

Financial Feasibility Analysis of the Relocation of the 2 X 30 Mw PLTG from East Halmahera to Bintan (Case Study: PT PLN Nusantara Power)

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Abstract. *The growth in electricity demand on Bintan Island shows a significant upward trend, while the current electricity system still relies on the Batam-Bintan interconnection and diesel-based backup generators with relatively high operating costs. To bridge the potential power deficit in the period before the interconnection and new generators are operational, PT PLN Nusantara Power plans to relocate the Haltim ex-Batanghari 2x30 MW gas-fired power plant to the Bintan system. This study aims to analyze the financial feasibility of the relocation project as a basis for investment decision-making. The research used a quantitative descriptive approach based on case studies with a financial feasibility analysis using Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), and Benefit Cost Ratio (BCR) indicators. The analysis was conducted using two electricity selling price schemes: the existing Basic Electricity Tariff (TDL) scheme and a tariff scheme based on the target rate of return on investment (target IRR). Furthermore, a sensitivity analysis was conducted to changes in investment costs, electricity selling price, gas fuel price, capacity factor, and project life to assess the project's financial resilience. The results of the study indicate that in the electricity selling price scheme based on TDL, the relocation project is declared financially unfeasible because it produces a negative NPV, an IRR lower than the Weighted Average Cost of Capital (WACC), and a BCR less than one. In contrast, in the target IRR-based tariff scheme, the project meets the feasibility criteria with a positive NPV, an IRR higher than the WACC, a BCR greater than one, and an investment payback period still within the project's lifespan. However, the results of the sensitivity analysis indicate that the project has a high level of sensitivity to changes in electricity tariffs and gas fuel prices.*

Keywords: *Financial Feasibility; Power Plant Relocation; Sensitivity Analysis.*

1. Introduction

The year-over-year increase in the number of electricity customers indicates a significant increase in energy demand. This situation has limited the margin between system capacity and peak load in some areas, potentially increasing the risk of disruptions if not addressed through capacity additions or optimization of existing assets. As a company mandated to provide national electricity, PT PLN (Persero) continues to develop its electricity system, both through the construction of new power plants and through strategies to optimize existing assets. One area facing power adequacy challenges is the electricity system on Bintan Island, Riau Islands Province, which currently relies on the Batam-Bintan interconnection and diesel generators with relatively high operating costs.

Bintan Island currently has only one main source of electricity, namely the Batam-Bintan interconnection of 115 MW and a diesel reserve of 12.6 MW on Bintan Island, with a total system capacity of 127.6 MW. However, the peak load in 2025 reached 101.46 MW and is projected to continue to increase in the Electricity Supply Business Plan (RUPTL) of PT PLN (Persero) 2025–2034 to reach 217.7 MW in 2033. Power reserves are dwindling from 46.5 MW (2020) to only 26.1 MW in 2025. This condition indicates a dwindling reserve margin and increasing system vulnerability to disruptions, especially with dependence on one main source of interconnection and the use of diesel which has relatively high operational costs.

On the other hand, there is an existing power plant asset in the form of a 2×30 MW gas-fired power plant currently located in East Halmahera Regency, North Maluku Province. The unit is a General Electric (GE) Frame 6 gas turbine type MS6001B that was originally built and operated in 1994 in Paulimo Padang, then relocated to Batanghari in 1997, and in 2022 moved to East Halmahera to support the needs of PT Antam's smelter. However, during its development, the plant has been mostly in standby condition due to the uncertainty of optimal smelter operations. Considering the need for additional power in the Bintan system and the condition of assets that are still technically feasible, PT PLN (Persero) plans to relocate the 2×30 MW PLTG to Bintan and assigns the project implementation to PT PLN Nusantara Power as a generation subholding. The planned construction location is in Kampung Tanjung Kruing Village, Teluk Sasah, Seri Kuala Lobam District, Bintan Regency, Riau Islands, with a land area of approximately ± 5 hectares and is planned to be connected to the existing 150 kV network.

