

## **SOCIALIZATION OF PKM EDUCATES UB BOSS FARM FARMERS IN MAKING BIOGAS AS ENVIRONMENTALLY FRIENDLY RENEWABLE ENERGY FOR TOFU PRODUCTION**

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### **ABSTRACT**

Biogas is a gas produced from the process of decomposing organic materials by microorganisms under anaerobic conditions. Biogas can be burned like LPG and become an alternative source of renewable energy that is environmentally friendly. Biogas contains 60% CH<sub>4</sub> gas (methane); 38% CO<sub>2</sub> gas (Carbon Dioxide); and 2% N<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>, H<sub>2</sub>S gas. The name of the partner is UB BoSS Farm with a business as a Cattle-Buffer Farmer as well as producing tofu which is located in Cibadak Village, Ciampea District, Bogor Regency. The number of cows is 40 and 2 buffaloes, so that the potential for wet waste produced is 420 kg/day which is equivalent to 117,600 liters/day of biogas; solid total of each tail is 16% and solid volatility is 77% TS. The stages of implementing PKM activities that have been carried out include discussion, socialization, and evaluation of activities (pre-test and post-test). The results of PKM activities showed a change in the level of knowledge of participants regarding what factors were influential, and the stages of the biogas manufacturing process from 20% to 93.33%. The post-test results also showed that most of the participants (86.67%) now have knowledge about raw materials around the business area that can be used as biogas.

**Keywords:** cibadak village, ciampea, bogor regency, biogas, renewable energy

### **INTRODUCTION**

Cows are quite mammals widely cultivated throughout Indonesia. Especially for residents of Indonesia in agricultural areas most of whom earn a living as farmers and ranchers. The size of the land agriculture and profits are in tropical regions, make things easier for the majority of Indonesia's population in cattle farming. Apart from that, factors economics also plays an important role in cattle farming, because this business provides major contribution to the livelihood of a number large community. In rural areas of Indonesia, at least the ranchers have the most cows less than 3-4 cows.

The large number of cattle breeders in the area Indonesia has positive and negative sides if reviewed from various points of view. Cow is a livestock commodity promising from an economic perspective. Every year, The need for beef in Indonesia continues increases, as do imports that continue increases at an increasingly higher rate. This trend is encouraging motivation of the community, especially those in rural areas with large areas of land for intensify cattle farming business. It is just, if viewed from another aspect, cattle farming also has a negative impact, especially for environment.

Cattle farming in general produces livestock waste in the form of liquid waste and solid waste. Livestock solid waste can in the form of livestock manure and animal feed residues, while liquid waste includes sewage cage washing, livestock sanitation waste water, and livestock urine. Livestock waste produced from This cattle farming will have a direct impact on environmental cleanliness level. One cow can produce solid waste as much as 20-30 kg and as much as 100–150 liters of liquid waste per day. Livestock waste can cause problems related to problems hygienic which is classified into three types, including the production of noxious gases, contamination soil due to excessive livestock manure content, and also water pollution. This is why attention breeders regarding livestock waste management very important.

Approximately 25 kg of foam manure is produced by one adult cow weighing 450 kg per day. Lots of it wasted cow dung and even pollute the surrounding environment, can be overcome with processing this waste, one of them by means of biogas production. Biogas is a gas which appears when organic materials such as feces, whether animal or human, and rubbish Organics are stored in an airtight place. Anaerobic breakdown which occurs during the process of fecal fermentation naturally produces methane gas. When burned, the gas produced by this biogas will ignite, this is because of the animal waste used as raw material, decomposes into methane gas.

The nature of the methane gas produced from this biogas superior when compared to non-alternative fuels. Biogas methane gas is friendlier environment and is renewable because it originates from organic materials and waste.

