Investment Project Analysis of Addition 30 MW New Gas Engine Power Plant for Electricity Sustainability in Batam (Case Study: PT. PLNB)

Review of Integrative Business & Economics Research

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ABSTRACT

The Batam-Bintan electricity system is an integrated electric power system where power plants with distributed load centers are connected to one another on Batam Island and Bintan Island (the largest load center is in Batam city), with peak loads that have ever occurred in 2020 is 488.5 MW on March 2020. Over the last 5 (five) years (2016-2020) the average growth of electricity consumption in Batam-Bintan is 7.83% with a Reserve Margin of 20% in 2020. With consideration of the realization of this growth and availability of reserves and the end of Power Purchase Agreement 17.4 MW in December 2019, so to maintain the adequacy and reliability of the electricity supply, a new power plant with a capacity of 30 MW is needed which is expected to be COD in 2020. By using the Capacity Factor (CF) assumption of 70% and the price of gas 6.9 USD / MMBTU, it can be seen that for this type of Gas Engine Power Plant it has basic cost of electricity supply IDR. 1,146 / kWh. Methodology that uses the writer are external analysis to define growth of electricity, assumption the data to define investment the project and use Monte Carlo Analysis for sensitivity analysis.

Keywords: growth of electricity, reserve margin, capacity 30 MW, basic cost of electricity supply

1. INTRODUCTION

The Batam-Bintan electricity system is an integrated electric power system where power plants with distributed load centers are connected to one another on Batam Island and Bintan Island (the largest load center is in Batam Island), with peak loads that have ever occurred in 2020 is 488.5 MW on March 2020.

The basic load of the Batam Bintan system is currently served by PLTGU Tj Uncang 120 MW, and IPP generators namely PLTU Tj Kasam 2 x 55 MW, PLTGU MEB 82 MW, PLTGU DEB 82 MW, and PLTU CTI 12.5 MW in Bintan. Medium load and peak load are served by PLTG ELB 70 MW (IPP), PLTMG Panaran 3x8 MW owned by PLN Batam, PLTMG Kabil 17.4 MW owned by IPP with natural gas and oil-fueled generators (PLTD HSD, MFO owned by PLN Batam).

Over the last 5 (five) years (2016-2020) the average growth of electricity consumption in Batam-Bintan is 7.83% with Average Reserve Margin of 15% (similar with 90MW) in 2020. With consideration of the realization of this growth and availability of reserves and the end of PJBTL PLN Batam with PT IMP is 17.4

MW in December 2020, so to maintain the adequacy and reliability of the electricity supply, a new generator with a capacity of 30 MW is needed which is expected to be COD in 2021. The plant will act as a peaker so that it must have characteristics that can operate independently. flexible and has a fast lean

2. LITERATURE REVIEW

2.1 Net Present Value

According to Modigliani – Miller, Net Present Value (NPV) is defined as present value of all cash flow minus Initial Investment (Dr. Rodney Boehme:nd). The NPV method is important for the investors because it takes into account the time value of investor's money (Gitman, L.J and Chad I.Z, 2012). The NPV method is the investors expect a return on the money that they spent for the project. The rule is when the present value of cash flow positive as well as negative in project is greater than the cost of making the first place. As the result, the project will return success to meet investor's expectations and will increase the project value.

Function:
NPV is employed to conclude accept – reject decision with criteria as follows:

- If the NPV is less than $0, reject the project
- If the NPV is greater than $0, accept the project (Gitman, 2009:430)

Strength:

- Cash flows assumed to be reinvested at the hurdle rate
- Account for time value of money – Consider all cash flows

Weaknesses:

- May not include managerial options embedded in the project

The formula:
NPV = Present value of cash inflows – Initial Investment (CFo)

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - CF_o$$

$$NPV = \sum_{t=1}^{n} (CF_t \ x \ PVIF_{r,t}) - CF_o$$

2.2 Internal Rate of Return

Definition: Internal Rate of Return (IRR) is the discount rate that equates the NPV of an investment opportunity with $0; it is the rate of return that the firm will earn if it invests in the project and receives the given cash flows.
Function:
To determine the compound annual rate of return that the firm will earn if they investing in projects and receives a given cash inflow.
Strengths:

- Account for time value of money - Considers all cash flows - Less subjectivity

Weaknesses:

- Assumes all cash flows are reinvested at the Internal Rate of Return (IRR)
- Difficulties with project ranking and multiple IRRs

$$\$0 = \sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} - CF_o$$

2.3 Pay Back Period

Definition: Payback Period (PBP) is the amount of time required for a firm to recover its initial investment in a project, as calculated from cash inflows
Function: Payback period is factored in to make accept-reject decision based on the following criteria:

- If the PBP is shorter than the maximum acceptable payback period, accept the project
- If the PBP is longer than maximum acceptable payback period, decline the project

Strengths:

- Easy to use and understand - Can be used as a measure of liquidity

Weaknesses:

- Does not account for time value of money - Does not consider cash flows beyond the payback period (PBP) - Cutoff period is subjective

Formula:

PBP = (Last year with a negative NCF) + (Absolute Value of NCF in the year/Total Cash Flow in the following year)

2.4 Weighted Average Cost of Capital (WACC)

Suppose a firm uses both debt and equity to finance its investments. If the firm pays R_B for its debt financing and R_S for its equity, what is the overall or average cost of its capital? The cost of equity is R_S, as discussed in earlier sections. The cost of debt is the firm's borrowing rate, R_B, which we can often observe by looking at the yield to maturity on the firm's debt. If a firm uses both debt and equity, the cost of capital is a weighted average of each. This works out to be:

$$\frac{S}{S+B} \times R_S + \frac{B}{S+B} \times R_B$$

The weights in the formula are, respectively, the proportion of total value represented by equity:

$$\left(\frac{S}{S+B}\right)$$

and the proportion of total value represented by debt:

$$\left(\frac{B}{S+B}\right)$$

This is only natural. If the firm had issued no debt and was therefore an allequity firm, its average cost of capital would equal its cost of equity, R S . At the other extreme, if the firm had issued so much debt that its equity was valueless, it would be an all-debt firm, and its average cost of capital would be its cost of debt, R B .

Interest is tax deductible at the corporate level, as stated in the previous section. The after-tax cost of debt is:
Cost of debt (after corporate tax) = R_B x (1 - t_C)
where t_C is the corporation's tax rate.

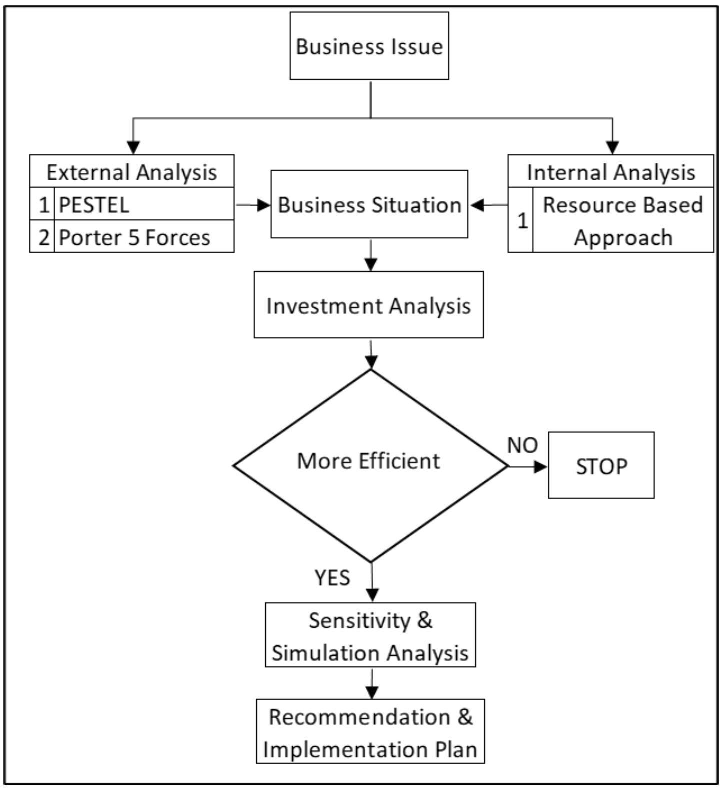
Assembling these results, we get the average cost of capital (after tax) for the firm:

$$\text{Average cost of capital} = \left(\frac{S}{S+B}\right) \times R_S + \left(\frac{B}{S+B}\right) \times R_B \times (1 - t_C)$$

Because the average cost of capital weighs the cost of equity and the cost of debt, it is usually referred to as the weighted average cost of capital, R_{WACC}, and from now on we will use this term.

