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## Feasibility Study on the Application of Biogas from Buffalo Faeces as Source of Energy on Coffee Shops

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**Abstract.** This study aims to investigate whether bio gas from buffalo faeces can be used as a new substitute energy for other energy sources namely LPG gas and kerosene for coffee shop. This research was conducted at the coffee shop owned by Mr. Saragih in Lumban Suhi-suhi Village, Pangururan District, Samosir Regency, from April to June 2018. This research was a feasibility study using bio gas as an energy source for cooking. Then calculated financial analysis and observed with SWOT analysis. Parameters observed were production costs, revenues, income, Benefit Cost Ratio (B / C), Revenue Cost Ratio (R / C), Return On Investment (ROI), Break Even Point (BEP), and SWOT Matrix. The results of financial analysis were calculated using the bio gas unit, namely the production cost of Rp 2,167,000; revenue of Rp. 4,360,000; income of Rp. 2,193,000; B / C is 1.01, R / C is 2.02; ROI of 50.3%; BEP Price is Rp. 3,976; BEP Production of 270 glasses. Development strategies included promoting bio-gas devices to the community, improving service in coffee shops, improving product quality, making coffee shops that are modern and unique from others, and making faeces banks.

**Keyword :** energy substitute, biogas, LPG, kerosene

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### Introduction

Samosir Island is an island located and surrounded by Lake Toba. The total area of Samosir Regency reached 254,715 Ha, consisting of land area is 144,455 Ha and lake waters area is 110,260 Ha [1]. Samosir Island is famous for its natural tourism and historical tourism. Some of them are the Sigale-gale Show, the Huta Bolon Museum, the Tombs of the Batak Kings, hot springs, and there are also various other natural uniqueness such as Lake Sidihoni which is a lake above the lake. The uniqueness of Samosir Island is amazing and Samosir Island also has an important role in the development of Lake Toba tourism destinations. The area of tourist destinations on Samosir Island is not only famous



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in Indonesia, but it has well known abroad. That's way makes the central government want to develop tourist areas in Indonesia, including on Samosir Island. 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 [2] .

Most of the people's livelihoods in Samosir Regency are farmers and breeders. The livestock that many people maintain in Samosir Regency are buffalo and goats. The population of buffalo reached 28,181 and goat reached 9700 in 2015 [3]. The utilization of livestock waste there has not been utilized properly by farmers. Buffalo waste is an organic material that is easily biodegradable, so if not managed properly causing environmental pollution both biologically, chemically and physically. Improper management of livestock waste can cause pollution of water, soil and air, impact on decrease in environmental quality, quality of life of farmers and their livestock, and can lead to social conflict [4]. Good waste management, besides being able to prevent environmental pollution, also provides economic value to livestock business. One of the uses of livestock faeces is as a source of bio-gas energy and liquid fertilizer/slurry [5]. This research investigated a new way for coffee shop to find new energy instead of LPG or kerosene by using biogas.

## Material and Methods

This research was carried out in a coffee shop owned by Mr.Saragih in Lumban Suhi-suhi Village, Pangururan District, Samosir Regency, North Sumatra Province, The study lasted for 2 months, starting from April 2018 to June 2018.

The type of research was a feasibility study. Business feasibility study is an activity that studies about a business that will be carried out, in order to determine whether or not that business [6]. Feasibility studies help to find approaches, and alternative solutions for practicing an idea [7]. From the definition above, a feasibility study was conducted including financial aspects and SWOT on one of Pak Saragih's coffee shops in Lumban Suhi-suhi Village, Pangururan District, Samosir District, using



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bio gas as an energy source for cooking. Then calculated in financial analysis and observed with a SWOT analysis [8].

### *Method of data collecting*

#### - Primary Data Collection Techniques

The primary data collection technique is the technique of collecting data directly (surveys) to coffee shops, knowing the types of energy sources used and dishes and drinks sold. This technique can be done by interviews and unstructured observations.

#### - Secondary Data Collection Techniques

Secondary data collection techniques are data collection techniques obtained through library materials to support the completeness of primary data. Secondary data collection techniques can be done by documentation studies and library studies.

### *Implementation of Research*

- Prepare everything needed during surveys such as questionnaires, data books, and stationery.

- A preliminary survey was conducted to determine the circumstances and situation of the research environment.

- Surveys and interviews were conducted around coffee shop that were selected and interviews were conducted with coffee shops using questionnaires.