One of the potential locations for large ruminant farms and the tofu industry is in Cibadak Village, Ciampea District, Bogor Regency. The by-product of cattle farming is livestock waste, which is the remaining waste from livestock business activities such as livestock raising. This waste includes solid waste and liquid waste such as feces, urine and other waste. Apart from livestock waste, waste from the tofu making business is tofu dregs. Both livestock waste and tofu waste are useful as raw materials that can be used as raw materials for biogas (Nisrina, 2018). It is common knowledge that Mother Earth holds a wealth of natural gas and oil. However, we cannot continue to use it without making efforts to innovate with promising alternative energy. One alternative energy that can guarantee the energy needs of the Indonesian people is biogas energy (Figure 1).

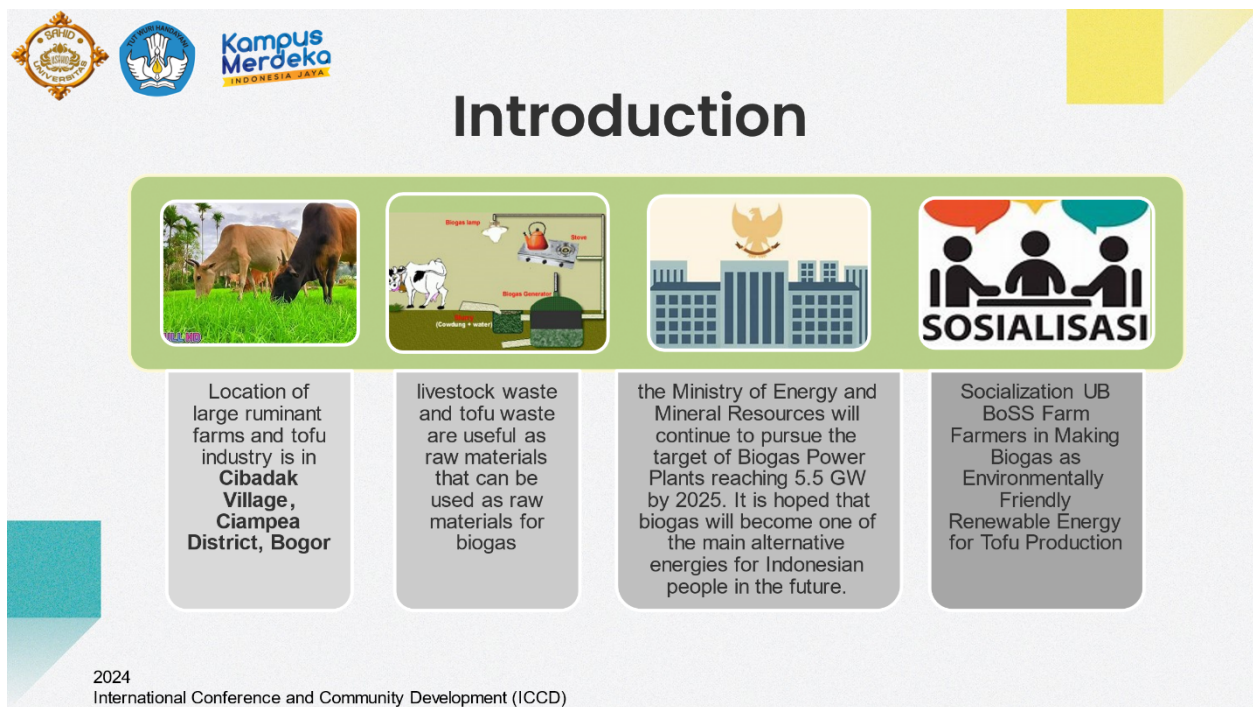


Figure 1. Alternative energy that can guarantee the energy needs of the Indonesian people is biogas energy

It is common knowledge that Mother Earth holds a wealth of natural gas and oil. However, we cannot continue to use it without making efforts to innovate with promising alternative energy. One alternative energy that can guarantee the energy needs of the Indonesian people is biogas energy. Biogas energy is energy produced from organic waste such as livestock manure, or kitchen waste such as used vegetables. This waste will go through a decomposition process called an anaerobic digester in an airtight room. The main components of biogas energy are methane gas (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>). These two gases can be burned or oxidized and release energy, and it is this energy that humans can use for their daily needs. However, the size of the gas component depends on the anaerobic process and the composition of the basic ingredients for making biogas energy. The greater the methane content of biogas energy, the greater the energy that can be produced from the biogas (Nisrina, 2018)(Abilmazhinov et al., 2023)(Abilmazhinov et al., 2023).

