Biogas : Alternative energy on supporting environmentally coffee shop in Samosir Island

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Abstract. Samosir Island is one of tourism destination in Indonesia and there was an increasing of coffee shop number. This research tries to investigate how much financial profit received by coffee shop if it use biogas as a new energy source. This research had been conducted from April to June 2018. Research parameter were production costs, income, revenue, Benefit Cost Ratio, Revenue Cost Ratio, Return On Investment, Break Even Point, and identify opportunities, threats, strengths and weaknesses by SWOT analysis to identify whether the community of Samosir is willing to use biogas. The results of financial analysis namely production cost IDR 1,964,500; income of IDR 4,360,000; revenue of IDR 2,303,000; B/C (%) was 79.7; R/C (%) was 151; ROI (year) of 1.6; BEP Price was IDR 5,302; BEP Production of 361 glass. By SWOT Analysis it was known that development strategies are taken place include socialize biogas technology, benefits of biogas on energy, fertilizer and soil quality to the community, benefits of biogas in saving fuel purchases and providing biogas stock devices on biogas group. The result showed that biogas was worthy of being used as a new energy source on the coffee shop business on Samosir Island.

1. Introduction

The Indonesian Ministry of Tourism (Kemenpar) has launched the Sustainable Tourism Observatory (STO) program. This program collaborates with 5 Universities in Indonesia to develop sustainable tourism destinations. One of them is the University of North Sumatra with one of the observatory destination, namely the tourist area of Lake Toba including Samosir Island. In accordance with the objectives of the program, namely sustainable tourism, in order to achieve a continuation of tourism activities, a priority has to be set up, i.e. to preserve the environment and also sustainable tourism relies on local villagers in its management [1].

Related to environmental preservation, for example, the community of tourism in Central Java invites tourists to see and participate in the operation biogas unit. Activities like this turned out to be interesting activities for tourists both local and international tourists. Through this program, tourists are expected not only to visit destinations, but also to take care of the environment [2]. With the increase of tourists to an area, it will definitely have an impact on people's welfare. That is the other goal of sustainable tourism. In addition, tourism is expected to be the leading sector of the community economy [3].

Biogas technology is a simple technology with great benefits. These benefits include source of energy alternative either for cooking human food or roasting coffee bean and source of organic fertilizer [4], source of energy to cook animal feed [5], source of energy for chicken brooder [6], source of microbial to improve soil quality [7].

One sub-district that has many tourism locations on Samosir Island is Pangururan. Tourist locations include Parbaba White Sand Beach, Pusuk Buhit Mountain, Sitio-Tio Hot Spring, various tourist villages with the majority of mothers weaving in traditional ways, locations of ancient dust and stone.
from ancient Toba volcanic eruptions which occurred 74,000 years ago, waterfalls, hills Tele Tubbies, a museum of ancient Toba volcanic eruptions and Toba cultural attractions [8].

Besides that, Pangururan District has the largest buffalo population for Samosir Regency [9]. Since the time of the ancestors of the Batak tribe, buffaloes have been a very reliable source of power for ploughing and transportation, as a source of fertilizer and as a community savings. With the development of tourism, buffalo has an aesthetic impact on the environment because its faeces are found in the environment. Therefore a policy is needed to get rid of negative impacts while having a positive impact. This policy is by utilizing biogas technology.

From the results of the preliminary survey, there were 58 coffee shops which used LPG gas to prepare coffee for consumers. LPG sometimes scarce in Samosir Island and [10] mentioned that biogas was an alternative energy especially in rural area to overcome scarcity of energy.

This study aims to investigate the economic benefits of coffee shops if they use biogas as a new energy source. Research parameter were production costs, income, revenues, Benefit Cost Ratio (B/C), Revenue Cost Ratio (R/C), Return On Investment (ROI) and Break Even Point (BEP). Besides that, a SWOT Analysis was carried out to find out whether biogas technology is willingness to be used by people of Samosir Island.