- Tabulation of data: Data that has been obtained from the survey results are collected and arranged well to facilitate data analysis.

- Data Analysis: Data that has been collected is then analyzed to become an information for research.

- Summarize Data: Data that has been analyzed is then concluded to be a summary of the information needed in the study [9].

### *Parameter*

The parameters measured in this research are 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 SWOT Analysis.



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## Analysis Method

The analytical methods used are:

a. Quantitative analysis is used to calculate financial analysis including

- Production costs ( $TC=FC+VC$ ),
- Revenue ( $TR=P \times Q$ )
- Income ( $II=TR-TC$ )
- R/C Ratio = Total Revenue (R) : Total Production Costs (TC)
- B/C Ratio = Total Income (B) : Total Production Costs (TC)
- ROI (Return On Investment) =  $\text{Income/capital} \times 100\%$
- BEP Production = Total Production Costs (TC) : Total Production (Q), and
- BEP Price = Total Production Cost (TC): Price (P)

b. Qualitative Analysis by IFAS and EFAS Matrix Analysis

According to [5], the strategic factors of a company can be concluded by combining external strategic factors with internal strategic factors into a summary analysis of strategic factors.

## Results and Discussion

### Bio Gas Unit

The bio gas unit that has been installed at the location of Mr.Saragih's coffee shop is 4 x 1 m. The construction of the bio gas unit installed was a plastic biodigester. The bio gas unit was placed in a hole 50 cm deep and 1.5 m wide. The contents of the bio gas unit was buffalo faeces and water. Comparison of faeces and water is 1: 2. After processing for 30 days, bio-gas was produced.

### Comparison Results of Financial Analysis of Biogas Energy Used, LPG Gas and Kerosene

Table 1. Results of Financial Analysis Comparison of Biogas Energy Used, LPG Gas and Kerosene

	Biogas	LPG	Kerosene
Production Cost (IDR)	2.167.000	2.080.000	1.940.000
Revenue (IDR)	4.360.000	4.000.000	3.600.000
Income (IDR)	2.193.000	1.920.000	1.660.000



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R/C	2.02	1,92	1,85
ROI (%)	50,3	48	46,11
B/C	1,01	0,92	0,85
BEP Price (IDR)	3.976	4.160	4.311
BEP Production (cup)	270	260	242

From the comparison table of the financial analysis above shows that the use of biogas units can increase revenue and income. The use of a bio gas unit is feasible because it has  $R / C > 1$  and  $B / C > 1$ .

### *Business Conditions*

Mr.Saragih coffee shop is located in Lumban Suhi-suhi Village, Pangururan District, Samosir Regency, about 35 km from Tomok Ferry Port, 16 km from Simanindo Harbor, 5.2 km from Tele-Pangururan intersection, and 6 km from the city center. In Pangururan there are 58 coffee shops, but only two modern coffee shops. This is a good business opportunity if Mr.Saragih's coffee shop developed into a modern coffee shop. Because most local and international tourists prefer modern coffee shops than traditional coffee shops.

### *Business Development Strategy*

#### Determining Internal Factors (IFAS)

##### - Strengths

###### a. Saving Production Cost

the use of bio-gas energy sources from buffalo faeces is more efficient in terms of production costs than other energy sources (LPG Gas and Kerosene).Memakai Sumber Daya Alam yang

###### b. Renewable

Bio gas used for energy sources is derived from buffalo faeces, where faeces from livestock are renewable natural resources.

###### c. Tools and Materials of Biogas Devices are Easy to Obtain and Low Prices

##### - Weakness

###### a. There is no Feses Bank



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There are several coffee shops that do not have livestock so they cannot get faeces from livestock to be used as bio-gas energy material.

b. Location of Coffee shop was not strategic

because around the coffee shop is an agricultural area and far from the city center.

Table 2. Table of SWOT Analysis Matrix of IFAS Coffee Shop Business Development

Internal factors	N	Weight	Rating	Weight x Rating	Information
<b>Strenghts</b>					
a. Saving Production Cost	1	0,2	4	0,8	
b. Use renewable natural resources	1	0,3	4	0,12	
c. Bio Gas Devices and Materials are easily obtained	1	0,2	3	0,6	
<b>Subtotal</b>	<b>3</b>	<b>0,7</b>	<b>11</b>	<b>1,52</b>	<b>79,17%</b>
<b>Weakness</b>					
a. There is no Feses Bank	1	0,2	1	0,2	
b. Location of Coffee shop was not strategic	1	0,1	2	0,2	
<b>Subtotal</b>	<b>2</b>	<b>0,3</b>	<b>3</b>	<b>0,4</b>	<b>20,83%</b>
<b>Total</b>	<b>5</b>	<b>1</b>	<b>14</b>	<b>1,92</b>	

