Training Programme of Biogas to Minimize Environmental Pollution in the Tempok Village Sub Tompaso District

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Abstract

The cattle in the village Tempok traditionally maintained, in the sense that no caged animals. On the afternoon of cattle grazing in the garden, the evening brought home and left on the home page. The problem, waste of cattle can cause environmental pollution. Based on the problems of making biogas training was conducted with the aim to increase knowledge and awareness of peasant farmers in minimizing environmental pollution and produce biogas reactor. The goal of this group was the farmers' cattle Pinatoroan and Samperongan. The method used of the application of science and technology was extension and training program of making biogas. Waste of cattle produces methane (CH4), which can increase greenhouse gas emissions. One of the activities that can be done is processing of biogas as an effort to improve environmental quality. Biogas reactor is made of 2 pieces and has successfully seen the fire coming out of the stove. This activity is done to reduce greenhouse gas emissions produced from waste of cattle. The result of the application of science and technology was to increase knowledge and awareness of peasant farmers in minimizing environmental pollution. Biogas reactor produces gas as a fuel substitute. Benefits derived from these activities is to reduce expenditures for kerosene, reducing the dependence of fuel wood, the home page be clean, pleasing to the eye and reduce odor.

Keywords: biogas, cattle waste, environment

Introduction

According to Putro (2007), global energy crisis caused world oil prices reached U.S. $ 70/barrel. This condition influenced the life of Indonesian including rural people of the districts Tompaso. There is a need to provide an alternative energy supply through development non-fuel energy technologies which are environmentally friendly.

Based on joint decision of the Minister of Home Affairs and Minister of Agriculture, No. 54 of year 1996: 304/KPTS/L.P.120/4/96, about Guidelines for Implementation of Agricultural Extension, a program to improve farmer groups, based on local conditions and potential resources, and considering the strategic environment that influence it, have been run (Department of Animal Husbandry, 1998). The program was primarily intended for low income rural households. One energy technology in accordance with the requirements of the rural households was biogas technology. According to Srisertpol *et al*. (2010), biogas was one kind of energy and sustainable development that were essential to energy and environmental planning. Biogas from cattle waste could substitute kerosene which were expensive and scarce in rural area.

In District Tompaso there were two groups of cattle farmers, namely group of cattle farmers Pinatoroan and Samperongan. The groups maintained their cattle traditionally and extensively. On the morning until late afternoon the cattle were let grazing in the field. In the afternoon, around 18:00 o'clock, the cattle were brought back and let slept in their home yard. The system caused environmental problem due to unmanaged of the cattle dunk(El-Hadidi and A-Turki, 2007).

Based on these problems, we conducted a program to use cattle waste to make biogas. The purpose of program was to train members of the cattle farmer groups to convert their cattle waste into biogas. This program were consisted of two activities namely extention service and training. These activities were done as efforts to increase awareness of the cattle farmers in minimizing environmental pollution.

Materials and Methods

Based on the background and the problems above, extention service and training for groups of cattle farmers Semporongan and Pinotoroan have been conducted. Pinotoroan group consisted of 23 members while the Samperongan group have 20 members. In livestock development, especially beef cattle, extension service take an important role especially in strengthening of farmer groups and increase adoption of farm technology (Abdullah, 2008). Extension service that have been conducted in the rural Tempok were aimed at changing of the farmer behavior toward a better direction (Pambudy, 1999). Materials and media used were brochures and LCD projector. After the extension services, the farmers were trained in making biogas reactor and how to produce biogas. Materials and equipment used was waste of cattle, two old drum container, hoses, and gas stove. Extension service have been successfully carried out can be seen from the compactness of the group members in response to the manufacture of biogas. Technology adoption is measured from the biogas reactor has been successful in producing a flame.

Results and Discussion

The number of cattle owned by members of the Semporongan group was 55 and Pinatoroan group owned 64 cattle. The cattle were privately owned by the group. The cattle released waste daily. Unmanaged cattle waste produced methane (CH_4), which increased greenhouse gas emissions (GHG). Methane was a greenhouse gas that accumulates in the atmosphere due to human activities (Masse *et al*., 2003). Therefore, cattle farming have been blamed to cause global warming.

Livestock waste was a potential source of CH_4 emissions (Moss, 1993 in Masse *et al.*, 2003). Therefore, it should be converted into biogas. According to Yiridoe et al. (2009), production of biogas in general, was considered financially feasible if it was made from 50 cows or 200 sows.

