JOURNAL OF APPLIED SCIENCES RESEARCH

ISSN: 1819-544X
EISSN: 1816-157X
2017 April; 13(4): pages 12-17

Published BY **AENSI Publication**
http://www.aensiweb.com/JASR
Open Access Journal

The Effect Of Renewable Energy Source Utilization On The Community Economy In Balong Wetan Umbulharjo Cangkringan Sleman Yogyakarta

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Received 18 February 2017; Accepted 22 April 2017; Available online 26 AApril 2017

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ABSTRACT

Background: Manure often results in problems in the society. This waste, in addition to having odor, also results in disease. However, if this waste is managed well and correctly, many benefits will be obtained. **Objective:** This research aimed to study the economic benefit of cow manure utilization as a renewable energy source. **Result:** The people of Balong Wetan were generally farmers and cow breeder. This condition was really suitable because they live in the mountain slope. However, they had not utilized their cow manure waste. They disposed cow manure around their stall. Consequently, less good smell resulted. This condition made Widodo aware of beginning to construct digester and biogas reactor to utilize the cow manure waste. According to Widodo, if this manure problem was not coped with, it would have resulted in disease. Widodo's attempt, in fact, yielded positive result. Cow manure waste could be converted into biogas that could be used as energy source. In addition, cow manure waste that had been degassed could be used as organic fertilizer with quality equal to the chemical fertilizer's quality. Moreover, the always-cleaned cow stall could produce quality cow milk. This Widodo's success could open Balong Wetan people's insight. Balong Wetan people gradually began to imitate constructing digester and biogas reactor surrounding their house. This digester and biogas reactor construction was helped by local government recalling that Balong Wetan people were largely at low economic level. **Conclusion:** Cow manure waste utilized as energy source affected positively the people's economy. People could produce their own biogas that could be used as fuel in their household and could produce organic production from cow manure waste. Thus, people no longer needed to buy fuel or fertilizer, so that the money usually spent on those needs could be saved or spent on other needs. Another economic effect was that people could sell cow milk at higher price because the quality was better due to the daily cleaned stall. In addition, the people's creativity emerged to open business by processing the cow manure waste.

KEYWORDS: Cow Manure Waste, Renewable Energy Source, and Community Economy Improvement.

INTRODUCTION

The utilization of manure as energy source begins to increase in Indonesia. It indicates that the society's awareness increases of the limited and reduced volume of fossil energy [1]. Meanwhile, the potential renewable energy source is found very easily and abundant, for example, manure. The livestock breeding existing in

Indonesia is distributed throughout all areas, but its manure has not been utilized maximally yet. This waste, if not utilized well, will of course result in environment pollution and global warming [2]. Because livestock manure contains methane resulting in heating effect [3]. Otherwise, when this waste is utilized as energy source, in addition to maintaining environment, it can also improve economic income.

According to Zalizar, unprocessed manure waste can result in various diseases, because it contains dangerous microbes such as *Escherichia Coli* or called *E. Coli* bacteria [4]. It is confirmed by Harlia and Suryanto finding the content of *E.Coli* bacteria in cattle manure [5]. It means that cattle manure is dangerous when it is used directly to fertilize the plant, particularly vegetable plant. Because *E. coli* bacteria can enter into vegetable plant and then consumed by human being. Otherwise, if this cattle manure is processed, for example using digester, the bacteria existing in the manure will be destroyed and the odor pollution will decrease, so that *slurry* (waste released from digester) is safe to be used to fertilize plant. In addition, the gas contained in cattle manure will be separated and the gas can be used as the energy source useful to human life.

The community having utilized cattle manure waste to be energy source, among others, is that of Balong Wetan Umbulharjo Cangkringan Sleman Yogyakarta. This community utilizes cow manure waste meet the need for electricity and fuel energy through digester technology. Balong Wetan people, on average, are farmers and cow breeders. This fertile land under Mount Merapi's slope is very suitable to raise cow. It is reasonable that one household has up to five cows. They are coordinated tidily in a cow breeder group named Ngudi Makmur, with 60 households as its members.

The awareness growing among Balong Wetan people of utilizing manure to be energy source is affected by such factors as: raw material obtained easily, reducing livestock waste, environment-friendly production process, low production cost, and economic profitability. In addition, the community is no longer dependent on the fluctuating-costing fossil energy provided by the government, like gas provided by Pertamina.

Departing from this background, the author is interested in studying more deeply the utilization of cow manure waste as the alternative renewable energy source in Balong Wetan Umbulharjo Cangkringan Sleman Yogyakarta. This research focuses on the process of building the community's awareness of utilizing cow manure and its effect on community economy.