3. RESEARCH METHODOLOGY

The first step in this research after knowing the existence of a business issue is conducting an environmental scanning. External analysis is conducted to determine the opportunities and threats that exist outside the company, while Internal Analysis is conducted to determine the strengths and weaknesses of the company. Apart from environmental scanning, it is also necessary to deepen the theory regarding investment analysis. The result of environmental scanning is that the company knows the right strategy to stay in a strategic position in the industry it is doing.



Investment Analysis is conducted to answer business issues. The selection of the right payment scheme options is made from the results of the investment analysis. The payment scheme that will be chosen for sensitivity analysis and simulation analysis is a payment scheme that provides a larger NPV value or in other words, which provides greater cost savings for the company.

Recommendation and implementation contain a project schedule that is specifically related to business issues only (selection of payment schemes), while in the recommendation section the author tries to present answers to research objection and recommendations for the continuation of this research if any

4. RESULTS

In estimating the Estimated Engineering Price for the 30 MW Gas Engine Power Plant (named *PLTMG Baloi*), the approach taken is to use financial modeling, where in the financial model used will use the DCF (Discounted Cash Flow) approach, which in this approach will compare between the costs required for this project (investment costs, O&M costs, etc.) and cash flow projections in the future, which will be analyzed on a present value basis using a discount rate.

The results of calculations in the financial model used are in the form of units of Rp/kWh, which consists of several tariff components as follows:

- **Component A (Capital Recovery)**
  This component is a tariff component that considers the return-on-investment costs from a power plant. The rate value for Component A will be calculated based on the specified investment analysis parameters.
- **Component B (Fixed O&M Cost)**
  This component is a tariff component that takes into account fixed O&M costs at the time the power plant operates commercially.

- **Component C (Fuel Cost)**
  This component is a tariff component that takes into account the cost of fuel (gas) when the power plant operates commercially.
- **Component D (Variable O&M Costs)**
  This component is a tariff component that takes into account the variable O&M costs when the plant is operating commercially.

From the tariff components above, the estimated budget in the Estimated Engineering Price (EEP) for the *PLTMG Baloi* is only for components A, B and D. While component C is not included, due to the assumption of fuel supply (Gas) is from PLNB

In forming the financial model used, it takes some data and assumptions (technical aspects, commercial aspects, and other aspects) related to the project that need to be described. The data and assumptions used are based on the results of joint discussions that have been carried out for the finalization of this EEP calculation, with reference to references to similar projects or other reference data

Notes:

1. Assume the exchange rate (USD ± Rp and EUR ± Rp) using the BI middle rate as of July 29, 2019 (1 USD = Rp. 14,010 and 1 EUR = Rp. 15,598).
2. The assumption of Gross Output Unit in the above calculation is 33.96 MW.