Biogas itself can be used by the community as an alternative energy to replace Liquefied Petroleum Gas (LPG) for cooking and generator fuel to produce electricity. Apart from that, biogas is considered safer for the earth because burning biogas can reduce glass gas emissions. Biogas can also reduce odors, insects and pathogens that come from traditional waste dumps. According to the Ministry of Energy and Mineral Resources, biogas development in Indonesia is both a challenge and an opportunity for Indonesia. There are several aspects that still need to be reviewed, such as access to funding, direct use, technology, coordination, sustainable development, governance, investment and policy. The Ministry of Energy and Mineral Resources noted that 47,505 household biogas units have been installed throughout Indonesia, producing 75,044.2 m<sup>3</sup>/day of biogas or around 26.72 million m<sup>3</sup>/year.

The energy source that comes from livestock manure is biogas. This energy can replace LPG which still uses fossil fuels as the main raw material for its manufacture. Livestock manure contains chemical compounds which, when processed, produce bio gas containing 60-70% methane gas, 30-40% carbon dioxide and several other gases.

This gas is produced from fermentation by the activity of anaerobic bacteria in free oxygen, which is processed in such a way as to produce liquid fuel in the form of ethanol and solid residue which can be used as compost for plants. Even though biogas utilization is not yet optimal and there are still many things that need to be addressed, the Ministry of Energy and Mineral Resources will continue to pursue the target of Biogas Power Plants reaching 5.5 GW by 2025. It is hoped that biogas will become one of the main alternative energies for Indonesian people in the future. is coming, and can be an effort to protect the earth from global warming. Therefore, the urgency of this activity is to increase the education and motivation of Cow and Buffalo Breeder Partners as well as Tofu MSMEs in protecting the environment by utilizing cow dung waste and tofu dregs into Biogas as renewable and environmentally friendly energy. Biogas is a gas produced from the process of decomposing organic materials by microorganisms under anaerobic conditions (Abilmazhinov et al., 2023)(Pertiwiningrum et al., 2020)(Dhungana and Lohani, 2022). Biogas can be burned like LPG and is an alternative source of environmentally friendly renewable energy. Biogas contains 60% CH<sub>4</sub> gas (methane); 38% CO<sub>2</sub> gas (Carbon Dioxide); and 2% N<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>, H<sub>2</sub>S gas.

Biogas is a renewable bioenergy that is still under development in Indonesia. It seems as if fossil energy has almost been swallowed up by the earth due to excessive exploitation activities, which we must use wisely. Fossil fuels are non-renewable energy. Nowadays, most household, vehicle and public utilities use fossil energy. In fact, fossil energy is formed due to natural processes in the form of degradation of organisms that occurred millions of years ago. That is why there is a chance of running out of energy when new sources of fossil materials are not able to replace it quickly. There are various types of fossil energy, such as petroleum, coal and natural gas. Biogas as bioenergy is currently being developed so that it can become potential energy to answer all the problems that arise due to the use of fossil energy. The problem we face when overexploiting is uncontrolled environmental pollution. Air pollution results from carbon contamination, fine particles and dangerous substances that threaten health.

Literally, the word "bioenergy" is composed of two words, namely bio and energy. Bio means living thing, energy is something that is used for human survival. So bioenergy is renewable energy originating from biological sources that have value for human life. This source comes from organic or biological substances which are certainly easy to find and have different variations. This energy can become an environmentally friendly alternative energy for fuel and electricity sources. Bioenergy that comes from life is biomass. Indonesia is an archipelagic country, has fertile land and abundant biodiversity. The availability of natural biological materials opens up opportunities to convert and utilize alternative energy sources that are more environmentally friendly than fossil energy. The design of Biogas can be show at Figure 2.