Method:

This study employed qualitative approach. It is because, firstly, this approach becomes the more rooting source of description and explanation. Secondly, it can build closer relationship between author and informants becoming the target of research. Thirdly, it gives the author the opportunity of revealing the chronology of social events, assessing, and explaining the causal relationship occurring in local events. Fourthly, it facilitates the author in answering the questions posed [6].

The subject of research included cow breeders affiliated with Ngudi Makmur group, Balong Wetan Umbulharjo people, and Water, Energy, and Mineral Resource Service. The sample was taken using purposive sampling technique with criterion and snowball sampling. The data was collected using observation, interview and documentation techniques. Data validation was carried out using triangulation, and data analysis using Miles and Huberman's interactive model of analysis [7].

Result:

1. *The utilization of Renewable Energy Resource: from individuals to Groups:*

The abundant volume of cow manure in Balong Wetan is a problem that should be solved by the community itself. As it is not dealt with well, it will result in air pollution and some diseases. This fact makes Widodo, one of Balong Wetan people, aware of constructing digester and biogas reactor personally in his house. He learnt to develop digester and biogas reactor from other village. The construction runs smoothly. The digester and biogas reactor constructed can be utilized maximally and can reduce the cow manure waste existing in his house.

Widodo's successful work spreads to all classes of Balong Wetan people. Some people begin to be motivated to imitate him by constructing digester and biogas reactor. Recalling that the cost needed is substantial and the economic condition of community, on average, is poor, they agree to ask the government for grant. On the other hand, Sleman Regency government has released energy-independent village program for the villages with renewable energy source potency. The community's wish is likely in line with the government's expectation. For that reason, the community coordinated by Ngudi Makmur group applies for the construction of digester and biogas to the government via Water, Energy, and Mineral Resource Service to process the cow manure into gas energy.

Water, Energy, and Mineral Resource Service followed up Balong Wetan people's application by conducting field survey related to digester and gas reactor construction plan to develop an energy-independent village. After the preconditions have been met and Water, Energy, and Mineral Resource Service approved it, the cow breeders affiliated with Ngudi Makmur group were offered with digester and biogas reactor construction. In initial stage, only ten (10) households were available. After the construction of digester and

biogas reactor for these 10 families has been successful, the group applied again for the construction of more digesters and biogas reactor for other cow breeders to Water, Energy, and Mineral Resource Service. In the second stage, Water, Energy, and Mineral Resource Service constructed digester and biogas reactor for fifty (50) households. It is as suggested Widodo below:

"Awalnya, saya prihatin dengan banyaknya limbah kotoran sapi yang terbuang. Kalau dibiarkan pasti jadi masalah. Karena, di samping bau juga banyak lalat. Lalu saya mencoba membuat digester dan reaktor biogas. Belajar dari desa lain. Setelah berhasil, orang-orang banyak yang tanya dan mau meniru. Tapi kendalanya pada biaya. Setelah diskusi kita sepakat minta bantuan pemerintah. Ternyata disetujui. Lalu disurvey oleh dinas SDAEM. Pertama, kita dibuatkan digester dan reaktor biogas untuk 10 orang yang bersedia. Terus kita mengajukan proposal kembali untuk 50 orang yang belum kebagian". (Originally, I was very apprehensive with a large amount of cow manure waste disposed. If it was not dealt with, it would be a problem, because in addition to be odorous, it contains many fliers. Then I try to construct digester and biogas reactor, by learning from other village. Having been successful, many people asked about it and imitated it. But the constraint lies on its cost. Having conducted discussion, we agreed to ask the government for help. And in fact, the government approved it. Then Water, Energy, and Mineral Resource Service conducted a survey. Firstly, the government constructed digester and biogas reactor for 10 persons. Next, we proposed for 50 persons).

The process of constructing digester and biogas reactor is conducted together by community and government. The community contributed to construction work (mutual cooperation), while government contributed to construction cost. This system, according to Purwoko, is consistent with the government's policy in developing an energy-independent village. Furthermore, Purwoko explained that in developing an energy-independent village, there are three (3) systems conducted: firstly, completely funding by the service, meaning that 100% of funding is provided by the service, the community is required to participate only in the implementation. Secondly, it is balanced funding system: 50% government and 50% community. Thirdly, 100% of funding derives from the community, while the service gives technical guide only. In the construction of digester and biogas reactor in Balong Wetan, the government applied the first system, completely funding from the government, in both first and second stages.

The successful construction of digester and biogas reactor in Balong Wetan in fact affected the surrounding people. Nowadays, many people surrounding Balong Wetan try to imitate constructing digester and biogas reactor to deal with the problem of cow manure waste they have. It occurs because they know and see directly the benefit of such expedient technology.