No.	Deskripsi	Total
		Eq. Rp
I	CIVIL WORKS	51,183,264,175
I.1	Civil and Structural Works excluding piling works	47,774,352,175
I.2	Piling Works	3,408,912,000
II	MECHANICAL WORKS	257,982,198,514
II.1	Gas Engine	230,594,813,319
II.2	Plant Water Sytem	320,970,980
II.3	Waste Water Treatment System	2,756,968,645
II.4	Fire Protection System	2,878,533,735
II.5	Compressed Air System	8,509,031,426
II.6	Laboratory and Laboratory Equipment	-
II.7	Air Conditioning and Ventilation System	354,088,587
II.8	Crane and Hoist	2,635,403,554
II.9	Workshop and Machinery Equipment	-
II.10	Gas Fuel System	9,932,388,268
II.11	Horizontal Centrifugal Pumps	-
II.12	Fuel Oil Storage Tank and Handling (N/A)	-
II.13	Nitrogent Storage (N/A)	-
II.14	Mobile Equipment	-
III	ELECTRICAL WORKS	46,828,844,767
III.1	Generators and Main Generator Output System	-
III.2	Plant Electrical	11,694,428,210
III.3	Power Transformer	12,395,905,089
III.4	20 kV Switchgear kV Complete Works	20,150,632,104
III.5	Instrumentations and Control	2,587,879,364
IV	OTHERS	-
IV.1	Plant Inspection and Test prior to Completion of EPC Work	-
IV.2	Plant Supervision during the Warranty Period	Include
IV.3	Calculation & Study	-
V	TOTAL	355,994,307,455

Operation and Maintenance (O&M) Fees

The reference price used in estimating O&M costs is to use an estimation approach based on a practical approach, based on comparative data from previous references. The estimated O&M costs are set as follows:

a) Fixed O & M costs per year are assumed to be 3.75% of EPC costs, which is Rp. 13,350,000,000
b) Variable O & M costs per year are assumed to be 1.25% of EPC costs and consider CF = 70, which is Rp. 4,450,000,000.

5. DISCUSSION

The calculation results based on the results of the calculation of the financial model with the DCF (Discounted Cash Flow) approach which has considered the data and assumptions described above, the following results are obtained:

Description	Price	
	c US$/kWh	Rp
Component - A	2.2610	316.76
Component - B	0.5180	72.57
Component - D	0.1511	21.17
Component ABD	**2.9300**	**410.50**

Financial Analysis Parameters.

Description	Unit	Value
IRR Equity	%	13.72%
IRR Project	%	11.10%
WACC	%	8.40%
NPV	Milyar Rp.	59.95
BCR	x	1.17
Payback Period		7 Years 2 Months
DSCR		1.55

During the implementation of the 30 MW PLTMG Baloi, it is possible that there will be an offer of electricity purchase price in Rp/kWh which has a different assumption and calculation approach. The following are the results of sensitivity analysis to the parameters of the assumption of the exchange rate, the results obtained are as follows:

Description	WACC	IRR Equity	IRR Project	NPV (Rp Juta)	BCR	Payback Period		Levelized Tarif (cent$/kWh)	Tarif ABCD (Rp/kWh)	Levelized Tarif ABD (Rp/kWh)
Base Scenario - 1$ = Rp 14.010	8,4%	13,76%	11,10%	59.953	1,17	7 th	2 bln	8,8533	1.240,35	410,5
Base Exchange Raate - 1$ = Rp 13.940 **(- 0,5%)**	8,4%	13,76%	11,10%	59.653	1,17	7 th	2 bln	8,8533	1.234,14	408,44
- 1$ = Rp 14.080 **(+ 0,5%)**	8,4%	13,76%	11,10%	60.253	1,17	7 th	2 bln	8,8533	1.246,55	412,55
- 1$ = Rp 14.150 **(+ 1 %)**	8,4%	13,76%	11,10%	60.552	1,17	7 th	2 bln	8,8533	1.252,75	414,60
- 1$ = Rp 14.220 **(+ 1,5%)**	8,4%	13,76%	11,10%	60.852	1,17	7 th	2 bln	8,8533	1.258,95	416,65

6. CONCLUSION

Based on calculations in the financial model with the DCF approach (Discounted Cash Flow) which have considered, among others:

- Net Power Plant capacity of 30 MW.
- Capacity Factor 70%.
- Power Plant Contract period for 15 years.
- The useful life of the generator is 15 years.
- Exchange rate with an exchange rate of Rp. 14,010/ US$.
- The cost of purchasing assets at the end of the contract period is Rp. 0, which is assumed to use an approach based on the generator residual value at the end of the contract period, which is calculated by considering the useful life of the generator and the power plant contract period, using a depreciation value approach based on the straight-line method.

The result of the cost of purchasing electricity (ABD component) is Rp. 410.50/kWh.

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