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Community Assistance in the Post-Pandemic Period through the Application of Appropriate Technology in an Effort to Realise Energy Independent Villages Based on Healthy Livestock

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ABSTRACT This community service aims to provide assistance to the people of Gonggang Village, Poncol District, Magetan Regency, during the post-pandemic period through the application of science and technology according to community needs in an effort to create an energy independent village based on healthy animal husbandry. The main problems faced by the people of Gonggang Village due to the duration of the Pandemic are economic downturn, low quality of public health, and unmonitored development of children under five. The community is required to have economic resilience in fulfilling their life needs to survive. The presence of academics in the community is carried out by applying Appropriate Technology, so that people have a quality, healthy and productive life. Community Assistance during the Post-Pandemic Period is carried out through the application of appropriate technology based on community needs, through the application of Appropriate Technology for Utilising Cow Manure into an energy source / Biogas. With the application of this appropriate technology, it is hoped that a healthy energy independent village based on healthy livestock can be achieved, because it has obtained an energy source to replace LPG. This community service is using methods: training, coaching, Focus Group Discussion (FGD), practicum, modelling and mentoring for 6 months. Strategies for achieving goals with: 1) classical material 2) field practice 3) follow-up implementation. Collaboration: this Community Service activity is a collaboration between 3 (three) Poltekkes, namely Poltekkes Semarang, Poltekkes Malang and Poltekkes Surabaya. The overall implementation time of the activity is 6 months. Outputs: 1) Publications; 2) publications through mass media; 3) Intellectual Property Rights.

INDEX TERMS Assistance, IPC; IPE; Tornakjagas.

I. INTRODUCTION

Gonggang Village is the southwesternmost village of Magetan Regency and East Java, bordering Wonogiri Regency in Central Java. It is located in the south side of the Lawu mountain range. Gonggang Village has an area of 10.87 km2, with a total of 1,171 households. Based on village data, the total population of Gonggang Village as of April 2021 is 4,118 people, consisting of a male population: 2,037 people, female population: 2.081. Gonggang Village has 6 hamlets, among others: Dk Gonggang, Dk Kopen, Dk Dagung, Dk Candi, Dk Templek, and Dk Biting. Gonggang village has 6 primary schools, consisting of 4 public primary schools and 2 madrasah ibtida'iyah. For advanced schools in Gonggang Village, there are 2 junior high schools, namely: MTs MMA Gonggang which is located in Dk Dagung, and MTs. Hasanuddin which is located in Biting Hamlet and 1 senior high school, namely MA Ma'arif in Dk Dagung. In addition to

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formal schools, Gonggang Village also has 1 Islamic Boarding School, namely Pesantren Umdatul Falah.

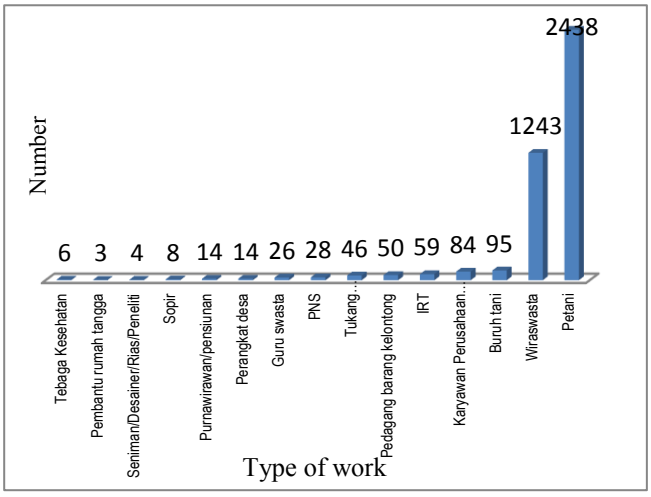

FIGURE 1. Data on the types of work of the people of Gonggang Village, Poncol District, Magetan Regency as of April 2021