2. The economic effect of Renewable Energy Source Utilization:

The utilization of cow manure waste processed into energy source affects the Balong community's economy. Balong community can use energy source and waste residue to:

a. Cook and illuminate environment:

The cow manure waste put into digester changes into biogas. This biogas is used to cook and to illuminate environment. Biogas resulting from cow manure does not affect the quality of cooking. It means that the meal cooked using cow manure fuel is not dangerous or safe to consume, because the gas released by biogas reactor is the neutralized vapor. In addition, Balong community also utilizes biogas resulting from cow manure waste as the environment lighting. During electricity extinguishing occurs, Balong community still can turn on the lamp, because the biogas they have can be used to activate the electricity generator. As Widodo says:

"*Masyarakat sini sekarang sudah banyak yang memanfaatkan gas dari limbah ternak untuk memasak dan penerangan. Secara ekonomis lebih irit, karena mereka tidak beli. Secara kualitas, rasa dari hasil masakan juga tidak berbeda. .....Di samping untuk masak, biogas ini juga digunakan untuk penerangan saat ada pemadaman listrik"*. (Many people here utilize gas resulting from manure waste for cooking and lighting. It is more economic, because they do not buy it. In the term of quality, the taste of meal produced is not different. … In addition to cooking, this biogas is also used for lighting during electricity extinguishing).

It is justified by Markiyati stating that biogas resulting from manure waste can be used for cooking. Currently, she unnecessarily worries with the increasing price of gas or the scarcity of gas supplied by the government, because she cooks using biogas resulting from his manure waste. Furthermore, she explains that having biogas resulting from cow manure waste can save her domestic expense. It is because before using biogas, she usually used 3kg-sized tube LPG costing IDR 15,000.- and she needed 3-4 tubes to meet her daily needs a month.

b. The fulfillment of fertilizer need:

Cow manure waste that has been removed for its gas can be used as plant fertilizer. This waste has better quality than chemical fertilizer. In the presence of such the waste, Balong people no longer need chemical fertilizer because the volume of cow manure waste has been abundant. As Sukamto suggests:

"Limbah sisa gas dari kotoran sapi dapat digunakan untuk pupuk. Limbah ini hanya perlu diendapkan beberapa saat sebelum digunakan, supaya tidak panas. .....Untuk masalah pupuk kami sekarang sudah mandiri, sebab di sini pupuk sudah melimpah". (The cow manure residual waste can be used as fertilizer. This waste should be deposited first for some moments before being used… In the term of fertilizer, we have been independent, because the fertilizer supply has been abundant here).

It is line with Purwanto stating that the cow manure residual waste is flowed into zalacca garden. He says "I flow the liquid waste as the residue of biogas production released from reactor into zalacca garden, and I use it for fertilizing the zalacca plant".

c. The growth of creative economy:

The residual biogas waste released from the digester can be used as the admixture for producing pellet or fish meal and fungus demplot (demonstration plot). Some of Balong people can produce pellet and fungus demplot using this residual waste to be sold or used by themselves. This creativity is of course profitable economically because the raw material to produce it is abundant.

d. The increase of milk quality:

The quality of cow milk the waste of which is put into digester is different from that disposed haphazardly. The stall cleanliness affects the presence of bacteria in it. The clean stall contains less bacteria then the dirty one. For that reason, the stall cleanliness affects the quality of milk produced. The quality of milk of course affects its selling price. This statement is in line with Purwoko saying:

"Harga susu sapi di Balong Wetan sudah mencapai Rp. 5.000,- per liter, sedangkan di lokasi lain harganya baru Rp. 3.800,- per liternya. Ini disebabkan kualitas susu di Balong Wetan lebih baik. Menurut dinas kesehatan, susu sapi di Balong Wetan lebih steril dari bakteri. Hal ini sangat masuk akal, karena kebersihan kandang sapi di Balong Wetan terjaga dengan baik. Setiap hari dibersihkan dengan diguyur air, agar kotoran masuk ke digester biogas". (The price of cow milk in Balong Wetan has reached IDR 5,000.- per liter, while in other location it reaches only IDR 3,800.- per liter. It is because the quality of milk in Balong Wetan is better. The cow milk in Balong Wetan, according to the Health Service, is more sterile from bacteria. It makes sense, as the cleanliness of cow stall in Balong Wetan is maintained well. It is cleaned everyday by spraying it with water, to remove the manure into biogas digester).

