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JURNAL INFOKUM, Volume 10, No.3, Agustus 2022 ISSN : 2302-9706

ENHANCES CONTROL OF ENVIRONMENTAL FEASIBILITY SECURITY IN MEDAN CITY DEVELOPMENT IN LIQUID WASTE BIODIGESTER TOFU FACTORY

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ABSTRACT

Article Info

Received, 01/08/22
Revised,28/08/22
Accepted. 30/08/22

The impact of processing the tofu industry is liquid waste which mainly causes problems. Tofu liquid waste can be used as biogas. For this reason, it is necessary to study a feasibility analysis for constructing a biodigester from a technical, economic, and environmental perspective. The engineering work process in technical analysis determines the type of digester and the appropriate and efficient placement obtained from operational costs, land area, and production capacity. The technical analysis survey found that the type of reactor installation was chosen was the modified Cover Lagoon Anaerobic Reactor (Colar) with a portable model with a capacity of 200 liters. The economic analysis study is used to determine the feasibility of developing a Biodigester in determining the budget details and obtaining the estimated cost of Rp. 2,301,000, - and investment in the next five years with parameters Net Present Value (NPV) = Rp. 7.512.000,- (positive value), Probability Index (PI) = 3.2 1 in the investment period, Internal Rate Of Return (IRR) at the generally accepted interest rate, the NPV is positive, and there is no IRR and Payback Period (PP) = 1.3 Years (≤ investment period of 5 years). Environmental feasibility analysis shows that the outer biodigester is safe and has a slightly pungent odor and reduced tofu factory liquid waste. Handling from the exterior involves a particular route to closed drainage or pipe to a final disposal site or a closed septic tank.

Keywords: Waste Treatment, Liquid Waste, Medan City Development

1. INTRODUCTION

Tembung is a municipality in North Sumatra. Besides being known as a new and developing city, Tembung is famous for the tofu industry that spreads in each region. For example, the tofu industry in Tembung is located in North Sumatera (Prayogo, 2013). As well as other tofu factories, liquid waste produced from factories is dumped into the ground or irrigation. This habit, if carried out continuously, will damage the ecosystem in the area that is drained of waste (Singhal et al., 2008) . Tofu producers are still indifferent to liquid waste because the impact is not explicitly accommodated into the production and consumption model, even though by ignoring the long-term impact for production and consumption it is not met but also ignores the social costs that should be borne by the impact recipient (PAHRODF, 2017).

Biogas is a combustible gas that is produced from the decomposition process of organic materials by bacteria that live in conditions without oxygen. From these problems, it is necessary to utilize tofu waste properly and can provide added value from waste. Sewage treatment systems or reactors have the advantage of reducing bad odors and preventing the spread of disease (Solly & Lubis, 2019).

In this case, previous research needs systematic planning in order to be able to see the value of less and more in order to create a good use of waste, as well as the impact on human life and ecosystems. Biogas is one of the energy technology solutions to overcome community difficulties due to rising fuel prices (Sahari et al., 2013). Based on previous experience the use of biogas energy is very helpful because the energy is environmentally friendly and renewable (Solly ARyza, Muhammad Irwanto, 2016). The management system in planning greatly affects the cost and time so that the desired function can be achieved. To increase development time and reduce costs is to find solutions, namely the need for science and technology in various fields (Shaija & Elizabeth, 2016). A feasibility study on the utilization of tofu factory waste into biogas is a prospect that involves a number of investment feasibility studies on financial aspects that are useful for identifying alternatives to be developed (Nurillah, 2014). Several other aspects are considered to see whether or not the biodigester is feasible from engineering and environmental aspects.

2. METHOD

2.1 Digester Planning

Making biogas, as in principle, is the anaerobic or closed decomposition of organic matter from free air to produce gas, which is mostly flammable methane and carbon dioxide. Determination of the model based on needs and costs (5), based on other interests the choice of reactor size is the availability of waste not paying attention to the family or gas (2).