The entire population of Gonggang Village is Muslim, with the following distribution of occupations (FIGURE 1). The 59% of population work as farmers, 30% work as self-employed, 0.23% as farm labourers, and the rest are civil servants, health workers, teachers, craftsmen, artists, etc. Gonggang Village is a fertile area where rice is the main crop. Some of the less irrigated land is moorland with cassava and vegetable crops. The results of the initial survey in Gonggang Village showed that 60% of the farmers and farm labourers' own livestock in the form of cows and goats. The average number of cattle is 2 per household, because it is very easy to get animal feed. The method developed is cow fattening. Farmers usually buy young cattle, raise them, and after 3-4 months sell them to the animal market in Gorang-gareng, Parang, Plaosan or Dagung Market. Farmers refer to their animals as raja-kaya, which in Javanese means wealth.

The group of breeders and farmers is called Gapoktan, and it exists in each hamlet. The problem faced by Gapoktan as a partner is manure disposal management. Farmers dispose of livestock manure by throwing it into the ditch around the house, or collecting it to be used as fertiliser. This results in natural pollution characterised by the abundance of flies and the pungent odour typical of cowsheds. Cow dung has not been utilised as a source of biogas energy. The presence of appropriate technology (TTG) is expected to process livestock manure into biogas energy (Hidayati & Suryadi, 2019). The Community Service Team has expertise in the technology of making biogas from livestock manure (TABLE 1).

Making biogas is easy and inexpensive. Biogas is derived from livestock manure, produced by an-aerobe microorganisms or fermentation of organic materials. As an illustration, each cow produces 2 kg of dung per day (Karno, Beny Suyanto, 2019). For one family, dung from 2 cattle (4 kg) is enough to meet the biogas needs of the family (Purwandari, 2018). Thus the family no longer needs to buy LPG as they are currently using. There are currently an estimated 2,400-2,500 cows in Gonggang Village. The manure produced is 5,000 kg/day. This amount is able to provide independent household energy for the residents of Gonggang Village. The remaining waste used by biogas is in the form of sludge (effluent), where the volume at the inlet and outlet is the same. Thus, it also has the potential to pollute the environment due to this biogas waste discharge. The presence of TTG (Appropriate Technology) is able to process the waste (effluent) of the remaining biogas into Liquid Organic Fertiliser (POC), which has economic value. The economic value of this organic liquid fertiliser per litre is Rp. 1,500 (Fahruddin & Sulfahri, 2019). Biogas waste takes about 6 months to be used as manure. It is hoped that waste generated from livestock activities can be minimised to "Zerro waste

TABLE 1.
Analysis of the Condition of Problems and Potential faced by Partners in the Community of Gonggang Village, Poncol Kec, Magetan Regency

No	Partner Name	Data	Partner Problem	Partner Potential
1.	Gapoktan	Management of cow dung processing is done conventionally. Livestock manure, especially cattle, is disposed of carelessly. Cow manure is not utilised, other than for conventional fertiliser.	Cow manure is disposed of carelessly. Partners are not aware of any technology in utilising cattle manure.	Livestock manure can be utilised for renewable energy. Sufficient energy/biogas demand from livestock manure. Opportunity to increase energy independence to replace LPG gas.
2.	Gapoktan	Disposal of liquid sludge remaining Biogas effluent has the potential to pollute the environment. The amount/volume of sludge before and after taking the Biogas energy is the same..	The amount of faecal sludge before and after taking biogas is the same. Partners do not know that biogas waste management can pollute the environment..	The sludge from the biogas effluent can be used for Liquid Organic Fertiliser (POC). The waste can be sold for economic value.

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FIGURE 2. University activities in applying appropriate technology for the community through youtube

FIGURE 4. Community service opening

FIGURE 3. Gonggang Village Office, Magetan District

FIGURE 5. Gonggang Village Head's support for Community Service activities through Youtube

activity" (Marlina, Zamzam, & Hidayati, 2019). This Community Service Team has experts in the field of making liquid organic fertiliser left over from biogas waste effluent (FIGURE 2, FIGURE 3, FIGURE 4, and FIGURE 5).

