CURRENT STATUS OF ANIMAL WASTE BASED BIOGAS PLANTS IN MALAYSIA

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ABSTRACT. Biogas plant is an anaerobic digester that produces biogas from organic materials. The general purpose of implementing biogas plant in an animal farm is to obtain biogas from animal manure and the effluent of biogas digester after fermentation process can be used as organic fertiliser. There are 15 biogas plants based on livestock waste that have been developed throughout Malaysia until 2018. Two more biogas plants are planned to be built in Segamat and Keningau. All biogas plants built were originally aimed for domestic use which is as source of energy used for cooking and incinerator as well as to generate electricity for farm use. Out of 15 biogas plants, 7 plants were built on cattle farms, 4 plants on pig farms, 3 plants on poultry farms and only 1 plant on buffalo farm. Total construction cost for each biogas plant is between MYR4,500 to MYR30 million. Based on the survey conducted, it revealed that only 40% of the plants are still functional. However, 60% were dormant or nonfunctional due to poor maintenance, design errors, lack of technical knowledge to run the system consistently, improper planning and monitoring or insufficient livestock waste to continuously producing biogas.

Keywords: biogas, biogas plant, animal waste, environmental pollution

INTRODUCTION

In Malaysia, the livestock sector's growth and trends to sustain the self-sufficient level (SSL) by adopting intensive or confinement operation system has increased the livestock waste, resulting in environmental problems. Livestock waste is one of the significant source of water and air pollution. As such, waste management at farm level has been an issue of increasing concern. Therefore, there are various technologies and methods proposed by the Department of Veterinary Service (DVS) in order to mitigate environmental pollution attributed to livestock waste such as waste treatment pond, composting, biogas system, bio-reactor and bio-filter. However, biogas plant is the only waste management system that can minimise environmental problems, at the same time give profits to farmers (Kurt *et al.*, 2012). Biogas is a source of sustainable energy that has high potential to replace non-renewable energy sources such as coal, oil and natural gas as energy sources for cooking or generating electricity. The general purpose of implementing biogas plant in an animal farm is to obtain biogas from animal manure and the effluent of biogas digester after fermentation process can be used as organic fertiliser for agriculture use. In the meantime, biogas

system helps to minimise environmental pollution and greenhouse gas emissions as methane is 30 times more harmful than carbon dioxide (Princeton University, 2014). Methane is the major compound in biogas which enable to trap heat in the atmosphere that can cause climate change (Nurul Aini *et al.*, 2012). In the past few years, DVS has emphasised the application of intensive farming system especially for pig and poultry farms. Therefore, the opportunity to develop a biogas plant in an animal farm is getting brighter. However, the spread of biogas technology has remained extremely low in Malaysia despite several promotions to encourage farmers to implement the system. Thus, the project has been proposed to evaluate all biogas plants based on livestock waste in Malaysia. This paper will give an overview of the current status of biogas plants until 2018.

MATERIALS AND METHOD

For the purpose of this study, the list of livestock waste biogas plants was obtained from the State Department of Veterinary Services. The primary data was collected through survey method in which a structured questionnaire form was distributed to the owners of biogas plants from April to July 2018. The questionnaire included 34 questions which contained information of farmers and farm's background as well as biogas plants background. Fourteen respondents were involved in this study and the respondents have been interviewed during technical visits in order to get additional information related to the biogas plants. Table 1 show 5 out of 34 important variables used in this study.

RESULTS AND DISCUSSION

Based on the current survey conducted by the DVS, fifteen biogas plants from livestock waste were developed throughout Malaysia as at 2018 and the location of the biogas plants are as shown in Figure 1. Two more biogas plants have been planned to be built in Segamat and Keningau based on pig and dairy cattle manure respectively. All biogas plants built were originally aimed for domestic use, that is, as energy sources for cooking and incineration, as well as to generate electricity for farm use. Out of fifteen biogas plants, seven plants were built on cattle farms, four on pig farms, three on poultry farms and only one on a buffalo farm as shown in Figure 2. It was found that only 40% of the biogas plants were still functional. 60% were dormant or nonfunctional due to many factors such as poor maintenance, construction and design errors, weak technical support and lack of technical knowledge to run the system consistently, improper planning and monitoring as well as insufficient livestock waste to continuously produce biogas. The capacity of biogas plants can be divided into three categories: small-scale (<1,000 m^3), medium-scale (1,000 m^3 to 10,000 m^3) and large-scale (>10,000 m^3) as shown in Table 2. 56% were small-scale biogas plant, 11% were medium-scale and 33% large-scale biogas plant. Various materials could be used in the construction of the biogas digesters and Table 3 shows the type of biogas digester according to livestock commodities. Most of

Table 1. Overview of variables in the questionnaires.

Variable	Type of the Question	Value	Unit
Biogas plant location	Open-ended question	-	-
Status of biogas plants	Close-ended question	-	-
Capacity of the digester	Open-ended question	No.	m^3
Type of biogas digester	Open-ended question	-	-
Installation cost	Open-ended question	No.	MYR
Type of farm	Open-ended question	-	-

Table 2. Capacity of biogas plant according to livestock commodities.

		DIGESTER CAPACITY (m^3)		
<1000		1,000-10,000	>10,000	
TYPE OF FARM	Cattle	7	0	0
	Pig	1	0	3
	Poultry	0	1	2
	Buffalo	1	0	0
Percentage		56%	11%	33%

Table 3. Type of biogas digester according to livestock commodities.