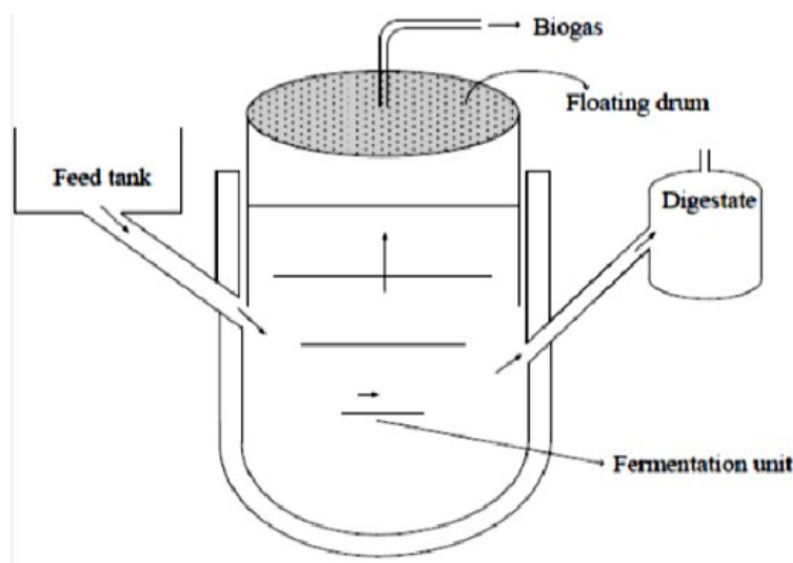


Figure 2. Design bio gas

**Activity Objectives**

The activities carried out aim to raise enthusiasm and improve the skills of the community so that they can continue to carry out waste utilization activities into renewable energy, namely biogas which is environmentally friendly and can be produced independently. Renewable energy products in the form of biogas made from livestock waste can be an alternative renewable energy product, especially Cibadak Village, Ciampea District, Bogor Regency, West Java, which is expected to become an energy independent area in the future.

**Benefits of Activities**

The Community Service Activity (CSA) that have been carried out have the benefit of providing socialization regarding bio gas production technology as an alternative form of environmentally friendly renewable energy so that renewable energy can be produced independently and make Cibadak Village, Ciampea District, Bogor Regency, West Java. become an energy independent region in the future.

**METHOD****Activity Implementation Method**

The CSA were carried out on April 30 2024 at the UB BoSS Farm business premises with a business as a Cattle- Buffalo Breeder as well as producing tofu, in Cibadak Village, Ciampea District, Bogor Regency, West Java. The partner in implementing this activity is UB BoSS Farm. Discussions related to the implementation of CSA were held together with the chairman of the UB BoSS Farm Group, Mr. Hairul Firdauz. The stages of implementing CSA activities that have been carried out include discussion, socialization, and evaluation of activities (pre-test and post-test). The number of participants involved in the activity was 15 people. The stages of implementing the activities that have been carried out began with a discussion with Mr. Hairul Firdauz, to discuss the technical implementation of the socialization. The socialization activity begins with a pre-test. The pre-test was carried out to determine the partner's initial level of knowledge of the material. After the socialization was completed, post-test activities were carried out. Post-test activities were carried out to see changes in partners' knowledge levels after the activities were carried out.

**Effective Time for Implementation of Activities**

This CSA was carried out on April 30 2024. On that date, the participants gathered at the UB BoSS Farm Business Place with a business as a Cattle- Buffalo Breeder as well as producing tofu, which is located in Cibadak Village, Ciampea District, Bogor Regency, West Java. The activity began with a series of discussions, socialization and evaluation, which included a pre-test and post-test to measure the participants' level of knowledge and understanding.