II.METHOD

This community service is using methods: training, Training of Trainers, Focus Group Discussion (FGD), practicum, model making and mentoring for 6 months. The strategy to achieve the objectives with: 1) classical material; 2) field practice; 3) follow-up implementation, with the aim of realising a Healthy Village and energy independence through the application of appropriate technology based on healthy livestock. This Community Service activity can take place well because of the collaboration between universities, by applying collaboration of various disciplines. Parties related to this activity include: 1) Magetan Regency Government; 2) Health Office of Magetan Regency; 3) Village Government; 4) Poncol Health Centre; 5) Healthy District Forum (FKS); 6) Farmer and Breeder Groups; 7) Posyandu cadres; 8) Teacher groups. The implementation time was 6 months. The resulting outputs are 1) Journal publication; 2) publication through mass media (TV); 3) application of appropriate technology IPR.

Achievements after the implementation of community service in 2022 include: 1) there is 1 (one) biogas installation model; 2) there is 1 (one) installation model for the use of biogas waste into POC (Liquid Organic Fertiliser); 3) there is a kiosk for selling liquid organic fertiliser; 4) there is a plant model that uses liquid organic fertiliser.

Through the presence of appropriate technology, which is in the field of expertise of higher education, it can create a healthy community towards energy independence, based on the potential resources owned by the community, through the Interprofessional Collaboration / Interprofessional Education approach. The benefits and urgency of this Community Service activity are that the community has economic resilience by having energy based on their resources, the community can take advantage of appropriate technology for agricultural fertiliser needs through self-produced liquid organic fertiliser. For institutions, there is an application of appropriate technology for the community, especially partners, so that the welfare of independent and healthy village communities is realised. Interprofessional Collaboration / Interprofessional Education between various professions of nurses, midwives, environmental sanitation techniques, biomedical and dental health. Collaboration between Poltekkes Kemenkes Surabaya, Semarang and Malang.

A. PATTERN OF SUPPORT.

In realising the economic independence and resilience of the Gonggang Village community, support has been sought from various parties (TABLE 1).

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TABLE 2. The FGD materials nalysis

No	Basic Material	Description
1.	Energy Independent Village concept and criteria	Related Stake Holder
2.	Potential, willingness and commitment of the Gonggang Village community	
3.	Team potential in training activities	
4.	Training participants	
5.	Training materials	
6.	Time of activity implementation Debriefing	
7.	Potential location of the practicum	
8.	Potential location of biogas installation construction.	

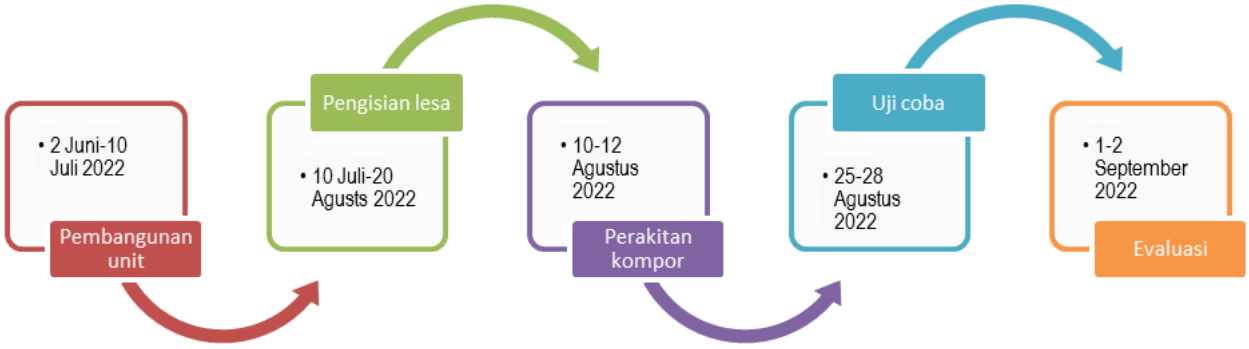

FIGURE 6. Activities of biogas plant construction

1. Regent of Magetan. The Regent of Magetan provides support for university activities in applying appropriate technology for the community (FIGURE 6).
2. The Healthy District Forum supports this community service activity. He is one of the environmental sanitation workers who received an award to the State Palace by President Joko Widodo in 2017 (FIGURE 2).
3. The Head of Gonggang Village, Poncol Kec, Magetan Regency, East Java, Agus Susanto, SE, fully supports the implementation of Community Service Year 2022.

