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Analysis of the Potential of Alternative Electrical Energy: Biogas Source of Livestock Waste in Jeneponto

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Abstract: Livestock wastes such as fesses, urine, feed residues can produce biogas. In the villages of Bontomanai and Kalimporo, Bangkala sub-district is the two villages with the largest livestock population in Jeneponto Regency, South Sulawesi. The problem is 89% of Bontomanai and Kalimporo villagers have not been able to utilize livestock waste into biogas power source. This research aims to analyze livestock waste as a source of biogas power plant in Jeneponto Regency. The population of livestock are cows, buffaloes, goats, horses. Using descriptive method, data collection techniques were conducted by looking at the spaciousness, through direct interviews with villagers Bontomanai and Kalimporo. The results showed the average production of dung cow 294 kg/day, horse 464 kg/day, buffalo 210 kg/day and goats 88 kg/day. Through, the anaerobic fermentation process, biogas production of 238.16 mVday, livestock waste can be a source of electricity 46,6397 kWh every day.

Key words: Livestock waste, biogas, energy alternative, electricity source, process, production

INTRODUCTION

Energy and its utilization constitute the transforming agent which has taken humanity its primitive state to the present level of civilization. The role and impact of energy in nations development can not be emphasized because of it is an indispensable commodity for national growth. Given this, most residential and industrial consumers of electricity have adopted the use of generator sets as an alternative source of the power supply (Ilin *et al.*, 2016). However, in the recent times, there has been a considerable surge of interest and activity worldwide in searching for more efficient ways of using existing energy sources that are naturally available including solar, tidal and wind, even biogas derived from animal faeces (Megbowon and Popoola, 2007).

Indonesia has several potential sources of energy, consisting of two types, conventional energy sources such as coal, petroleum, natural gas. Non-conventional energy sources such as solar cells, thermoelectric generators, solar power plants, wind power, tidal and other electricity. An alternative energy development program from biogas provides substantial benefits to households and creating new jobs for the community.

Residues and cow dung contain significant amounts of volatile organic material that can be converted into biogas. Biogas contains the primary ingredient CK, which can be used as fuel for power generation because it has a considerable heat value of 23,880 Btu/lbm (Simamora *et al.*, 2006). Through a device that can generate electrical voltage by converting biogas energy into electrical energy.

Utilization of biogas has several advantages when compared with fuel (fuel oil). Among them, biogas has environmentally friendly properties and can be updated. Most of the energy consumption comes from power generation, transportation, industry and community sectors.

Biogas system can be interpreted as a biomass conversion process that contains volatile organic materials into biogas in an environment that lack of oxygen through anaerobic bacteria. Biomass is the mass of plant and animal waste that has the potential to become an alternative source of biogas energy, either by being burned directly or after being converted into other materials.

The process of fermentation of organic material without involving oxygen called anaerobic digestion gas is produced in part (over 50%) in the form of methane (CH_4) and carbon dioxide gas ($C0_2$). The anaerobic fermentation process of organic materials such as manure, man and plant waste, in a digestive room (digester).

The above statement is similar with biogas consists of methane (50-70%) and carbon dioxide (25-45%), a ratio of about 3:2. Methane is the critical component because it is a highly flammable gas that can be used as fuel for cooking, lighting, water heaters and if the sulphur is removed, it can be used to run biogas powered generators to produce electricity.

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Through the process of production of biogas than produced the process of solving waste materials that involve anaerobic conditions in a digester. Research results of Harilal states that biogas is an alternative conventional energy product produced from various organic wastes (Sorathia *etal.,* 2012).

The problem is that 89% of Bontomanai and Kalimporo villagers have not used livestock waste to be used as a source of electrical energy. Only 11 % use cattle manure as biogas cooking stove. The rest is discarded because it does not know the potential of biogas that can meet the needs of electrical energy. Referring to the estimated potential livestock waste in Jeneponto Regency, it is necessary to analyze the potential of livestock manure which can be used as a source of biogas energy into electricity.

MATERIALS AND METHODS

This research is a qualitative descriptive research, to analyze the potential of livestock waste into biogas energy source. The raw material of farmers in Bontomanai and Kalimporo Village, Jeneponto Regency, South Sulawesi is a village with some livestock that is potentially a source of biogas energy.

The description of farmer's potential in Jeneponto is presented in Table 1 according to the development of livestock population by species over the last 5 years (2011-2015), amounting to 269,202 livestock.

In general, the number of livestock population in Jeneponto Regency in 2015 is 269,203 tails divided into several typos of animals which is 29,925 of horses; 3,759 of cows, 79,101 of buffalo and 156,417 of goats.

The technique of data collecting done by observation, documentation and direct interview to the citizen. The population in this study are horse, cow, buffalo and goat in Bontomanai and Kalimporo villages, Bangkala subdistrict, Jeneponto Regency.

The potential of livestock waste to become one of the raw materials of biogas production can be found in farming areas. Especially, large-scale farms that produce large amounts of waste and routine.

Thus, the accurate data available in the two villages of Bontomanai and Kalimporo are potential breeders of individuals and grouprs that have livestock, seen in Table 2 and 3. Some animals owned by individual breeders, 17 horses; 25 cows, 10 buffalo; 19 goats.