Discussion:

Dealing with the problems emerging and developing inside ourselves is not easy. Moreover, such the problem is not realized as a problem requiring serious attention. An individual's wish to solve the problem may not be supported by others encountering the same problem, because they consider it as reasonable [8]. The abundant volume of waste manure aforementioned is the example of problem considered as reasonable by surrounding community. The community is as if accustomed with the problem and considers it as a not-serious problem, despite odor they smell everyday. In such case, there should be a solution requiring creativity of an influential figure within society. A society figure's ability of solving problem is often followed by other members of society. It can be seen from the case of Widodo successfully solving the cow manure waste problem and eventually followed by other members of society.

Innovation adoption theory suggests that there are only few creative and innovative people within society [9]. Such the people have high courage to try and to be failed. Meanwhile, some others only want to imitate others' success because they are afraid of being failed and always want to be successful. Widodo's success proves that Rogers' theory still applies particularly to rural community, such as Balong Wetan community.

The process of imitating the success occurring in the society does not occur spontaneously. However, it passes through a process with more people trying to follow it. From the case above, it can be seen that in the process of constructing digester and biogas reactor, there were originally only 10 households agreeing with the construction, but the number increased in the following year, and then it developed in surrounding area. Such the development is reasonable, according to innovation adoption theory, because the innovation recipients have different knowledge. Therefore, an individual's education, according to Rogers, highly affects the adoption of innovation [9].

In addition to education level, an individual's acceptance to innovation is determined by the economic benefit of innovation [10]. An economically profitable innovation will be more acceptable to society, and vice versa. The case of digester and biogas reactor innovation transmitted by Widodo to Balong Wetan community was responded to quickly, because the community recognized its economic benefit. They see directly the benefit of digester and biogas reactor from those constructing it previously, so that they were interested to imitate it.

The successful innovation diffusion in the society usually impacts on the introduction of subsequent new innovation. Therefore, according to Rogers, community empowerment agent should promote the innovation clump or package to the community sustainably [9]. The successful pellet production for fish meal or fungus demplot is the sample case of same clump innovation diffusion developed in Balong Wetan. The rural

community adopts innovation package more quickly and more easily than that diffused separately, for example, digester and biogas reactor introduced in Kampong A and fungus demplot innovation introduced in Kampong B. Psychologically, it is because the community has believed in the benefit of innovation previously introduced by the community empowerment agent. For that reason, the community empowerment agent should introduce innovation that can result in economic profit first before introducing other innovation.

The economic effect of cow manure utilization as energy source is the availability of sufficient biogas for cooking. Biogas resulting from cow manure waste has bright blue color, not resulting in smoke or odor, so that the kitchen is kept clean [11, 12]. This biogas can be used continuously and incessantly as long as the raw material of manure waste is supplied routinely into the digester. The time taken for cooking water, according to Hastuti, is 15minute quicker than that using fuel or petroleum [13]. It means that the cost spent is more economic. The people who have used biogas no longer need to buy fuel as the need for fuel has been met by cow manure. Therefore, those usually looking for fuel wood in the forest can use their time for other activity giving added-value economically.

The utilization of cow manure was as energy source makes this product very valuable. Therefore, the owners of cow breeding in Balong Wetan take care of their cow and stall well. They clean their cow and stall everyday, so that cow and stall are clean. This condition indirectly affects positively the quality of milk produced. The selling price of cow milk with well-maintained stall is more expensive than that with poorly-maintained stall [13]. It means that there is an increase in community's income.

On the other hand, slurry or the cow manure that has been freed from gas is organic fertilizer rich of elements needed by the plant. Even, certain elements such as protein, cellulose, lignin and etc can not be replaced with chemical fertilizer [13]. Thus, the use of slurry as plant fertilizer is an appropriate measure to Balong community. Economically, the use of slurry can save planting cost, because they get slurry freely. The plant productivity is better than that fertilized with chemical fertilizer as well [14]. Therefore, the user of cow manure waste can use their money for other purpose.

Conclusion:

The utilization of cow manure as energy source in Balong Wetan affects positively the community economy. The economic effect that can be felt directly by the community includes the availability of fuel (biogas) need for cooking, the availability of plant fertilizer, the improvement of income from milk selling, and the growth of creative economy. Therefore, it is recommended for the government and the agent of community empowerment to encourage the cow breeders to utilize their cow manure waste to be the environment-friendly energy source.

This research's finding shows that there is still a renewable energy source that can be used to achieve the people's wellbeing without damaging ecosystem. Therefore, economic community empowerment programs related to the natural energy source utilization needs to be emphasized on the use of renewable energy source to prevent ecosystem damage. The future research is recommended to keep studying other renewable energy source that can be used to build the people's wellbeing.

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