The budget plan is a plan for a building in the form and benefits of its use along with the amount of costs required and the arrangement of implementation in administration and work techniques (9). Efficiency in development is based on the amount of biogas volume that has been previously surveyed and already knows the amount of liquid waste that comes out/discharged every day so that the price of biogas is also economically competitive.

2.2 Production Cost and Biogas Capacity

Production costs of making this tofu is a self-owned factory so that production costs are more efficient. The results of a survey that has been carried out previously by researchers, the amount of tofu production every day is 120 kg of milled soybeans. The fixed cost component of tofu production consists of costs for the purchase of winnowing filters, tubs, molds, buckets, bodies, machines, mills and sieves. To find out the amount of waste capacity, the coefficient of waste = 9.46 liters/Kg and tofu waste of 90 liters = 0.08204 is obtained by the formula Waste Capacity = Waste Coefficient x Total Soybeans (10)(11).

The research method used in this study is gradually starting from a survey of the research site, observation, literature study/previous research and interviews with an academician/and a developer or owner of a tofu factory in the village. A development feasibility study is a research on whether or not a project (investment) can be implemented successfully (13).

2.3. Environmental analysis

As a continuation of the improvement of research in terms of adverse effects and good effects of biodigester development for the environment and the surrounding community that is safe and economical.

3. RESULTS AND DISCUSSION

3.1. Cover Lagoon Anaerobic Reactor (colar)

The total production of tofu with the amount of soybeans is 120 kg, according to the capacity obtained by the survey, the digester selected is a cover lagoon anaerobic reactor (colar) / modified closed anaerobic reactor with a portable model with a capacity of 200 L. place/land only need 5 mx 3 m = 15 . Technically, this type of reactor is a modification according to the location of the tofu factory which has previously been surveyed based on a safe and economical reactor. In terms of input and output systems, tofu liquid waste is accommodated in tank 1 after the anaerobic process, biogas will enter in tub 2, the results of methane will be seen on the monometer in tub 2.

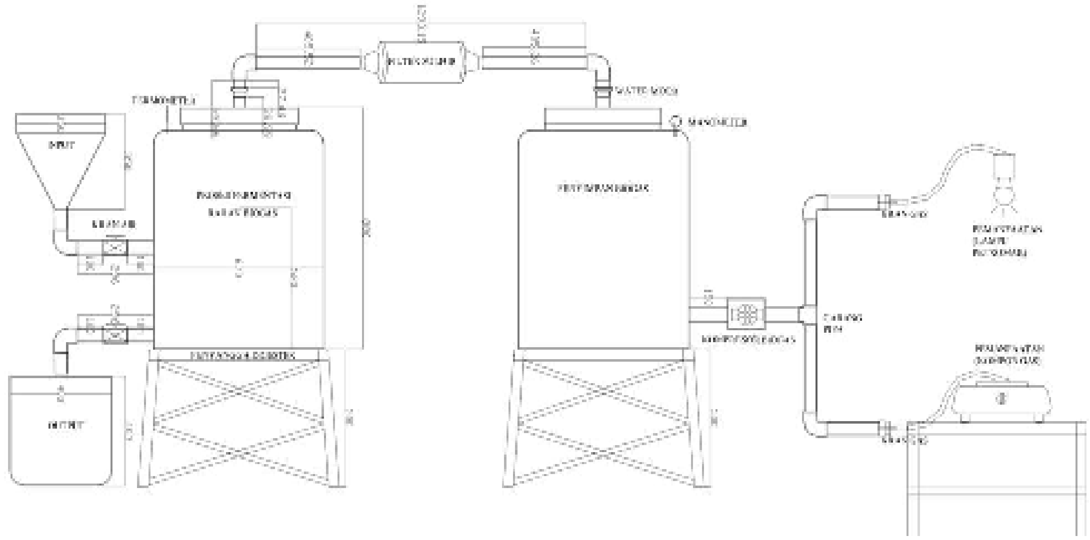

Figure 1. Tofu Liquid Waste Digester Design(12)

3.2 Detailed Description of the Budget(15)

From the survey results that have been carried out previously, the details of the cost budget obtained material costs of Rp. 2,123,000 and operating costs Rp. 178,000 with a statement that the cost of land is the land itself, not buying and not renting with the value of Rupiah. 0.