Determining External Factors (EFAS)

- Oppurtunities

a. Market demand is quite high

there are 10-20 visitors every day to traditional coffee shops and there are 30-50 visitors every day to modern coffee shops.

b. Consumer Purchasing Power

For a glass of coffee at a traditional coffee shop for IDR 3,000 - IDR 5,000 and a glass of coffee at a modern coffee shop for IDR 8,000 - IDR 15,000.



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- c. Often the scarcity of subsidized 3 kg LPG gas  
the amount of subsidized LPG 3 kg gas supply is around 1120 tubes per day. However, in reality the community often complains because of the frequent scarcity of 3 kg LPG gas.
  - d. Regional Government Support  
The making of bio-gas units in Samosir Regency has the support of the local government, especially the Tourism and Agriculture Service of Samosir Regency.
- Threats
- a. Busyness of Coffee Businessmen  
average coffee shop business hours are 8-12 hours, so there is a lack of time to make or fill the contents of bio gas.
  - b. The presence of competitors  
There are several coffee shops that use modern coffee machines that add to the coffee shop business value.

Table 3. SWOT Analysis Matrix EFAS Coffee Shop Business Development Table

External Factors	N	Weight	Rating	Weight x Rating	Information
<b>Opportunities</b>					
a. Market demand is quite high	1	0,2	4	0,8	
b. Consumer Purchasing Power	1	0,1	3	0,3	
c. Often the scarcity of subsidized 3 kg LPG gas	1	0,2	3	0,6	
d. Regional Government Support	1	0,1	3	0,3	
<b>Subtotal</b>	<b>4</b>	<b>0,6</b>	<b>14</b>	<b>2,0</b>	<b>71,43%</b>
<b>Threats</b>					
a. Busyness of Coffee Businessmen	1	0,2	2	0,4	
b. The presence of competitors	1	0,2	2	0,4	
<b>Subtotal</b>	<b>2</b>	<b>0,4</b>	<b>4</b>	<b>0,8</b>	<b>28,57%</b>



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Total	6	1	18	2,8
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Based on the results of IFAS and EFAS analysis, the scores of each factor both internal and external can be presented as follows:

- *Strenghts* : 1,52
- *Weakness* : 0,4
- *Oppurtunities* : 2,0
- *Threats* : 0,8

### Strategy Determination

Table 4. SWOT Matrix

Internal Factors	<b>Strenghts (S)</b> 1. Savings Production Costs 2. Using renewable natural resources 3. Bio Gas Devices and Materials are easily obtained	<b>Weakness (W)</b> 1. There is no Feses Bank 2. Location of Coffee shop was not strategic
Eksternal Factors	Strategy (SO) 1. Promoting biogas devices to the society 2. Improve service in coffee shops 3. Improve product quality	Strategy (WO) 1. Make a coffee shop that is modern and unique from the others 2. Promote modern coffee shops using biogas units
<b>Oppurtunities (O)</b> 1. Quite High Market Demand 2. Consumer Purchasing Power 3. Frequent Scarcity of Subsidized 3 kg LPG Gas 4. Local government support	Strategy (ST) 1. Increase coffee shop businessmen creativity 2. Using a modern coffee maker.	Strategy (WT) 1. Making Faeces bank
<b>Threats (T)</b> 1. Busyness of Coffee Businessmen 2. The presence of competitors		





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## Conclusion

Mr.Saragih's coffee shop business that used biogas units from buffalo faeces as an energy source was feasible. This means that biogas could be a new source of energy for village coffee shop and could substitute LPG or kerosene. In financial analysis the biogas unit is more profitable than other energy sources (LPG and kerosene). The results of the financial analysis calculated using the biogas unit were production costs is Rp. 2,167,000; receipt is Rp. 4,360,000; income is Rp. 2,193,000; B / C is 1.01, R / C is 2.02; ROI is 50.3%; BEP Price is Rp. 3,976; BEP Production is 270 cups. However, to support Mr.Saragih's coffee shop business needs strategies to develop the business by means of SWOT analysis. Development strategies include promoting biogas devices to the society, improving service at coffee shops, improving product quality, making coffee shops that are modern and unique from others, using modern coffee machines and making faeces banks.

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