III.IMPLEMENTATION

The stages of community assistance implementation are divided into 6 stages, as shown in the figure below. Figure 1: Stages of implementation of community assistance activities

A. PREPARATION STAGE

Prior to the implementation of the activity, FGDs with stakeholders and coordination meetings were held.

The FGD was held on Tuesday, 4 May 2022 at Balaidesa Gonggang. FGD participants were 12 people. Consisting of all elements of the community who participated in the activity. are as follows:

Technical preparation for training implementation includes

1. Coordinating with relevant partners, namely village officials, village midwives, farmer group associations, and village farmers.
2. Preparation of guidebooks and module materials for application activities on converting cow dung into bogas on a household scale.
3. Determining the class organisation (trainer, small committee, class management structure).
4. Developing training schedule and time load.
5. Communicate/coordinate with relevant parties from the Health Office, Community Health Centre and Village Government regarding the technical readiness of the workshop.
6. Designing methods and duplicating materials.

B. *IMPLEMENTATION OF CLASSICAL ACTIVITIES*

The core time in the implementation of activities for 1 day. The implementation of classical activities took place in the hall of the Gonggang Village Hall. Participants who attended

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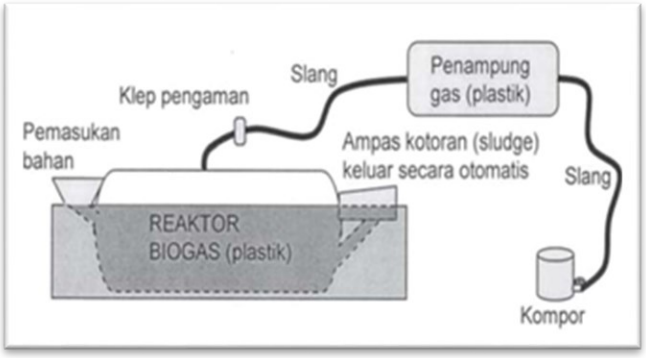

FIGURE 7. **Schematic of biogas plant construction in household scale**

FIGURE 8. **Biogas plant construction in household scale**

the implementation included: Posyandu Cadre administrators, Farmer Groups, Village Officials and Teacher Groups. The implementation of the classical activity began with the opening. Present to open the event was the head of Poncol sub-district. Invitations consisted of the Head of Puskesmas, District Health Office, Head of Puskesmas, representatives from Poltekkes Surabaya, Malang and Semarang, and all training participants. Classical activity material: practical material on converting cow dung into bogas on a household scale.

C. *PRACTICE*

The practical was carried out in 1 day, namely day 2. Activities in this practical are preparing tornakjagas needs, preparing locations for suitable installations, preparing tools, materials, fitters and workers. Practice is carried out in one of the places in Dusun. The construction of the biogas plant is divided into 3 stages, namely: construction of the installation unit; filling the biogas plant, assembling the stove components, testing. A schematic of the biogas plant construction process is shown in the FIGURE 7 and FIGURE 8.

D. EVALUATION

Evaluate success and follow-up. Identify difficulties faced by the community. The evaluation was conducted on 1-2 September 2022. The results of the evaluation showed that cow dung, even though it is only 1 cow, is proven to be able to produce biogas to meet family-scale needs. However, if the number of cows is more, it will produce even more biogas volume.

E. *FOLLOW-UP*

The follow-up of this training and mentoring is to convince the participants that cow dung can produce biogas. Thus, they can share this knowledge with other communities. The hope is that the community will have energy resilience through cow dung management. What is needed from the participants' participation is:

1. Commitment to realising an energy independent village
2. Willingness to leave a small portion of their land to make biogas installation
3. Requires a small amount of funding (around Rp 5,000,000) to build 1 installation unit in approximately 1 month.
4. Follow up to practice in their respective groups and households.