Table 1. Description of the Details of the Budget(12)

No	Job description	Specification	Volume	Price Unit(Rp)	Total Price(Rp)
I	Material Cost				
1	Initial Reservoir Bak	200 L	1	220,000	220,000
2	2nd Container	150 L	1	180,000	180,000
3	Funnel	Currently	1	5,000	5,000
4	Keni	1/2Inc	1	5,000	5,000
5	Bak support	Fruit	1	400,000	400,000
6	Manometer	Fruit	1	60,000	60,000
7	Digital Thermometer	Fruit	1	45,000	45,000
8	Disulfurliser	Kg	1	75,000	75,000
9	Mini Compressor	20 watts	1	850.000	850.000
10	Flexible gas	meters	3	15,000	45,000
11	Solatape	Fruit	4	2,000	8.000
12	Palf	1/2 Inch	2	12,000	24,000
13	gas faucet	1/2 Inch	1	20,000	20,000
14	shock draught	1/2 Inch	3	2,500	7,500
	shock draught	1 Inch	2	4,000	8.000
16	shock drat inside	1/2 Inch	1	6,500	6,500
17	Pipe	1/2 Inch	1	5,000	5,000
18	Pipe	1 inch	1	7,000	7,000
19	joss gas stove	Fruit	1	55,000	5,000
20	gas hose clamp	Fruit	6	1,500	9,000
21	pipe glue	Fruit	2	8.000	16,000

JURNAL INFOKUM, Volume 10, No.3, Agustus 2022 ISSN : 2302-9706

22	drum nut	1 Inch	2	10,000	20,000
23	drum nut	1/2 Inch	3	10,000	30,000
24	frying pan	Fruit	1	22,000	22,000
		Amount			2,123,000
II	Operating costs				
25	Workers' wages	Person	2	50,000	100,000
26	Electricity	20 watts	12	6,500	78.000
27	land/ land		5x3	15	-
		Total number			2,301,000

3.3 Production cost and capacity

Researchers have conducted previous surveys and obtained values and descriptions of fixed costs.

Table 2. Fixed costs of biogas unit production(12)

No	Description	Unit	Price(Rp)	Amount(Rp)
1	Digester Unit	1	2,123,000	2,123,000
2	Show Filter	2	824,000	1,772,000
3	Bucket	5	180,000	900,000
4	Filter	2	213,600	427,200
5	Milling	1	6,000,000	6,000,000
6	Print	2	412,800	825,600
7	Heating Furnace	55	73,800	4,059,000
	Total number			16,056,800

3.4 Amount of biogas

Waste Capacity = Waste Coefficient x Amount of Soybean
= 9.46 x 120= 1.135 Lt/day - 300 Lt (tofu production process the next day)
= 1.135-300 =0.835

Amount of Biogas = 835/90 L (11) x 0.08204
= 9.28 x 0.08204 = 0.76 /day

So, the biogas produced from the production of 120 kg tofu is 0.76

3.5 Biodigester feasibility study

Technical analysis

The type of biogas reactor installation chosen is a modified Cover Lagoon Anaerobic Reactor (Colar) with a capacity of 200 L. The selection of this Biodigester is the result of survey conducted on the previous day While the land area after the survey analysis technically, the area of the tofu factory production area is 12.5m x 15m = 187.5 .