		TYPE OF BIOGAS DIGESTER				
Concrete		Brick	Fiberglass	Stainless Steel	HDPE	
TYPE OF FARM	Cattle	2	1	3	1	0
	Pig	2	0	0	1	1
	Poultry	2	0	1	0	0
	Buffalo	0	0	1	0	0
Total		6	1	5	2	1

Table 4. Construction cost of biogas plants according to type of biogas digester.

		TYPE OF BIOGAS DIGESTER					
Concrete		Brick	Fiberglass	Stainless Steel	HDPE		Total
COST (MYR)	<50,000	0	1	4	0	0	5
	50,000-100,000	2	0	0	0	0	2
	100,001-500,000	0	0	0	1	0	1
	>500,000	4	0	1	1	1	7
							15

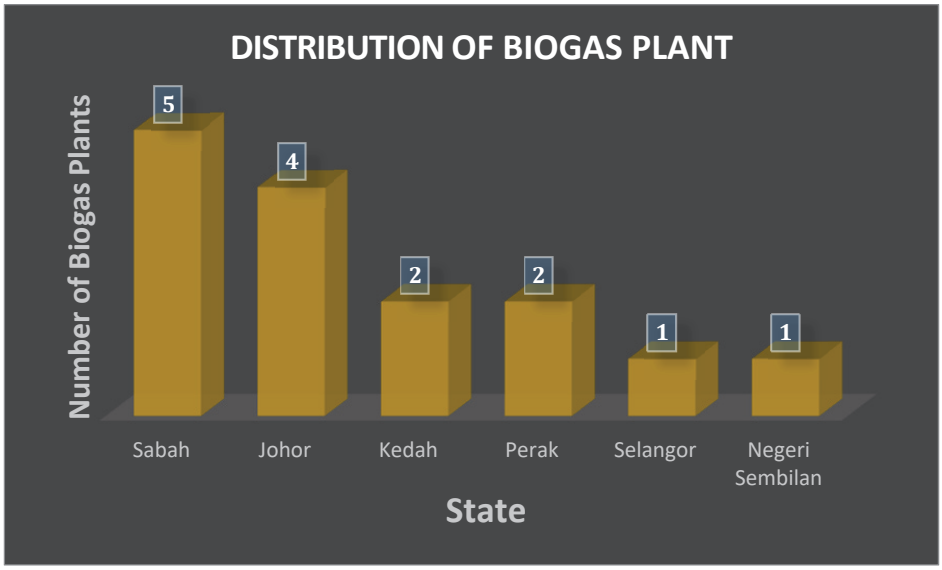

Figure 1. Distribution of biogas plant by state.

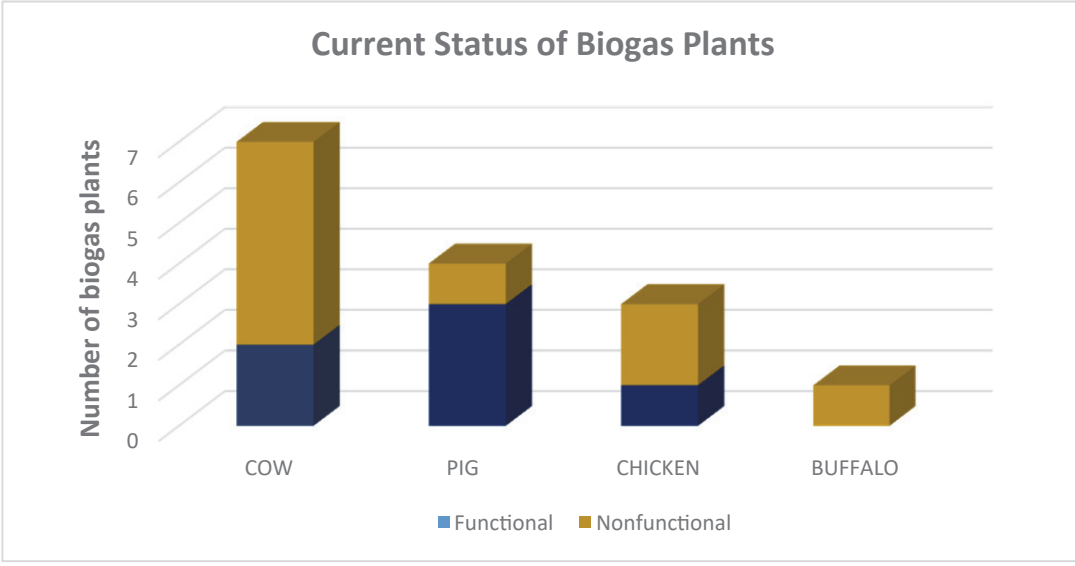

Figure 2. Current status of biogas plants.

the farm operators chose concrete digester followed by fiberglass, stainless steel, brick and high-density polyethylene (HDPE). Total construction cost for each biogas plant is between MYR4,500 to MYR30 million. The construction cost according to type of biogas digester is shown in Table 4. Based on the data obtained, seven biogas plants recorded construction costs above MYR500,000, five biogas plants cost below MYR50,000 and three biogas plants were built in the range between MYR50,000 to MYR500,000.

CONCLUSION

The Department of Veterinary Services Malaysia had conducted various seminars and campaigns to promote as well as to disseminate biogas technology to local small and medium as well as large scale farmers. However, the adoption of the technology has remained extremely low. A concerted effort must be taken in order to approach farmers to develop biogas technology in Malaysia as this waste management technology can reduce environmental pollution and increase farm profits. Further studies on the pre-feasibility and viability of biogas plant for treatment of livestock waste in Malaysia is being conducted by DVS in order to convince farmers to implement the biogas system. The government involvement is important as support networks, especially in providing incentive to all farmers such as proposing the distribution of subsidy to all farmers that build biogas plants in the future, hence, helping to preserve and save the environment.

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