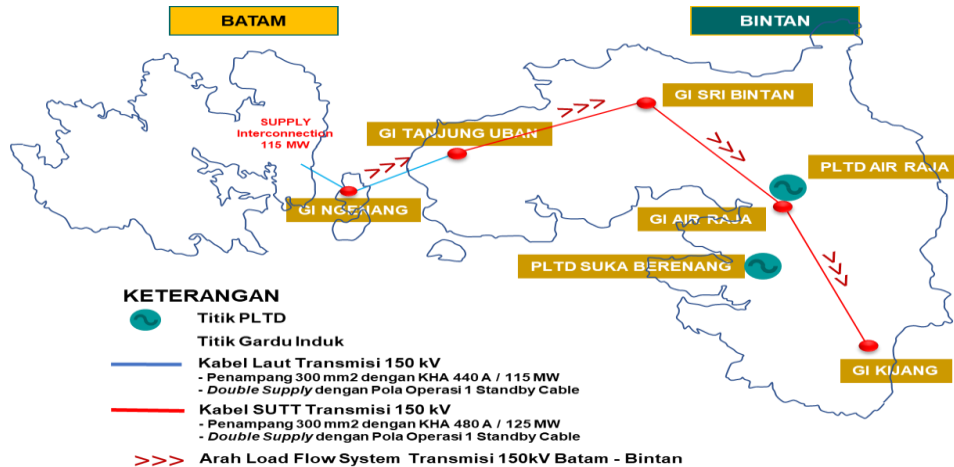


Figure 1.1 Electrical System (Batam-Bintan Interconnection)

In the RUPTL, the construction of the 500 MW Sumatra–Batam–Bintan interconnection is only planned to be operational in 2028, and plans to add new power plants are still in the procurement stage and are planned to be operational in 2026–2030.

2. Research Methods

This research is a descriptive analytical study with a case study approach that uses quantitative financial analysis as the primary evaluation method. The case study approach was chosen because the research focuses on a single, in-depth research object: the relocation project of the Haltim Gas-Fired Power Plant (PLTG) with a capacity of 2×30 MW to the Bintan electricity system.

A descriptive approach was chosen because this study does not conduct experiments or manipulate variables, but rather analyzes existing data, both technical and financial. According to Sugiyono (2018), descriptive research aims to provide a systematic, factual, and accurate picture of the facts and relationships between the phenomena being studied. In this context, the phenomenon being studied is the need for additional power in Bintan and the potential to meet this need through power plant relocation.

3. Results and Discussion

3.1. Identification of Power Needs in Bintan

Currently, the electricity system in Bintan consists of a 150 kV submarine cable interconnection system from Batam and a 20 kV isolated system. The highest peak load in the Bintan system is around 105 MW which will occur in mid-2025. The power supply from the 150 kV Batam-Bintan submarine cable interconnection system itself has a capacity of 115 MW

per circuit with a power capability of around 111 MW. Other power supplies in Bintan are obtained from PLN's Air Raja and Suka Berenang diesel power plants with a total power capability of around 12.6 MW.

The Bintan system's current power requirements are entirely supplied by the Batam electricity system via the Batam-Bintan 150 kV submarine cable interconnection system. The Air Raja and Suka Berenang diesel-powered plants are currently used as backups.

Based on operational load data for June 2025, the peak load reached 105 MW and the minimum load was 64.8 MW. The average load was around 83.4 MW, with a difference between peak and peak loads of approximately 20 MW.