Economic Analysis

Year-end depreciation= Depreciation percentage x fixed investment
= 10% x Rp16,056,800
= Rp 1,605,680

Depreciation value/year = IDR 16,056,800 – 1,605,680/5
= IDR 2,890,224

Table 3. Calculation of depreciation using linear method

year-	Final score Depreciation(Rp)	Score Depreciation(Rp)
0	16,056,800	2,890,224
1	13,166,576	2,890,224
2	10,276,352	2,890,224
3	7.386128	2,890,224
4	4,495,904	2,890,224
5	1,605,680	2,890,224

Determining the cost of goods sold
Total Cost = Depreciation + Operating Costs/year
= IDR 2,890,224 + 2,136,000
= IDR 5,026,224,-
Hpp = Tc per year / gas production capacity per year
= Rp5.026,224 / (0.76 x 30 x 12)
= Rp5.026,224 / 273.6
= IDR 18,371,000,- /
So, the price of biogas / IDR 18,371,000,-
It is assumed that sales will be Rp. 20,000,000,-/
Gas profit/Th = price of biogas x amount of biogas / year – operating costs per year
= (20,000 x 273.6) – 2,136,000
= IDR 5,472,000 – IDR 2,136,000
= Rp. 3,336,000.00,-

Table 4. Net Present Value

Th ke	Discount Factor 6%	Cash In(Rp)	PV(Rp)
0	1	-	3,336,000
1	1.75	3,336,000	1,906,286
2	3.0625	3,336,000	1,089,306
3	5.359375	3,336,000	622,461
4	9.37890625	3,336,000	355,692
5	16,4130859	3,336,000	203.252
	NPV =		7,512,997

So, the Net Present value of Rp. 7,512,997, - is said to be feasible because it has a positive value.

Profitability Index = Typical inflow value (NPV) / Investment Value
= 7,512,997 / 2,301,000
= 3.2

Table 5. Discount Factor IRR

Discount Factor (i)%	P/a	Ab(Rp)	Investment(Rp)	Npv value(Rp)
3	5	3,336,000	2,301,000	12,976,879
10	3.7908	3,336,000	2,301,000	10.345.109
12	3.6048	3,336,000	2,301,000	9,724,613
20	2.9906	3,336,000	2,301,000	7,675,642
25	1.5077	3,336,000	2,301,000	2,728,687

The NPV at the prevailing interest rate is generally positive and there is no IRR.
Payback period(PP) = Total Value of Investment/ Profit 1 Year
= 2,123,000+(178,000x12)/3,336,000
= 4,259,000/3,336,000
= 1.3 (1 year, 3 months)/ return on investment

Table 6. Payback period

Year	Cash Flow(Rp)	Accumulation(Rp)
0	-2,301,000	-2,301,000
1	3,336,000	1,035,000
2	3,336,000	4,371,000
3	3,336,000	7,707,000
4	3,336,000	11,043,000
5	3,336,000	14,379,000

From the information above, it shows that the first year has made a profit, so the investment is feasible.

Environmental Analysis

It shows that the waste generated from the biodigester is not harmful but the smell produced is a little foul but the amount after the outer construction of the biodigester is less. For the handling of the outer waste of the biodigester, a closed pipe/drainage line is made directly to the final disposal site or a closed septic tank.

4. CONCLUSION

Based on the formulation of the problem and the research that has been done, the conclusion from the research is that the type of biogas reactor installation chosen is a modified Cover Lagoon Anaerobic Reactor (Colar) with a capacity of 200 liters with a detailed budget of Rp. 2,301,000,-. With the hpp method for a production capacity of 120 kg removing liquid waste 835 days can produce 0.76 biogas at a price of Rp 20,000, - / .

Based on the feasibility analysis, the NPV value = Rp. 7,512,997,- (positive value), Pi = 3,2 >>1 (in the investment term), for IRR with the conclusion that the calculation of the generally accepted interest rate NPV is positive and no IRR and Payback period of 1.3 years are found This means that the investment has returned to its capital (positive NPV) after 1 year 3 months 18 days.

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