**Activities Place**

The place where this community service activity is carried out is the UB BoSS Farm Business Place with a business as a Cattle- Buffalo Breeder as well as producing tofu, which is located in Cibadak Village, Ciampea District, Bogor Regency, West Java (Figure 3).

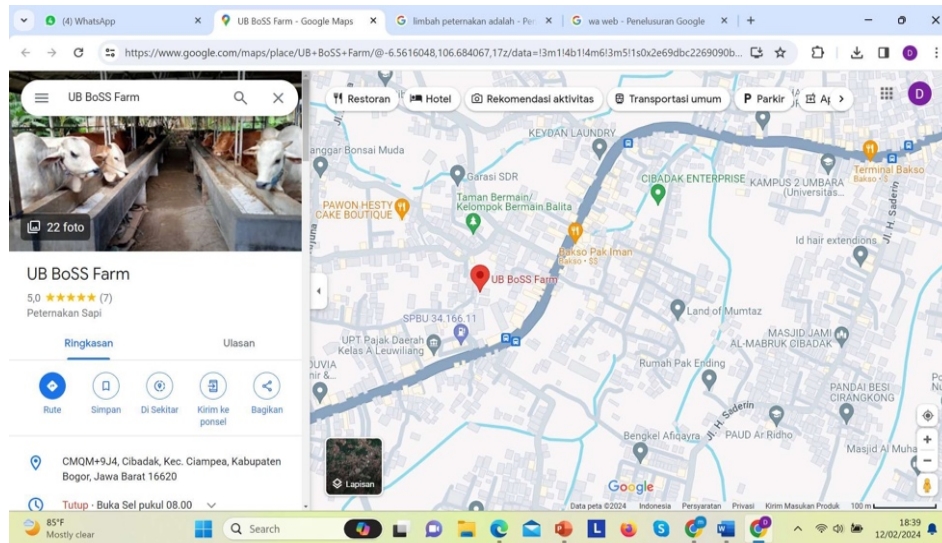


Figure 3. Located CSA in Cibadak Village, Ciampea District, Bogor Regency, West Java

This place was chosen as the right location to interact with the local community, especially the members of UB BoSS Farm whose business is as a Cattle-Buffalo Farmer as well as producing tofu, who are partners in this activity. Discussions and outreach were carried out at this location with active participation from the participants, so that knowledge and skills related to making biogas as renewable energy could be socialized and applied practically

## RESULTS AND DISCUSSION

The large volume of vehicles within 24 hours, day, night and morning, releases at least 1.13 kg of carbon emissions into clean air. This is what we often hear, that Jakarta's air is no longer clean, looks opaque, and is unhealthy for the living creatures beneath it. Large amounts of carbon emissions in many parts of the world are what cause climate change and global warming. Carbon emissions are the cause of climate change issues continuing to reverberate in the news media and in discourses on future life. What if in the future, humans have to face serious problems resulting from carbon emissions that pollute clean air.

To respond to this serious problem, the Indonesian government has made many efforts to reduce carbon emissions in Indonesia. One of them is the ratification of PERPRES no. 98 of 2021 concerning the Economic Value of Carbon (NEK). In this Presidential Decree, the government is committed to efforts to reduce CO<sub>2</sub> emissions with a target of reducing 41% by 2030. At the Conference of the Parties (COP) meeting, the President asked for support from international circles to realize this good intention.

But in reality, many breeders cows who ignore the problem of dung waste their animals. These cattle farm wastes in general it has not been managed well, In fact, quite a few of the breeders are dispose of waste directly into public waters. Problems like this have a direct impact to the environment and trigger its occurrence environmental pollution.

What's more, waste waste that farmers directly release to a water source that is the source of water for the population. Locally, this treatment causes water pollution moderate to high level depending on lots of waste. This will also have an impact directly on public health and can cause the spread of disease among people local residents. Apart from that, animal waste not processed properly also causes air pollution due to its unpleasant odor.

