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Project Feasibility Study of PLN Electricity Installation in Palm Oil Mill

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Abstract

PT. X is a Palm Oil Mill in North Kalimantan with 60 tons/hour operating capacity. PT. X processes Fresh Fruit Bunch from its own plantation into Crude Palm Oil and Palm Kernel. In its operational activities, PT. X requires electricity to operate production machines, lighting, and other operational needs. Currently, the electricity requirement for its operations uses 2000 kVA Steam Turbine with 400 kVA and 1029 kVA Generators. However, using generators requires high costs, especially diesel costs. Therefore, PT. X is considering other alternatives to reduce electricity costs by installing electricity from PT Perusahaan Listrik Negara (PLN). The PLN electricity installation project at PT. X requires expensive investment costs, for the cost of the cost of building PLN substations, customer substations, and installing electrical devices and digging cables. The project feasibility study is required based on non-financial and financial aspects. Based on non-financial aspects (legal, environment, technical, and management), using PLN electricity is more profitable than using generator. Project feasibility study of the financial aspect calculated in 10 years period. Based on the financial aspect, the Internal Rate of Return (IRR) is 72.2%, Net Present Value (NPV) is Rp. 17,285,538,368.50, Payback Period (PP) is 2 years, and Return on Investment (ROI) is 133.05%. So, this PLN electricity installation project is feasible and profitable for the Palm Oil Mill.

Keyword: *Feasibility Study, PLN Electricity Installation, Palm Oil Mill.*

INTRODUCTION

As the largest palm oil producing country in the world, Indonesia contributes 54% or around 35 million tons of the total 64 million tons of world palm oil production (Tsabita, 2021). This position beats Malaysia which is in second place as the world's palm oil producer. This shows that Indonesia has a very important role in the world palm oil market. Palm oil management in Indonesia is spread across 26 provinces, which 34.36% is

managed by smallholder plantations, 5.00% is managed by large state plantations, and 60.64% is managed by large private plantations (Kementan, 2023).

Crude Palm Oil (CPO) is produced from Fresh Fruit Bunches (FFB) which are processed in Palm Oil Mill (Stephanie, Tinaprilla, & Rifin, 2018). PT. X is a Palm Oil Mill in North Kalimantan with 60 tons/hour operating capacity. In its operations, PT. X requires electricity to operate production machines, lighting, and other operational needs. Currently, the electricity requirement for its operations uses a 2000 kVA Steam Turbine, 400 kVA and 1029 kVA Generators. However, the fuel cost for genset operation is very high, which is Rp. 3,597,322,182.00 per year in 2023. PT. X is considering other alternatives to reduce electricity costs by installing electricity from PT. Perusahaan Listrik Negara (PLN).

By using PLN electricity, PT. X will eliminate high generator operating costs, especially diesel costs. However, the PLN electricity installation project requires expensive investment costs. This investment cost includes cost of the cost of building PLN substations, customer substations, and installing electrical devices and digging cables. In addition, PLN electricity rates must also be considered. Therefore, the feasibility study is needed for this project. Management needs to analyze in order to make the right investment and financing decisions (Dewi & Darma, 2019). The feasibility study of this project includes financial and non-financial aspects (legal, environmental, technical and management aspects).

Project Feasibility Study

Project Feasibility Study is a way to obtain an investment assessment indicator to determine whether it is feasible to run or not and whether it requires a quick or long return on investment (Rasid, 2020). Purnomo said that feasibility study is a consideration in making a decision, whether to accept a planned project idea or reject it. The definition of feasible in the assessment of a feasibility study means the possibility of the project to be implemented can provide benefits, either in the sense of financial benefits or social benefits (Purnomo, Riawan, & Sugianto, 2017). The aspects of the feasibility study are shown below.