Table 1: Livestock population of jeneponto regency year 2011-2015

	Years				
Type livestock	2011	2012	2013	2014	2015
Horecs	24.3240	29.320	20.743	27.8170	29.925
Cows	3.3320	3.549	3.287	3.6020	3.759
Buffalo	38.6480	57.733	61.816	720730	79.101
Goats	95.2660	128.658	137.441	155.2970	156.417

Central Bureau of Statistics Jeneponto Regency

RESULTS AND DISCUSSION

The data in Table 2 and 3 are rosed as reference to calculate the potential of livestock waste, i.e., fesses and urine measured through the scales, hence, data of horses typoe is about 7 kg/day, cow 8 kg/day, buffalo 7 kg/day and the goat is 2 kg/day. Based on the number and typoes of animals owned by individual breeders and group farmers, the production of livestock waste p»er day can be calculated using the equation (Fitradiansyah, 2009):

PK = PTxA

OJ

Where
PK = Dirt production (kg/day)
PT = Livestock population A =
Average impurities (kg/day)

Based on the results of the count of the potential of livestock manure every day can be known livestock manure products for each rancher in Table 4 and group breeders in Table 5.

Based on the production of animal waste produced by the percentage of dry matter (BK), the biogas potential can be calculated based on the weight of the animal.

Table 2: Total livestock individual scale

Type livestock	Village bontomanai	Kalimporo
Horees	9	8
Cows	10	15
Buffalo	6	4
Goats	13	6

Table 3: Total livestock scale goup

	Villages		
Type livestock	Bontomanai	Kalimporo	Total
Horees	9	16	25
Cows	10	23	33
Buffalo	8	12	20
Goats	13	12	25

Table 4: Livestock poultry production

	Livestock population (PT)		A = Average inpurities (kg/day)	Dirt production (kg/day)
Type livestock	Individual	Groups		
Horses	17	25	7	294
Cows	25	33	8	464
Buffalo	10	20	7	210
Goats	19	25	2	88

Table 5: Biogas potential from livestock production

Type livestock	Gynecology BK *(%)*	Dirt production (kg/day)	Potential biogas
Goats	20	294	58.80
Horecs	26	464	120.61
Cows	20	210	4200
Buffalo	19	88	16.72

Total Bg = 238.16

Biogas production result is 238.16 tnVday in Bontomanai and Kalimporo villages winch is a general portrait of Bangkala subdistrict in Jeneponto which is very potential to be utilized as an electric energy generator. Production of methane (CH«) and Carbon dioxide ($C0_2$) gas can be estimated by calculating using Eq. 2 (Fitradiansyah, 2009). The potential of methane gas (KM), multiplied by methane, then:

KM = Bgx% methane levels = 238.16x50 = 119.08 mVday **[2]**

Furthermore for the potential of calculated electrical energy, referring to the theory for the use of 1 m^3, biogas can generate 4.7 kWh of electrical energy. So, the potential of electric power produced from livestock waste is:

- 238.16x4.7 = 1,119.352 kWh/day
- Daya =1.119.352/24 = 46.6397 kW

This means that the capacity of 1.119.352 kWh/day, biogas from livestock wastes in two villages Bontomanai and Kalimporo, able to provide the electric power of 46.6397 kWh every day that can be used as a source of household renewable energy.

Some research results based on the theory that Biogas is the product of a process called anaerobic digestion. Biogas contains about 50-60% methane (CH_4) and 30-40% Carbon dioxide ($C0_2$), 5-10% hydrogen, 1 -2% nitrogen and 0.3% water vapor. The resulting methane can contribute to the generation of electrical energy (Ahmmad and Haque, 2014).

Based on the potential density of population growth in the number of livestock available in Table 1, Jeneponto Regency in South Sulawesi has the potential to develop alternative generators that are cheap and environmentally friendly. One of the major advantages of biogas is the possibility of waste reduction. The production of biogas by anaerobic is viral in reducing waste.

Because this population density is closely related to the potential for biogas development. The more dense population of livestock, the potential for better-developed biogas.

Table 1 shows the total population of livestock in Jeneponto Regency until 2015 is 269,202 tail which consists of cattle animal 29.925 tail, buffalo 3,759 tail, horse 79,101 tail and goats 156,417 tail. If in Jeneponto Regency, the potential of livestock waste is assumed to produce a total production of faeces processed through biogas fermentation, then from 269,202 livestock can produce biogas produced and used as a source of electrical energy.

So, for one district has the potential to save the use of electric power can replace the use of diesel oil is quite expensive. According to economists and energy developers, there is a direct connection between energy use, economic growth and living standards.

Therefore, an analysis of the development of alternative energy sources is very important, to build an alternative power plant in South Sulawesi which has the considerable potential of raw materials of waste, the source of biogas in die future.

CONCLUSION

Referring to the calculation result of biogas potential to produce electricity 46, 46,6397 kWh every day in two villages of Bontomanai and Kalimporo, shows the potential of livestock waste in Jeneponto Regency can be developed become an alternative power source. Biogas is the product of a process called anaerobic digestion. Biogas contains about 50-60% methane (CH_4) and 30-40% carbon dioxide (CO_2), 5-10% hydrogen, 1 -2% nitrogen and 0.3% water vapor. The resulting methane can contribute to the generation of electrical eneigy.

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