2. Materials and Methods
This research was conducted on a tourism village which is Lumban Suhi-suhi, Pangururan District, Samosir Regency from April 2018 to June 2018. In order to get data of bio gas production, a unit of bio gas which made from a 20 mikron thick Polyethylene Plastic was installed. According to [11] unit biogas which was constructed from plastic gave the best either R/C or ROI. The size of biogas unit was 4 m long with 1 m diameter. The unit was filled with buffalo faeces. According to [12] animal faeces was a potential source of rural energy. 30 days hydraulic time was set up which after that, gas was filled into a plastic container and was used to boil water for making coffee.

Data of this research were compiled mostly by primary data for example by counting directly number of coffee shop, by doing interview with coffee shop owner in order to know what kind of energy sources used, how many glass of coffee has been sold in a day, is there any problem in getting LPG, LPG scarcity, etc.

This research is a kind of a feasibility study which studies about a business in this case coffee shop business and use biogas as source energy in making coffee. This study carried out, in order to determine whether or not the business is feasible[13]. Through this study an approaches, and alternative solutions could be found [14].

Data from installing bio gas unit and survey were processed in order to have financial aspects of coffee shop. In additiona SWOT analysis was followed in order to know community’s willingness on using biogas.

Parameter in this research were (quantitative analysis) Production Costs, Revenues, Incomes (Profit and Loss Analysis), Revenue Cost Ratio (R/C Ratio), Benefit Cost Ratio (B/C Ratio), Return On Investment (ROI), Break Even Point (BEP) Production, Break Even Point (BEP) Price, and qualitative analysis/SWOT Analysis.

Qualitative Analysis by Internal Factors and External Factors Matrix Analysis
According to [15], the strategic factors of a project can be concluded by combining external with internal strategic factors

3. Result and Discussion

3.1. Bio Gas Production

The gas production data in this study was taken after input was 30 days in biodigester which was according to hydraulic retention time. [16] found that biogas with input of 5 kg of cow feces every day obtained daily gas production of 144.3 liters. In this study, daily gas production of 450 liters of biogas
was obtained through the filling of 18 liter buffalo faeces per day. Smaller gas yields for each kg of input are likely related to animal feed. Cattle in the Ginting study received concentrated intake other than grass, meaning that the feed had better quality nutritional sources. While the buffalo in this study only consume rice straw and grass. This is in accordance with [17] whom said that livestock which consume low quality feed produced less biogas.

3.2 Financial Analysis of Coffee Shop by using Biogas

| Table 1. Financial Analysis Results Using Bio Gas |
|-----------------------------------------------|
| NO | DESCRIPTION | TOTAL | UNIT | PRICE (IDR) | The amount of costs (IDR) |
|----|--------------|-------|------|-------------|---------------------------|
| 1. | Expenses A Investment Costs | | | | |
| 1 | Bio Gas Devices | 1 | unit | 650.000 | 650.000 |
| 2 | Stove | 1 | unit | 250.000 | 250.000 | 900.000 |
| Total Investment Costs | | | | | 900.000 |
| B | Variable Costs | | | | |
| 1 | Faeces Purchases | 11 | sack | 5.000 | 55.000 |
| 2 | Coffee Purchases | 10 | kg | 80.000 | 800.000 |
| 3 | Plain Water Purchases | 150 | litre | 150 | 22.500 |
| 4 | Sugar Purchases | 4 | kg | 12.000 | 48.000 | 925.500 |
| Total Variable Costs | | | | | 925.500 |
| C | Fix Costs | | | | |
| 1 | Labour | 1 | person | 1.000.000 | 1.000.000 |
| 2 | Biogas Devices Depreciation | 3 | year | 650.000 | 18.000 |
| 3 | Stove Depreciation | 1 | year | 250.000 | 21.000 | 1.039.000 | 1.964.500 |
| Total Fixed Costs | | | | | 1.039.000 |
| Total Production Costs | | | | | 1.964.500 |

| D. Revenue | Coffee Sales | 545 | glass | 8.000 | 4.360.000 | 4.360.000 |
| Total Revenue | | | | | | |

| Table 2. Results of Financial Analysis by using Biogas |
|-----------------------------------------------|
| Biogas | |
| Production Cost (IDR) | 1.964.500 |
| Income (IDR) | 4.360.500 |
| Revenue (IDR) | 2.303.000 |
| R/C(%) | 151 |
| ROI (year) | 1.6 |
| B/C (%) | 79.7 |
| BEP Price (IDR) | 5.302 |
| BEP Production (glass) | 361 |
3.2.1. Production Cost

