kajian pengurangan emisi karbon melalui optimalisasi pemanfaatan limbah rumah potong hewan sebagai biogas. Prosiding Seminar Nasional Rekayasa dan Desain Itenas 2: F1-F6
[15] Asari A, Widodo P. (2015). Perancangan dan penerapan instalasi biogas skala kecil di Ciamis. Prosiding Seminar Nasional Pengembangan Teknologi Pertanian. 1: 415-423.
[16] Richards M. (2012). Penilaian Dampak Sosial Secara Partisipatif Untuk Proyek Dan Program Sumberdaya Alam. Forest Trends

[17] Taufikurrahman T. (2011). Rancangan desain pemilihan reaktor biogas. Teknika Polsri. 30(1):1-6.