Energy resources have a role very important for economic development national. Energy is needed for growth industrial, service, transportation and home activities ladder. In the long term, the role of energy developed especially to support growth of the industrial sector and other activities.

Even though Indonesia is a country oil and gas producers, but it is decreasing oil reserves, elimination of subsidies resulting in an increase in oil prices and quality the environment degrades due to the use of materials Excessive fossil fuel burning. Therefore, utilization of alternative energy sources Renewable and environmentally friendly is an option.



Organic ingredients are one of them examples of renewable energy sources that have not utilized optimally. One example organic materials that can be utilized are cow dung. Cow dung is often found scattered on the streets and even around residential areas inhabitant. Scattered cow dung can cause environmental pollution, such as air pollution and land pollution. Therefore, processing is required. cow dung appropriate and useful, namely converted into biogas as a form of renewable energy through anaerobic fermentation process.

This process takes place during processing or fermentation, the gas is mostly in the form of methane with the molecular formula carbon tetrahydride (CH<sub>4</sub>) or methane and carbon dioxide with carbon dioxide (CO<sub>2</sub>) molecular formula. Mixture This gas is flammable if methane content reaches more than 50%. The potential for gas production from a type of material actually quite high in terms of levels The organic material is also high and has levels C/N ratio 20:1 to 40:1.

Based on this problem, then researchers provide solutions in management livestock waste, especially solid waste from manure cow. Using cow dung as waste Organic is the main ingredient in manufacturing alternative energy and at the same time minimize the impact of environmental pollution due to waste farm. Socialization activities can be seen in Figure 5.

The CSA began with discussions with UB partners BoSS Farm business premises with a business as a Cattle-Buffalo Breeder as well as producing tofu, in Cibadak Village, Ciampea District, Bogor Regency, West Java., led by Mr. Hairul Firdauz accompanied by the Chairman of the Village Owned Enterprise. The results of this discussion resulted in an agreement in the form of socialization on the production of biogas from cow and buffalo dung as raw materials, to be held on April 30 2023. Before the socialization, a pre-test was carried out among the participants. The pre-test results showed that as many as 66.67% of participants did not know the technology for making biogas as an environmentally friendly renewable energy. The pre-test results also showed that 80% of participants did not know what factors were influential and the process stages that could be used. The pre-test results also showed that 93.33% of participants did not know the raw materials that could become biogas. Based on the results of the pre-test, it is known that there is a need to provide outreach regarding the technology for making biogas from waste from cow and buffalo, sheep and goat manure.



Figure 4. Biogas production technology outreach activities

Apart from livestock waste, waste from the tofu making business is tofu dregs (Subekti, 2011)(Rajagukguk, 2020)(Ardaniswari and Nugravianto, 2020)(Ni, 2014)(Sudarto, Salundik and Soenarno, 2023). Both livestock waste and tofu waste are useful as raw materials that can be used as raw materials for biogas.

The size of the digester used is a jerry can with volume 10 kg and hose that functions for emits gas with a size of 30 cm. Digesters This 10kg volume is able to accommodate the mixture as much cow dung and water as organic material approximately 6kg to 7kg, the digester volume is not can be too full to make room for gas reservoir. For making scale digesters Households can then use a digester larger in size with the length of the hose customized.

After the socialization activities were carried out, participants were given a post-test questionnaire to determine whether there was a change in the level of knowledge and skills of the participants. The post-test results showed that 93.33% of participants already knew what influencing factors and process stages could be used in biogas production technology. The post-test results also showed that 86.67% of participants already knew the stages of the bio gas

production process. The post-test results also showed that participants hoped that there would be follow-up activities in the form of creating bio gas infrastructure and human resource skills training in their area.