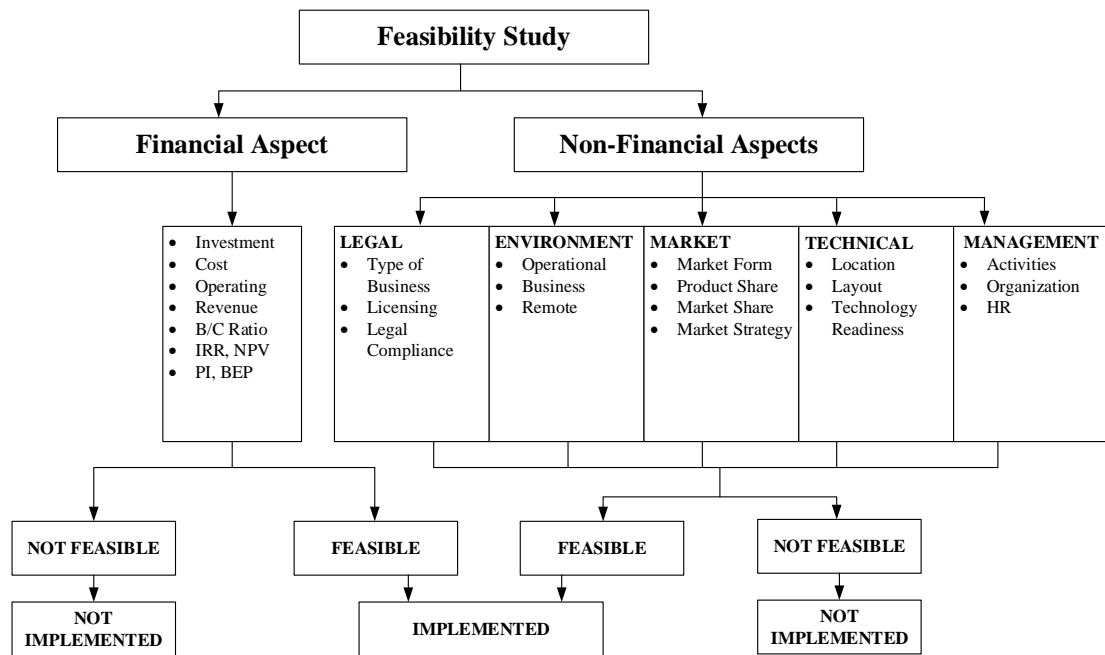


Figure 1. Aspects of feasibility study (Purnomo, Riawan, & Sugianto, 2017)

Legal Aspects

By analyzing the legal aspects, we can analyze the legal feasibility of the business, the form of legal entity with the business idea to be implemented, and the ability of the proposed business to meet licensing requirements.

Environmental Aspects

The environmental aspect analyzes the suitability of the business idea to the environment, including the operational environment, the near and far environment. In this aspect, the impact of the business on the environment is also analyzed.

Market Aspects

The market aspect analyzes market potential, competition intensity, market share that can be achieved, and analyzes marketing strategies that can be used to achieve the expected market share.

Technical and Technological Aspects

The technical aspect analyzes the technical readiness and availability of technology needed to run a business, such as determining the business location, business layout, selection of equipment and technology.

Management and Human Resources Aspects

The management and human resources aspects analyze the stages of business implementation and workforce readiness.

Financial Aspect

Financial aspect analyzes the amount of investment costs and working capital and

the level of return on investment from the business to be run. The financial aspect can be calculated using investment assessment formulas such as Cash Flow Analysis, Payback Period, Net Present Value, Internal Rate of Return, Benefit Cost Ratio, Profitability Index, and Break Event Point.

Net Present Value (NPV)

Net Present Value (NPV) is the present value of all cash flows from now until the end of the project. The project is accepted if $NPV > 0$ or the largest NPV (Purnatiyo, 2014).

$$NPV = \sum_{t=0}^N A_t \left(\frac{P}{F}, i\%, t \right)$$

NPV = Net present value

A_t = cash flow period 1

i = interest rate

N = useful life

Internal Rate of Return (IRR)

Internal rate of return is the value of the rate of return on investment capital that will make the NPV zero (Rasid, 2020). If $IRR >$ required interest rate, the investment project is feasible. If $IRR <$ required interest rate, the investment project is not feasible.

$$\sum_{t=0}^N R_t \left(\frac{P}{F}, i\%, t \right) - \sum_{t=0}^N E_t \left(\frac{P}{F}, i\%, t \right) - 0$$

R_t = cash flow of receipts in period t

E_t = cash flow of expenditures in period t

i = internal rate of return

N = useful life

Payback Period (PP)

Payback period is the time required to return the initial investment costs (Angray, 2019). If the payback period is smaller than the target return on investment, then the investment project is feasible. If the payback period is greater than the target return on investment, then the project is not feasible (Angray, 2019).

Return on Investment (ROI)

ROI is the rate of return on investment based on profit calculations or a comparison of annual profits to investment funds (Meilian, 2012). The higher the rate of return, the more attractive the project is for investors.

$$\%ROI = \frac{\text{Profit after tax}}{\text{Total investment}} \times 100\%$$

PLN Electricity Tariffs

According to ESDM Regulation No. 28 of 2016, electricity tariffs are electricity tariffs for consumers provided by PT. PLN (Persero). PLN electricity rates are determined based on tariff groups (ESDM, 2016). Based on payment, electricity rates are grouped into regular and prepaid electricity rates. Basic Electricity Rates for Industrial consist of:

1. Small industrial and household industries at low voltage, with a power of 450 VA to 14 kVA (I-1/TR);
2. Medium industrial purposes at low voltage, with a power above 14 kVA to 200 kVA (I-2/TR);
3. Medium industrial purposes at medium voltage, with a power above 200 kVA (I-3/TM);
4. Large industrial purposes at high voltage, with a power of 30,000 kVA and above (I-4/TT),