In average, a family energy needs for cooking was 2000 liters per day. According Putro (2007), household cooking energy needs can be met from waste of 3 cattle. Therefore, biogas produced by the group was considered financially feasible (numbers of cattle owned by the group were more than 50 with average of cattle owned was 3).

Biogas technology has been introduced and developed quite a long time in Indonesia (Widodo *et al.*, 2009). Biogas technology can be applied to the scale of household, commercial or village (Eze, 2009). Bond and Templeton (2011) explained that the biogas contains 50-70% CH_4 and 30-50% CO_2. In nature, methane gas was always there, but there was a need for equipment and specific conditions to accelerate the formation of gas (Putro, 2007).

Biogas reactor was a device that can process waste into biogas. Each biogas reactor unit had been made from two drum container. The other two drums were used to build a gas reservoir. Cattle waste was mixed with water in the ratio 1: 1, stirred until dissolved and then inserted into the biogas reactor. Biogas reactor was made simply to be accessible to the farmers (Figure 1). Lo *et al*. (1984) noted that unwillingness of North American farmers to adopt the biogas technology were due to the high capital investment for construction of biogas. The earlier reactor had been made for converting pig waste (Adl *et al*, 2012).

A larger drum with a capacity of 200 liters were filled with water. The drum served as a control gas formation. Then a smaller drum with a capacity of 120 liters were then be put into the larger. The drum were fed with fresh cattle waste every day. The biogas process could reduce the ratio of carbon to nitrogen (C/N) 21.82 to 14.19 (Chen *et al*, 2010).

The biogas were resulted after 3-4 weeks of cattle waste convertion in the biogas reactor. Biogas was produced by bacteria that convert organic material in the absence of oxygen (anaerobic process) (Putro, 2007). This process took place during processing or fermentation. The resulted gas was consisted mainly out of CH_4 and CO_2. If the content of CH_4 gas was more than 50%, then the mixture was highly

flammable gas. The CH_4 gas content in the biogas produced from cattle waste in this training were about 60%.

Figure 1. Biogas Reactors using Drum (Oley *et al*., 2009)

The biogas reactor was connected to the reservoir gas, methane gas generated out through the hose to the gas reservoir. The resulting methane gas can come out through the hose from the gas reservoir to the gas stove. After 4 weeks, the gas can be heated up and used for cooking. Biogas production could partially replace fossil fuel energy so as to reduce the environmental impact. Biogas was cleaner fuels and renewable energy (Schievano et al, 2009). Furthermore, Barnhart (2012) said that household-scale biogas technology could be used for cooking as a substitute to firewood and improved human health and the environment.

Training of making biogas for cattle farmers in the village of Tempok very beneficial to the availability of fuel energy. As a result, household expenditures for kerosene, which was increasingly expensive and scarce, could be suppressed. In addition, this activity could be beneficial for reduction of environmental pollution. According to Simpson (1979), biogas production may also benefited from reduction of flies and mosquitoes reproduction cycle. While, Aklaku et al (2006) explained that the presence of biogas as an energy source would free the farmer from the dependence on wood fuel, reduced bad smell and the presence of animal pests such as flies. According Biyatmoko and Wijokongko (2011), an important benefit of biogas as a fuel alternative was because of it was cheap, the raw materials were easily available, and because it was environmentally friendly. Methane gas that will burn and destroy ozone could be optimally utilized as a source of fuel in rural communities.

According Amjid et al (2011), the opportunity cost of women increased in the presence of biogas and gave a positive impact on households. But its application as an alternative energy source was limited because of several problems including costly investment for development of each farmer. Widodo et al (2009) conducted a

study to develop a biogas reactor for scale of the group farmers. In this case the development of the village Tempok need government intervention. According Biyatmoko and Wijokongko (2011), there was an urgency for socialisation of biogas uses and improving public perceiving in biogas utilization. This condition, especially in rural communities, including improvement of capacity in technical and management digester care.

Conclusion

Application of science and technology can improve farmer knowledge and awareness of in minimizing environmental pollution. The availability of two units of biogas reactor in the Tempok Village produced gas that can be used as a fuel substitute for petroleum. Benefits derived from these activities were reduction of expenditures for kerosene, reducing the dependence on fuel wood, produced a better environment for the farmer by means of cleaner yard and less smell of cattle waste.

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