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# Financial Feasibility and Risk-Adjusted Valuation of a Coal-Fired IPP Acquisition in an Emerging Market: A DCF and Monte Carlo Simulation Approach

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***Abstract*—*This study evaluates the financial feasibility and risk-adjusted attractiveness of acquiring a distressed 2x100 MW coal-fired power plant of Independent Power Producer (IPP) in East Kalimantan from the perspective of an Indonesian state-owned electricity utility. The asset is strategically important to the Kalimantan electricity system but has experienced operational underperformance and financial distress, exposing the offtaker to supply reliability and cost risks. A sequential case-study framework is applied, consisting of problem structuring, Discounted Cash Flow (DCF), sensitivity analysis, scenario comparison, and Monte Carlo Simulation. The deterministic DCF results indicate that all alternatives considered are financially viable. Share purchase base case fs NPV of IDR 831.51 billion, IRR of 7.73%, BCR of 1.14 and discounted payback period of 16.54 years. However, after uncertainty is incorporated through 20,000 Monte Carlo iterations, the stochastic mean NPV declines to IDR 422.77 billion, with 76.02% probability of positive NPV and 23.98% probability of negative NPV. Availability factor contributes the largest share of NPV variance. The findings suggest that acquisition can create value, but only if pricing discipline and a post-acquisition reliability turnaround are secured.*

***Keywords*—*DCF, Monte Carlo Simulation, IPP Acquisition, Feasibility, Risk-adjusted evaluation***

## I. INTRODUCTION

Indonesia's electricity sector continues to depend on a combination of utility-owned generation and electricity purchases from Independent Power Producers (IPPs) under Power Purchase Agreement (PPA). As demand grows, the ability of IPPs to maintain availability becomes important not only for supply reliability but also for the cost of electricity supply. The national utility's 2024 annual report shows the continuing expansion of Indonesia's electricity system and the material role of purchased power in the generation portfolio [1].

This study examines a 2 x 100 MW coal-fired power plant (CFPP) of IPP located in East Kalimantan. The assets are strategically relevant because underperformance could reduce the Kalimantan system reserve margin, create prolonged system alert conditions and increase replacement generation cost. At the same time, the IPP company was financially distressed, limiting its ability to sustain operations and maintenance (O&M) and to restore plant performance. The situation creates a strategic dilemma: acquisition may give the offtaker greater control over a critical generation asset, but may also transfer operational, contractual, and financial risks.

Most energy investment studies discuss greenfield generation, renewable energy projects, tariff evaluation, or technology alternatives [2]. Fewer studies examine the acquisition of an operating distressed CFPP of IPP from the offtaker utility's perspective in an emerging market. This paper addresses that gap by integrating deterministic DCF, sensitivity analysis, scenario comparison, and Monte Carlo simulation into a risk-adjusted acquisition evaluation framework.

Accordingly, this study aims to evaluate the financial feasibility and downside risk of alternative acquisition structures and timing scenarios for a distressed 2×100 MW coal-fired IPP, and to identify the risk-adjusted conditions under which the acquisition may be recommended from the offtaker utility's perspective.

## II. LITERATURE REVIEW

This section reviews the theoretical foundations of feasibility analysis, investment risk assessment, and probabilistic valuation methods used to evaluate the acquisition of a distressed power-generation asset.

*A. IPP, PPA, and Acquisition context*

An IPP is generally structured as a project company that develops, owns, and operates a power plant and sells electricity to an offtaker under a long-term PPA. Such structures help mobilize private capital for infrastructure but also allocate operational, fuel, volume, and payment risks between the seller and offtaker based on a tariff structure generally shown in Figure 1. In an acquisition case, the buyer evaluates not only physical assets but also contractual cash-flow rights, remaining concession life, debt obligations, and operational risk.