This biogas production is influenced by several factors such as temperature, level acidity, organic material composition, and quality. High temperatures can kill anaerobic bacteria so fermentation is not ongoing, anaerobic bacteria for production biogas in the digester can work smoothly optimum at a temperature of around 20-40°C. Under room temperature conditions and protected from direct sunlight, then production biogas would be much better.

Besides that, the condition of the cow's manure can also have an effect on the intensity of the gas produced. Cows are good to use as ingredients biogas is fresh cow dung in the room open less than 12 hours. So It is necessary to pay attention to the condition of cow dung used to obtain biogas maxima

### **Target Society**

The target community for this CSA is residents living in Cibadak Village, Ciampea District, Bogor Regency, West Java. More specifically, those who are members of the UB BoSS Farm Group business premises with a business as a Cattle-Buffero Breeder as well as producing tofu is the main focus of this activity. UB BoSS Farm business premises with a business as a Cattle-Buffero Breeder as well as producing tofu, in Cibadak Village, Ciampea District, Bogor Regency, West Java. is a group of breeders who play an important role in managing natural resources related to livestock in the region. This target community includes cattle, goat and sheep breeders, as well as tofu MSMEs which have great potential in developing renewable energy. Through the outreach activities carried out, the main aim is to provide knowledge and skills to the target community so that they can understand, adopt and apply biogas production technology that is environmentally friendly and affordable to implement. By increasing this understanding, it is hoped that target communities can produce biogas as quality and resilient renewable energy in the face of renewable energy availability. It is also hoped that this activity will help improve the standard of living and energy security of local communities in the long term.

Cow dung has great potential used as organic raw material for manufacturing biogas. In the manufacturing process, methane gas is already produced can be produced from the 14th day after fermentation. This process continues until the day 21st and so on. The longer the process fermentation, then gas is produced too the better and more numerous, marked with increasing digester volume from day to day which indicates there is an increase gas volume each day. At stage mixing the composition of water and animal waste, water composition should be used more, because water is a fermentation medium for bacteria anaerobes which will break down organic matter, This will affect the volume of gas generated. The quality of the gas produced during Biogas production is influenced by temperature, acidity level, organic material composition, and dirt quality.

### **CONCLUSION**

Through these community service activities, various positive results have been achieved. The results of the pre-test and post-test evaluation of participants showed significant changes in their level of knowledge and understanding regarding the production of biogas as an environmentally friendly renewable energy as a fuel for producing tofu. Before the activity started, most participants (66.67%) had a limited understanding of the technology for making biogas as renewable energy and the factors that influence it. However, after socialization and discussion activities, the majority of participants (93.33%) had a deeper understanding of the factors that play a role in making bio gas as environmentally friendly renewable energy, and the process stages. Apart from that, the post-test results also show that the majority of participants (86.67%) now have knowledge about raw materials around the business area that can be used as bio gas. Apart from changes in participants' knowledge, this activity also encourages active community participation in understanding biogas production technology and implementing it. Apart from that, they also expressed their hope for follow-up activities, such as further development of biogas building infrastructure in their area. These positive results create opportunities for the development of energy-independent villages based on raw materials from waste of animal origin, such as cows, buffalo, sheep and goats. With the improved understanding and skills gained through these activities, communities are expected to contribute to improving their energy security and quality of life in the long term.

Biogas production can already be seen since the 14th day of research. This matter evidenced by the presence of bursts of fire from the flame a fishing flame which indicates the presence of gas removed from the biogas digester. On the 18th day. Biogas production trials were also held with Biogas products can still be formed however has a more pungent odor in comparison on the first trial.

Processing agricultural waste into biogas can help farmers manage waste effectively. Apart from that, the organic fertilizer produced can also increase agricultural productivity. Cow dung has great potential used as organic raw material for manufacturing biogas. In the manufacturing process, methane gas is already produced can be produced from the 14th day after fermentation. This process continues until the day 21st and so on. The longer the process fermentation, then gas is produced too the better and more numerous, marked with increasing digester volume from day to day which indicates there is an increase gas volume each day.

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