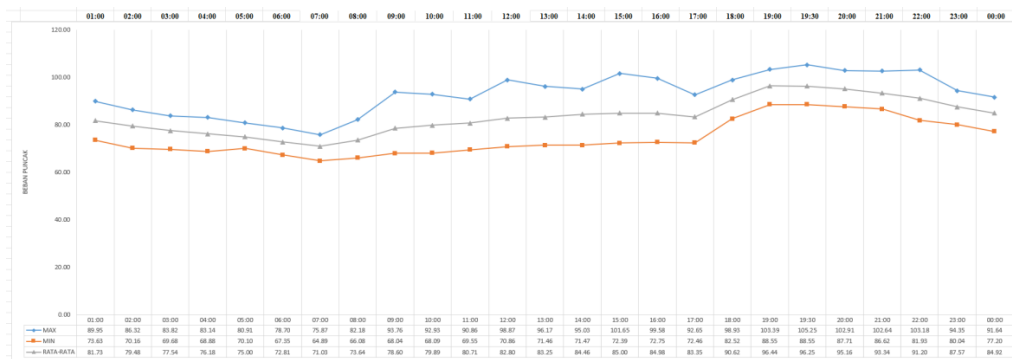


Figure 3.1 Bintan Island Daily Operational Charges June 2025

Additionally, the Bintan system has a waiting list of 18 customers with a total power requirement of 114 MW. However, of these 18 customers, only 10 have a high level of confidence, with a total power requirement of approximately 10 MW.

SEBARAN POTENSI PELANGGAN PULAU BINTAN									
NO	NAMA PELANGGAN	ULP	JENIS PELANGGAN	DAYA LAMA (VA)	DAYA BARU (VA)	KEBUTUHAN DAYA (VA)	TAHUN COD	POSISI WILUS	SUMBER
1	RSUP KEPRI	Bintan Center	TM		415,000	415,000	2027	PLN	RENDAH
2	PT CARINDO JAYA BAHARI	Bintan Center	TR		105,000	197,000	2025	PLN	RENDAH
3	LABORATORIUM DINKES	Bintan Center	TR		197,000	197,000	2025	PLN	TINGGI
4	PT INDOJAYA AGRINUSA (JAPFA) 1	Bintan Center	TR		197,000	197,000	2025	PLN	TINGGI
5	PT INDOJAYA AGRINUSA (JAPFA) 2	Bintan Center	TR		197,000	197,000	2025	PLN	TINGGI
6	PT INDOJAYA AGRINUSA (JAPFA) 3	Bintan Center	TR		197,000	197,000	2025	PLN	TINGGI
7	PT INDOJAYA AGRINUSA (JAPFA) 4	Bintan Center	TR		197,000	197,000	2025	PLN	TINGGI
8	PT MEITEC EKA BINTAN	Kijang	TM		1,100,000	1,100,000	2025	PLN	TINGGI
9	PT JAYANDI MANDIRI SUKSES (TAHAP DUA)	Kijang	TM	41,500	345,000	303,500	2025	PLN	TINGGI
10	PT INDOJAYA AGRINUSA (JAPFA) DINAS PEMBIBITAN	Kijang	TR		197,000	197,000	2025	PLN	TINGGI
11	PT BINTAN CELLULAR INDONESIA (YING FA)	Kijang	TT		40,000,000	40,000,000	2025	BAI	RENDAH
12	OPS PERTAMINA TG UBAN	Tj Uban	TM	5,540,000	6,650,000	1,110,000	2028	PLN	RENDAH
13	PT BINTAN INTI INDUSTRIAL ESTATE (BIIE)	Tj Uban	TM	8,860,000	13,800,000	5,140,000	2027	BIIE	TINGGI
14	PT BINTAN RESORT CAKRAWALA (BRC)	Tj Uban	TM	10,350,000	13,800,000	3,450,000	2025	BRC	TINGGI
15	PT BATAMRAYA SUKSES PERKASA	Tj Uban	TM		555,000	555,000	2025	PANBIL	RENDAH
16	PT DATA CENTER INDONESIA (DCI)	Tj Uban	TT		60,000,000	60,000,000	2027	BRC	RENDAH
17					(Staging Up To 1000 MW)				
18	SUNWOOD HOTEL	Tpi Kota	TM		555,000	555,000	2025	PLN	RENDAH
TOTAL KEBUTUHAN DAYA						114,007,500			

CONFIDENCE LEVEL
 TINGGI
 SEDANG
 RENDAH

Figure 3.1.2 Distribution of Potential Customers on Bintan Island

The Bintan system power balance for the period 2025 to 2034 can be seen in the following table.