Production cost in this research was IDR 1,964,500. - The financial analysis carried out for a period of one month. Generally a coffee shop owner in Samosir buys water for making coffee. The price of water is IDR 150,000, - for every 1000 liters or IDR 150, - for each liter. On production costs, coffee shops usually buy LPG and if they using biogas, they must buy buffalo faeces from farmers.

The activity of buying faeces could arouse the public interest to collect buffalo faeces which scattered in the environment. Thus a positive effect occurs, namely creating a clean environment both on land and lake waters while at the same time pleasing the tourists who come. As is known, people who maintain livestock whose cages are adjacent to the lake make a drainage stream to the lake [5].

3.2.2. Income

The income from the coffee shop is IDR 2,303,000, - The amount of this income causes the number of coffee shops to be 58 in Pangururan District. Coffee shop owner mostly worked as a farmer. But seeing the increasing trend of tourists, they switched professions to support tourism by opening coffee shops. Even so, farmland or livestock are kept by other family members.

The income earned by the community is better because of the costs incurred for fixed costs due to buying cheap bio plastic gas units and they saving money from the gas. This is in accordance with [19] whom mentioned that utilization of biogas in remote area supported people’ income because they obtain savings by utilization biogas.

In the future, if the community becomes skilled in assembling bio plastic gas units, then the community only needs to invest in buying the material, namely the plastic and the devices and the stoves. It is hoped that the community will also be skilled in assembling stove. Self-assembled stove using wrought iron will be stronger and durable.

3.2.3. Revenue

Revenue obtained from coffee sales where data were obtained from interviews, which could be sold for an average of 18 glass coffee or 540 glass in a month with an average price of IDR 8,000. - Revenue in this research was IDR 2,303,000.- From the interviews, coffee sales will increase if the coffee shop owner is able to serve complementary food for coffee in this case the favorite menu of the Samosir community which is gomak noodles. Gomak noodles cooked with different flavors and style are called spaghetti batak because of their delicious taste like spaghetti. Of course a breakthrough like this, not only attracts local buyers, but also local and foreign tourists who come to Samosir.

With the establishment of Samosir Island as a tourist destination, homestays around villages such as Lumban Suhi-suhi, Hutabolon, Siopat Sosor and Situngkir have emerged. The four villages are located in Pasir Putih Beach, which is a tourism site that has a sloping beach with white sand. Various tourist attractions are located on the Pasir Putih beach. Tourists who stay at the homestay really enjoy visiting coffee shops, especially the price of coffee is only IDR 8,000 per glass. Tourist prefer local coffee very much and sachet coffee/instant coffee is often resist by tourist. That is why, more local people process their own coffee bean now a days in Samosir [18].

From interview it was known that tourists will sit longer and order additional coffee if there is additional atraction such as traditional music. Therefore the community in Situngkir village, every week end invites local artists to perform at the Arts Stage to sharpen their artistic abilities both vocal and dance and gondang art.

3.2.4. R/C (%)

R/C describes whether an business is efficient because it is a comparison between total revenue and total production costs. The business is profitable as R/C was 151%. This is related to the low total cost. Cost components include coffee powder purchases; coffee more delicious if it is produced from volcanic soil such as land on Samosir. The price of coffee powder in Samosir is only IDR 80,000 and becomes very cheap when compared to the price of coffee powder in Eastern Indonesia, which is around IDR 500,000 per kg. Mineral water is obtained from the special location of Lake Toba, which
is a very clean location. 1 liter of water is only IDR 150, - Another cost component is the depreciation of the bio gas unit. Because bio-gas units from plastic are cheap, the depreciation price is also cheap. Although the price of 1 glass of coffee is only IDR 8,000, but because the small cost component causes the coffee shop business becomes very feasible.