IV. DISCUSSION

Natural disasters have caused invaluable losses of property and even lives. Because it lasted for years, the community developed itself through various independent efforts of community members. The value of mutual cooperation and togetherness in the community is still very strong, providing lessons about social resilience which is the main strength to get out of the pandemic. The culture of mountain communities that are tenacious, hardworking, honest and sincere is still an asset that needs to be preserved.

Disasters can come from natural and non-natural sources, namely humans themselves. The definition of disaster is supported by the explanation of Indonesian Law No. 24 of 2007 concerning disaster management which states that a disaster is an event or series of events that threaten and disrupt people's lives and livelihoods caused by natural and/or non-natural factors and human factors resulting in human casualties, environmental damage, property losses, and psychological impacts (Sumasto and Surtinah 2018). Natural disasters are caused by natural activities that occur either naturally, according to cycles or due to human actions. Some natural disasters can be predicted or occur suddenly, such as landslides, flash landslides, hurricanes (Hery Sumasto et al. 2019). Non-natural disasters are caused by social, economic, disease outbreaks and differences in understanding between humans (Pituruh and Purworejo 2005), for example the outbreak of the bird flu virus, brawls between students, wars and so on (Devi Riskianingrum 2013; Khan et al. 2020). To deal with potential disasters, it is necessary to increase community resilience in disaster risk reduction.

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After approximately 2 years of being hit by the covid-19 pandemic, there are many impacts that can be learned. One of them is the need for a comprehensive rearrangement of energy security, economic security, social security and health security. This community assistance is carried out in an effort to create energy security which can have an impact on economic, social and health security. In rural areas, people have long carried out energy conversion from kerosene to LPG (Liquid Petrolium Gas) and blue gas (Blue gas) to meet household energy needs. The need for LPG from time to time continues to increase, with prices potentially continuing to increase. Energy security is carried out through the management of cow dung into biogas that can meet household needs. This is needed as a new breakthrough in the use of alternative fuels and biogas is one of the future alternative fuel choices for Indonesian people who mostly live in rural areas.

It is expected that the community can be independent of household energy by making biogas with raw materials in the form of livestock manure including cows in the form of LESA or Letong Sapi. This is very important as part of resilience and preparedness for natural and non-natural disasters. This assistance is carried out by applying several research instruments, including: disaster risk instruments for toddlers, Vulnerability and Capacity as Determinants of Disaster Risk Mapping in Families Experiencing Maternal and Child Health Problems (Hery Sumasto, Surtinah 2017). Also carried out the application of instruments in the research Development of Instruments to Detect Disaster Risk in Children Under Five (Hery Sumasto, Nurwening Tyas Wisnu 2018). The application of the results of the research Development of instruments to measure disaster preparedness in the Poltekkes (Hery Sumasto, Sulikah 2019). Trauma healing during the earthquake disaster emergency response phase in Lombok, Indonesia. This research has been published through the reputable international journal Scopus (DOI: 10.5958/0973-9130.2019.00562.0; Online ISSN: 0973-9130; Year: 2019; Vol: 13; Issue: 4; Page: 1745-1748) (Hery Sumasto et al. 2019).

The use of biogas in Indonesia at that time was not yet widespread enough. This is partly because at that time the price of fuel was still relatively cheap, especially subsidised kerosene, and coincidentally Indonesia was still a member of an oil exporting country (OPEC). However, currently Indonesia is no longer an oil exporting country and subsequently the fuel subsidy is gradually eliminated by the government. Therefore, biogas as a future alternative energy should be developed now, especially in agricultural and livestock centres. Livestock waste (manure) has become one of the contributors to Greenhouse Gases (GHG) and as a factor that accelerates the rate of environmental degradation. Processing livestock waste into "environmentally friendly" materials means ensuring the sustainability of the livestock sector in the future.