Table 3.2.1 Bintan System Power Balance 2025-2034

Description	Unit/Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
1. Needs											
a. Sales	GWh	648	681	717	754	794	845	891	939	991	1047
b. Sales Growth	%	5%	5%	5%	5%	5%	6%	5%	5%	6%	5%
c. Production	GWh	682.4	717.0	754.4	794.0	836.2	889.9	937.8	988.8	1,043.6	1,102.0
d. Load Factor	%	70.7	70.8	70.9	70.9	71.0	71.0	71.1	71.1	71.2	71.2
e. Net Peak Load	MW	110.2	115.7	121.5	127.8	134.5	143.1	150.7	158.7	167.4	176.6
f. Net Peak Load Growth	%	5%	5%	5%	5%	5%	6%	5%	5%	5%	6%
2. Existing Supply											
a. Total Installed Capacity	MW	138	138	138	138	138	138	138	138	138	138
b. Total Net Capable	MW	124	124	124	124	124	124	12.7	12.7	12.7	12.7

Description	Unit/T ype	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Power (DMN)											
1) Owned by PLN	MW	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7
c. Transfer from Batam system	MW	111	111	111	111	111	111	-	-	-	-
3. Additional Plans											
a. Relocation of the Haltim Gas Power Plant	MW	-	60	-	-	-	-	-	-	-	-
4. Recapitulati on											
a. Total Existing Supply (DMN)	MW	124	124	124	124	124	124	124	124	124	124
b. Total Additional Supply	MW	-	60	-	-	-	-	-	-	-	-

Description	Unit/Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
c. Total DMN System	MW	124	184	184	184	184	184	184	184	184	184
e. Reserve Margin	MW	14	68	62	56	49	41	33	25	17	7
f. Reserve Margin	%	12.7	58.8	51.0	43.8	36.4	28.7	21.9	15.8	10.1	3.9

The power balance table above shows improved conditions in 2026-2030, with a reserve margin of up to 30%. However, it will decline again in 2031-2034, indicating that the Bintan system will still require power from the 150 kV Batam-Bintan submarine cable interconnection system until 2034.

3.2. Analysis of Idle Assets of PT PLN Nusantara Power

PT PLN Nusantara Power as a Subholding Generation Company has a main business of managing power plants in Indonesia under the supervision of PT PLN Persero as Holding.

Currently, the ex-Batanghari 2x30MW PLTG in East Halmahera managed by PT PLN Nusantara Power is operating to meet the isolated load needs of PT Antam's ferronickel factory with a PJBT period between PT PLN Persero and PT Antam until April 30, 2026.

Haltim ex-Batanghari 2x30 MW PLTG has Gas Turbine specifications from General Electric (GE) frame 6 manufacturer with MS6001B model with current DMN capacity of 30 MW per unit. This GT type can operate Dual Fuel (HSD & Gas). This gas turbine was initially built and COD in 1994 in Paulimo Padang, West Sumatra province, then in 1997 it was moved to Batanghari, Jambi province to fill the needs of the Jambi system at that time. In 1998 the relocation of Paulimo PLTG began COD at a new location, namely Batanghari Jambi, which was later also called Batanghari 2x30 MW PLTG and in 2022 it was moved to East Halmahera to support ANTAM's Smelter.

The realization of electricity production from the Haltim ex-Batanghari 2x30MW PLTG since it began operating in 2023 until this thesis was written is presented in the following table.

Table 3.2.1 Realization of Electricity Production from Haltim's ex-Batanghari Gas Power Plant 2x30 MW

KWh Production					
Month	Unit 1	Unit 2	Month	Unit 1	Unit 2
Jul '23	2,156,050	250,190	Oct '24	0.00	0.00
Aug '23	8,384,620	0.00	Nov '24	0.00	0.00
Sep '23	10,164,380	0.00	Dec '24	0.00	0.00
Oct '23	9,282,570	0.00	Jan '25	0.00	0.00
Nov '23			Feb '25	0.00	0.00
Dec '23			Mar '25	0.00	0.00
Jan '24	1,855,350	0.00	Apr '25	0.00	0.00
Feb '24	25,700.00	0.00	May '25	0.00	0.00
Mar '24	66,090.00	0.00	Jun '25	0.00	0.00
Apr '24	50,780.00	0.00	Jul '25	0.00	0.00
May '24	65,170.00	0.00	Aug '25	0.00	0.00
Jun '24	429,600.00	0.00	Sep '25	0.00	0.00
Jul '24	3,265,350.00	0.00	Oct '25	0.00	0.00
Aug '24	555,540.00	0.00	Nov '25	0.00	0.00