Table 1. Basic Electricity Rates for Industrial (ESDM, 2016)

Tariff group	Power Limit	Reguler		Prepaid (Rp/kWH)
		Load cost (Rp/kVA/Month)	Usage Cost (Rp/kWH) & kVArh Cost	
I-1/TR	450 VA to 14 kVA	*)	1,112	1,112
I-2/TR	14 kVA to 200 kVA	**)	WBP Block = $K \times 972$ LWBP Block = 972 kVArh = 1,057****)	-
I-3/TM	above 200 kVA	**)	WBP Block = $K \times 1,115$ LWBP Block = 1,115 kVArh = 1,200****)	-
1-4/TT	30,000 kVA & above	***)	WBP & LWBP Block = 1,191 kVArh = 1,191****)	-

Notes:

*) Minimum Bill (RM) Applied.

$$RM1 = 40 (\text{On Hours}) \times \text{Connected Power (kVA)} \times \text{Usage Fee}$$

***) Minimum bill (RM) applied.

$$RM2 = 40 (\text{On Hours}) \times \text{Connected power (kVA)} \times \text{LWBP usage fee.}$$

****) Minimum bill (RM) applied.

$$RM3 = 40 (\text{On Hours}) \times \text{connected power (kVA)} \times \text{WBP and LWBP usage charges.}$$

$$\text{On Hours} = \text{kWh per month: connected kVA}$$

****) Excess reactive power usage (kVArh) charges are imposed if the average power factor each month is <0.85 .

K = Comparison factor between WBP and LWBP according to the characteristics of the local electrical system load ($1.4 \leq K \leq 2$), determined by PT PLN (Persero).

WBP = Peak Load Time

LWBP = Off Peak Load Time

RESEARCH METHOD

The data collection method in this study is below.

1. Survey

Data collection through direct surveys to obtain an overview of the problem being researched.

2. Document Analysis

Collecting historical data including PLN investment costs, electricity consumption, and generator operating costs.

3. Focus Group Discussion

Qualitative data collection methods and techniques by group interviews, where a group of people discuss the problem being researched. In this study, 3 experts were selected who had experience and understanding related to this project.

4. Literature Review

Literature review is a technique for collecting information about problems and methods that are relevant to research from journals, books, internet sites, etc.

Figure 2 briefly describes the steps of this research.

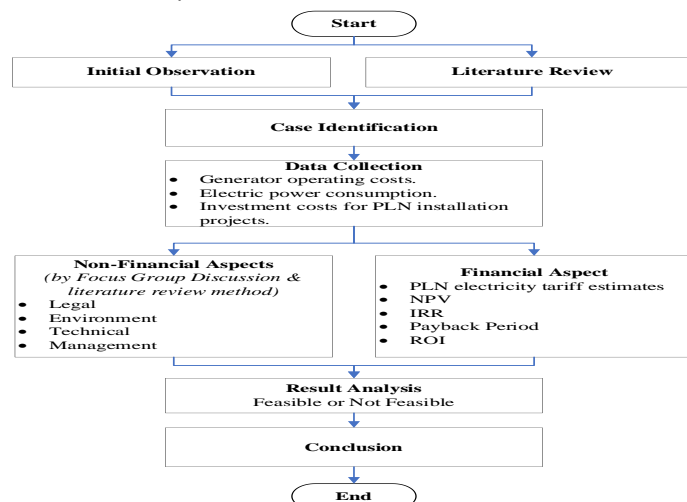


Figure 2. Flowchart of Research Steps

RESULT AND DISCUSSION

Feasibility study of non-financial aspects

The feasibility study of non-financial aspects was conducted by comparing the use of generators and PLN in some aspects including legal, environmental, technical, and management aspects. In this case, the legal aspect includes licensing, the environmental aspect includes the impact on the environment, the technical aspect includes the operation of technology, and the management aspect includes human resources, operations, and maintenance, where these aspects will also affect the financial aspect. Feasibility study of non-financial aspects through focus group discussions with experts and literature studies. Three experts were selected who had experience, knowledge, and were directly involved in the PLN electricity installation project at the Palm Oil Mill. The feasibility study of non-financial aspects is shown below.