3.2.5. Benefit Cost Ratio (%)
B/C in this research was 79.7%. B/C is a measure of the comparison between income and total production costs. Benefits cost ratio in this research indicated that coffee shop business is feasible and feasible to implement[21].

A coffee shop will get a better B/C if the store owner can make a breakthrough so that local people and tourism are more comfortable sitting and ordering more than a glass of coffee. A better taste of coffee, a nice and clean environment are a kind of strategy to get more consumer.

3.2.6. Break Even Point (BEP) Production
BEP is the amount of production that is produced where the producer in the position does not lose and is not profitable. This reflects the minimum production amount that must be produced by the producer. In this study, coffee shop owners succeeded in reaching the Production BEP if they managed to sell 361 glass of coffee.

3.2.7. Break Even Point (BEP) Price
BEP price is the price per unit of a product produced by a producer in a non-profit position and no loss which also reflects the minimum price per unit of goods specified by the manufacturer. In this study, Rp. 5,302, - Meanwhile, the general price of each glass of coffee in Pangururan District is Rp. 8,000, - Actually, if the owner of the coffee shop wants to get more consumers, then the normal price is Rp. 8,000 per glass can be reduced again so that it is cheaper than all other coffee shop prices. But there is a social understanding among the coffee shops that are also supported by the Tourism Office of Samosir Regency, that is to attract customers to buy coffee, not by slamming the price, but by improving the quality.

3.2.8. ROI (year)
ROI is an analysis to determine the level of business profits related to the capital used. The size of the ROI is determined by the level of capital turnover and the net profit obtained. ROI is income divided by capital and multiplied by 100% [20].

In this study the ROI was 1.6%, which meant that the coffee shop will obtained its investment back after 1.6 years.

3.3 How to increasing people willingness to use biogas
In accordance with the Minister of Tourism Regulation No. 14 of 2016 concerning the Guidelines for Sustainable Tourism Destinations, the Ministry of Tourism issues Sustainable Tourism Observatory (STO) Guidelines in 2017. Within the guidelines, there are nine issues and indicators of tourism destinations, including tourism season, jobs and employment, developing the economy of tourism destinations, tourism governance and ecosystems, local satisfaction with tourism, energy management, water management, liquid waste management, and solid waste management [1]. If the people of Samosir is willing to process faeces include urine of buffalo, it means that people manage 4 issues of STO which are energy, water, liquid waste and solid waste. Energy because by installing biogas unit, they produce renewable energy. There is less either liquid waste such as livestock urine or solid waste such as faeces goes onto Lake Toba. As the result, water will be cleaner. Like now, a routine action must be taken to remove water hyacinth from the lake which thrives because animal waste make water hyacinth grow better.Inorder to investigate people willing to use biogas, a SWOT matrix was conducted.
Table 3. Table of SWOT Analysis Matrix of Internal Factors Willingness of people using biogas unit

| Internal factors                                         | N | Weight | Rating | Weight x Rating | Information |
|----------------------------------------------------------|---|--------|--------|-----------------|-------------|
| **Strengths**                                            |   |        |        |                 |             |
| a. Saving Production Cost                                | 1 | 0,2    | 4      | 0,8             |             |
| b. Tools and Materials of Biogas Devices are Easy to Obtain and Low Prices | 1 | 0,3    | 4      | 0,12            |             |
| c. Available all the time                                | 1 | 0,2    | 3      | 0,6             |             |
| **Subtotal**                                             | 3 | 0,7    | 11     | 1,52            | 79,17%      |
| **Weakness**                                             |   |        |        |                 |             |
| a. It takes time to stir the biodigester so that the microbial is spread evenly | 1 | 0,2    | 1      | 0,2             |             |
| b. Faeces from sick animals could not be used            | 1 | 0,1    | 2      | 0,2             |             |
| **Subtotal**                                             | 2 | 0,3    | 3      | 0,4             | 20,83%      |
| **Total**                                                | 5 | 1      | 14     | 1,92            |             |

Determining External Factors
- **Strength**
  a. Using biogas will support government policy, for example the Tourism Service of Samosir Regency due to biogas affect aesthetic on tourism location
  b. Using biogas will minimize scarcity of subsidized 3 kg LPG gas
  c. Using biogas improve soil quality thus agriculture production

The biogas unit issues a by-product which is a ready-to-use liquid fertilizer slurry. Almost all people on Samosir Island farm, such as shallots, corn, coffee, rice, all of which require fertilizer. [7] proved that the type of soil on Samosir Island will be better if fertilized with organic fertilizers containing microbes in it.