Sep '24	0.00	0.00	Dec '25	0.00	0.00
Total				36,301,200	250,190

Based on the production realization table above, it can be concluded that the Haltim ex-Batanghari 2x30 MW gas-fired power plant is mostly on standby or idle. This is because Antam's load can be supplied by the rented diesel power plant located on site.

In order to take advantage of the estimated idle condition of the PLTG, it is planned to relocate the Haltim ex-Batanghari 2x30 MW PLTG to the Bintan System.

In general, the performance of the generators in Units 1 and 2 remains good, and the visual condition, based on the survey results, remains good. The following is a system-based classification of the conditions in Units 1 and 2.

Table 3.2.2 Classification System for Relocation

System	Condition	Information
<i>Gas turbine and auxiliary equipment package</i>	Visual condition is still good	Relocated
<i>Desalination and Demineralized water plant system</i>	The condition is still good because it has been operating for about 2 years.	Partially relocated
<i>Raw Water System</i>	The condition is still good because it has been operating for about 2 years.	Partially relocated
<i>Waste Water Treatment System</i>	The condition is still good because it has been operating for about 2 years.	Not relocated
<i>Pressurized air system</i>	The condition is still good because it has been operating for about 2 years.	Partially relocated
<i>Gas fuel system</i>	Condition is still good	Relocated
<i>HSD fuel oil system</i>	The condition is still good because it has been operating for about 2 years.	Partially relocated

<i>Fire detection and protection system</i>	The condition is still good because it has been operating for about 2 years.	Partially relocated
<i>Ventilation and air conditioning system</i>	The condition is still good because it has been operating for about 2 years.	Partially relocated
<i>Overhead and gantry crane</i>	Condition is still good	Relocated
<i>Workshop and warehouse equipment & accessories</i>	The condition is still good because it has been operating for about 2 years.	Relocated

4. Conclusion

The relocation of the Haltim Ex-Batanghari 2x30 MW Gas-Powered Power Plant to the Bintan System is technically capable of increasing the reserve margin of the Bintan electricity system and reducing dependence on diesel power plants. The relocation of the power plant can also be a short-term strategic solution to maintain the reliability of electricity supply before the operation of additional new power plants or strengthening the interconnection system. However, financially, its feasibility is highly dependent on the electricity selling price scheme implemented. This project shows conflicting results between the Basic Electricity Tariff (TDL) scheme which can make the project unfeasible compared to the tariff scheme based on the target return on investment (IRR) which can make the project feasible. Based on the results of the financial feasibility analysis, the Basic Electricity Tariff (TDL) scheme was declared not investment-worthy because it produced a negative Net Present Value (NPV) of (\$584,822,356.55), a Benefit Cost Ratio (BCR) value below one, and an Internal Rate of Return (IRR) and Payback Period (PP) value that could not be achieved due to the project's cash flow remaining negative throughout the project's life. On the other hand, in the target-based IRR tariff scheme of 8.5%, the project was declared financially feasible with a positive NPV value of USD 3,823,249.65, an IRR of 8.5%, a BCR of 1.0871, and a Payback Period of 8.656 years. The sensitivity analysis results indicate that the project is highly sensitive to changes in key investment variables, particularly EPC costs, gas prices, and electricity prices. A 20% increase in EPC costs, a 1% decrease in electricity tariffs, or a 1% increase in gas prices can significantly reduce project feasibility. This indicates that the project's financial robustness is relatively limited to changes in key investment assumptions. Overall, the relocation project of the Haltim ex-Batanghari 2x30 MW PLTG to the Bintan System can be considered as an alternative strategy for optimizing existing power plant assets within PT PLN Nusantara Power, provided that there is an electricity selling price scheme that can guarantee adequate returns on investment and the sustainability of project operations.

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