Tabel 2. Feasibility Study of Non-Financial Aspects

Aspect	Use of Generators	Use of PLN
Legal	Must have an Operational Certificate (SLO) from ESDM and must be renewed every 5 years. According to ESDM Regulation No. 12 of 2019, generators with a capacity of more than 500 kVA are required to have an SLO. The validity period of the SLO for generators based on ESDM Regulation No. 12 of 2021 is 5 years.	It is mandatory to have an Operational Certificate (SLO) from ESDM for new electrical installations with a permanent validity period, which is regulated in ESDM Regulation No. 27 of 2017 concerning the level of service quality and costs related to the distribution of electricity by PT PLN (Persero).
	Inspection at least once a year by the Department of Manpower, in accordance with the Minister of Manpower Regulation No. 38 of 2016.	No inspection required by the Department of Manpower.
Environment	Emission testing must be carried out once a year, according to the Regulation of the Minister of Environment and Forestry No. 11 of 2021.	There is no obligation for emission testing.
	Higher Greenhouse Gas (GHG) risk.	Lower Greenhouse Gas (GHG) risk.
Technical	The operation is more complicated so it	Operation is only for on/off of

	requires operators with special skills proven by SIO and must be renewed every 3 years.	the main MCB. Operator does not require SIO.
Management	Requires 2 operators on each shift.	Only 1 operator is required for each shift.
	Routine maintenance every 250 running hours or at least once a month.	There is no routine monthly maintenance.
	Overhaul every 10,000 running hours or every 4 years.	Transformer maintenance once a year.
	Using diesel fuel.	Pay electricity bills to PLN.

Feasibility study of financial aspects

From the historical data collection, it was obtained that the average power consumption of PT. X is 649,228 kWh/year, the fuel consumption cost is Rp. 3,597,322,182.00/year and the generator maintenance cost is Rp. 246,963,605.00. Operation of generator (existing) by 2 operators x 2 shifts with total salary of Rp. 275,713,944.55/year. From the data, the estimated annual operating costs of the generator can be calculated.

The budget plan for the PLN installation project in PT. X was prepared with total estimated cost of Rp. 4,908,904,156. This cost includes the cost of building PLN substations, customer substations, and installing electrical devices and digging cables. Project feasibility study of the financial aspect will be calculated in 10 years period.

To determine the financial feasibility, it is necessary to calculate the total operational costs of the using generator and PLN for 10 years. The estimated total operational costs of the using generator for 10 years is Rp. 55,789,745,737.85. This cost includes the cost of SLO, inspection, emission test, SIO and salaries of 4 operators, monthly maintenance, overhaul, and fuel consumption. Cash flow in the PLN installation project is the elimination of the generator operating costs, due to the generator will not to be operated after the PLN installation.

To calculate the estimated of using PLN costs for 10 years, first calculate the estimated PLN electricity tariff.

Total kWh = 649,228.00 kWh/year

Average operating hours = 20 hours (06.00 am to 02.00 am)

Peak Load Time (WBP) = 4 hours (5 pm to 8 pm and 1 pm to 2 pm)

Total Load WBP = 129,845.60 kWh/year

Total Load LWBP = 519,382.40 kWh/year

Total electricity tariff WBP = Rp. 289,555,688.00/year

Total electricity tariff LWBP = Rp. 579,111,376.00/year

Total electricity tariff = Rp. 868,667,064.00/year

Total Electricity Tariff + PPJ 3% = Rp. 894,727,075.92/year

Total electricity tariff + PPJ for 10 year period is Rp. 14,259,645,310.95 with an estimated 10% growth/year. The operational cost of using PLN for 10 years, is made by calculating the SLO cost, salary of 2 operators, monthly maintenance, annual maintenance, and electricity tariff + PPJ. From the calculation results, total cost of using PLN for 10 years is Rp. 17,917,714,605.39.

In the financial aspect feasibility study, several parameters were calculated including Internal Rate of Return (IRR), Net Present Value (NPV), Payback Period (PP), and Return on Investment (ROI). From the analysis, the Internal Rate of Return (IRR) was 72.2%, Net Present Value (NPV) Rp. 17,285,538,368.50, Payback Period (PP) 2 Years, and Return on Investment (ROI) 133.05%.

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Based on the financial aspect, the PLN electricity installation project is feasible.

CONCLUSION

Based on the research, it is known that the PLN electricity installation project at PT. X is feasible. Based on non-financial aspects, the use of PLN is more profitable than the use of generators. From a legal aspect, the use of generators requires an SLO that needs to be extended every 5 years and a minimum test check once a year, while the use of PLN only requires an SLO once forever. From an environmental aspect, the use of generators must undergo an emission test every year and has a higher risk of greenhouse gases, while the use of PLN does not require an emission test. Based on technical aspects, the operation of PLN electricity is easier than the operation of generators. Meanwhile, in terms of management, the use of PLN electricity requires less manpower and does not require monthly maintenance.

Based on financial aspects including Internal Rate of Return (IRR), Net Present Value

(NPV), Payback Period (PP), and Return on Investment (ROI), the PLN electricity installation project is feasible because it can provide benefits for the company.

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