Rural households as the basis of the agricultural sector, including livestock, also have a high level of energy consumption (oil and gas) and electricity. In other terms, the current dependence of households on gas energy (LPG = Liquid Petrolium Gas) is obtained from sources outside the region, causing welfare vulnerability when there is national energy price volatility, while in the village the raw materials for biogas are actually available.

The technology of making biogas through the application of rural appropriate technology from livestock waste raw materials is currently easy to implement at a relatively low cost. With the application of appropriate technology, Indonesian farmers and breeders are able to produce energy and liquid organic fertiliser (POC) independently while providing themselves to become pioneers of sustainable environmentally friendly organic agriculture. With the magnitude of the benefits that can be taken from livestock waste, it is appropriate that from now on the breeder and farmer community can be ATM (Adoption, Imitation and Modification) and apply biogas production technology that is easy and cheap and environmentally friendly.

Factors that support the successful utilisation of cow dung energy into biogas include: 1). Support from the Directorate of Labour of the Ministry of Health of the Republic of Indonesia, which provided funding for this activity; 2). Commitment from the community, village officials and all parties involved in this activity; 3) Support from school principals in the village, so that eventually the school became a model school, which has a small dentist through school dental health efforts; 4). The synergy with the activities of the police, village, health centre and health department; 5). There is a need for people who need alternative energy in realising an energy independent village. The potential for biogas development in Indonesia is quite large in an effort to meet household energy needs. This is due to the large population of livestock such as cattle = 11 million heads, buffaloes = 3 million ecots and horses as many as 500,000 heads. Each cow or buffalo can produce 10 kg/dung or Letong which is equivalent to + 2 M^3 of biogas per cycle (20-21 days).

In terms of economic calculation, every 1 M^3 of biogas can be equivalent to 0.62 litres of kerosene. In addition, biogas waste in the form of mud from the effluent or biogas digester outlet in the form of liquid is a Liquid Organic Fertiliser (POC) which is very rich in elements needed by plants. The sludge from the outlet as biogas waste can then be converted into granules by drying and this of course also has an economic value that is not small when sold as Granulated Organic Fertiliser (POG).

The development of biogas energy from livestock waste including LESA (letong sapi) can provide benefits, among others:

1. The community can be independent in providing their household energy needs.
2. Save on household financial expenditure in terms of purchasing or supplying energy, be it petrol, gas or LPG.

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3. Saving the country's economy because there is a reduction in subsidies for fuel.
4. Livestock sector activities become environmentally friendly, where methane gas or biogas produced from this sector is one of the contributors to greenhouse gases if not utilised as an energy source. Thus, pollution or pollution of air, water and soil is reduced.
5. Savings in the agricultural sector by reducing fertiliser expenditure, because the outlet from the digester can be used for fertiliser in both liquid and granule form.
6. Forest encroachment for pople around the forest to look for firewood is reduced.
7. Livestock population is maintained and can even increase. The availability of organic fertiliser (Liquid) produced from biogas waste also supports organic farming which produces healthy organic agricultural products.

IV. CONCLUSION

Community assistance in the post-pandemic period is carried out in realising healthy energy-independent villages through healthy livestock. This is done by applying the right technology to utilise cow dung as a source of energy/biogas. The community gets an alternative energy source for LPG from the processing of cow dung. The method of activity is carried out by: training, Focus Group Discussion (FGD), practicum, model making and mentoring for 6 months.

Strategy for achieving goals by: 1) classical material; 2) field practice; 3) follow-up implementation. So that community service activities can be carried out properly and comprehensively, it requires collaboration between universities and between disciplines. The achievement target of this community service is to assist the community in developing potential alternative energy sources in the form of biogas from cow dung, in realising energy security which has an impact on economic resilience. The appropriate technology applied is really needed by the community, after the covid 19 pandemic. In addition to producing biogas as a substitute for LPG, the application of this technology can also reduce water and soil pollution, because so far the disposal of cow dung is not carried out properly. Besides being used to get biogas, the liquid effluent can be used for organic liquid fertiliser. This will increase the economic resilience of the community.

The total time for the implementation of the activity is 6 months. Outputs: 1) Publication; 2) publication through mass media; 3) Intellectual Property Rights.

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