- **Weakness**
  a. It takes time to collect faeces. People are reluctant to do it
  b. It takes time to do the routine of filling the biodigester

Table 4. SWOT Analysis Matrix External Factors Willingness of people using biogas unit

| External Factors                          | N | Weight | Rating | Weight x Rating | Information |
|-------------------------------------------|---|--------|--------|-----------------|-------------|
| **Strength**                              |   |        |        |                 |             |
| a. Support tourism policy                 | 1 | 0,2    | 4      | 0,8             |             |
| b. Minimize scarcity of subsidized 3 kg LPG | 1 | 0,1    | 3      | 0,3             |             |
| c. Support soil quality                   | 1 | 0,2    | 3      | 0,6             |             |
| d. Support agriculture production         | 1 | 0,1    | 3      | 0,3             |             |
| **Subtotal**                              | 4 | 0,6    | 14     | 2,0             | 71,43%      |
| **Weakness**                              |   |        |        |                 |             |
a. It takes time to collect faeces. People are reluctant to do it
   1  0,2  2  0,4

b. It takes time to do the routine of filling the biodigester
   1  0,2  2  0,4

Subtotal       2  0,4  4  0,8  28,57%
Total          6  1  18  2,8

Based on the results of Internal Factors and External Factors analysis, the scores of each factor both internal and external can be presented as follows:

| Internal Factors | Strengths : 1,52 |
|------------------|------------------|
|                  | Weakness : 0,4   |

| External Factors | Strength : 2,0  |
|------------------|------------------|
|                  | Weakness : 0,8   |

Table 5. SWOT Matrix

| Internal Factors (IF) | Strengths                  | Weakness                                               |
|-----------------------|----------------------------|--------------------------------------------------------|
|                       | 1. Savings Production Costs| 1. Micromonism tends to settle at the bottom of the biodigester |
|                       | 2. Biogas devices are easy to obtained | 2. Faeces of sick animals should not be used |
|                       | 3. Low price               |                                                        |

| External Factors (EF) | Strategy on Strength of EF | Strategy on Strength of IF |
|-----------------------|----------------------------|---------------------------|
| Strength              | 1. Socialize biogas technology to the gov of Samosir | 1. Socialize the benefits of biogas in saving fuel purchases |
|                       | 2. Socialize the benefits of biogas on energy, fertilizer and soil quality to the community of Samosir | 2. Providing biogas stock devices on biogas group |

| Weakness              | Strategy on the Weakness of EF | Strategy on Weakness of IF |
|-----------------------|-------------------------------|---------------------------|
|                       | 1. Create a group in order to have faeces bank | 1. Biodigester is stirred 10 minutes every time it is filled |
|                       | 2. Create a working group on each biogas user | 2. If the lack of faeces occur, biodigester can be filled with water hyacinth, rotten fruit, rotten vegetables |

4. Conclusion

Coffee shop business while use biogas from buffalo feces as source of energy was feasible. The results of the financial analysis were as follows: production cost IDR 1,964,500; Revenue IDR 2,303,000; income Rp. 4,360,000; B/C (%) 79.7, R/C (%) 151; ROI (year) 1.6; BEP Price IDR 5,302; BEP Production were 361 glass. Development strategies as an effort to make community on Samosir is willing to use biogas were as follows: socialize biogas technology to the government of Samosir, socialize the benefits of biogas on energy, fertilizer and soil quality to the community, socialize the benefits of biogas in saving fuel purchases and providing biogas stock devices on biogas group.
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