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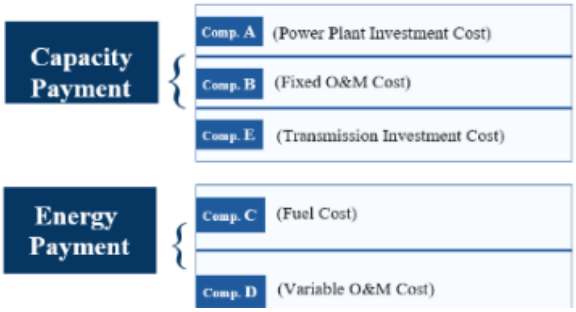



Figure. 1
Tariff component structure under the Power Purchase Agreement

Recent PPA valuation literature emphasizes that long-term electricity contracts embed risk exposures related to price, volume, credit, and market conditions [3]. This is directly relevant for a coal IPP acquisition, because the transaction value depends on both remaining contractual cash flows and the post-acquisition ability to improve operational reliability.

*B. DCF and Capital budgeting*

DCF is a core capital budgeting method because it evaluates the present value of expected future cash flow using a discount rate that reflects risk and the cost of capital [4]. Financial feasibility is usually evaluated by Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost Ratio (BCR) and discounted payback period [4] [5]. These indicators are widely used in energy and infrastructure studies as they translate engineering and operational assumptions into investment value [5].

The discount rate is also important. In natural resource and energy projects, the cost of capital should reflect project risk, leverage, and uncertainty rather than being treated as a purely static input [6]. Therefore, this study uses project-specific Weighted Average Cost of Capital (WACC) and compares the results against a utility benchmark WACC to test robustness.

*C. Risk Analysis and Monte Carlo Simulation*

A deterministic DCF provides a single valuation result, but energy assets are exposed to uncertain Availability Factor (AFA), coal prices, exchange rates, inflation, and O&M performance. Sensitivity analysis is useful to identify the variables that materially affect project value, but it does not estimate the probability of each outcome. Monte Carlo simulation addresses this limitation by treating key variables as probability distributions and repeatedly recalculating project value [7], [8].

Monte Carlo applications in power generation and infrastructure finance show that probabilistic analysis can complement DCF by estimating downside risk, expected value, and the probability of negative NPV [7], [9]. This study therefore uses Monte Carlo simulation to evaluate whether the acquisition remains feasible after simultaneous uncertainty is introduced.

## III. METHODOLOGY

*A. Research Design*

This research adopts a single case study design, focusing on distressed 2 x 100 MW CFPP of IPP in East Kalimantan. Case study design is appropriate because the object is a real acquisition decision that requires a combination of financial modeling, operational interpretation, and managerial judgment [10]. The research framework is illustrated in Fig. 2.

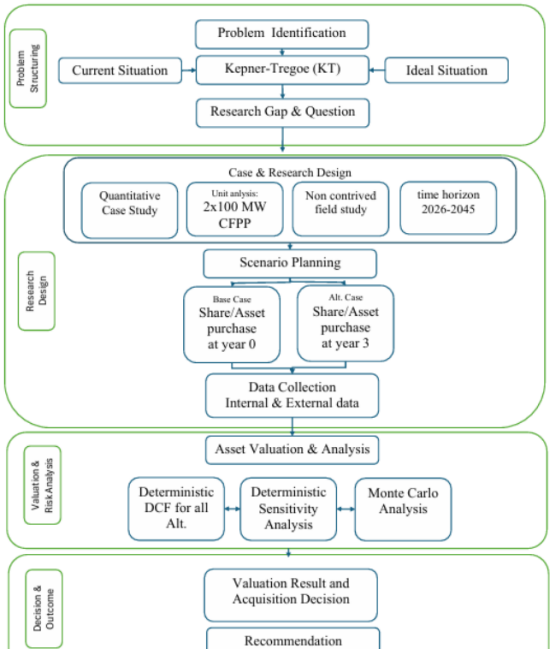



Figure. 2
Integrated Research Framework

The case object is a 2x100 MW CFPP of IPP located in East Kalimantan. For confidentiality, the IPP company is anonymized as PT XYZ. The valuation is conducted from the perspective of PT PLN (Persero), Indonesia's state-owned electricity utility, acting as offtaker under the PPA and as the potential acquirer.

*B. DCF Model*

The valuation for share purchase, asset purchase PPA and asset purchase appraisal are performed using Free Cash Flow to Firm (FCFF) for the 2026-2045 remaining operation horizon. Revenue in the share purchase case follows PPA tariff components, while asset purchase cases are evaluated using an LCOE-plus margin approach. The model incorporates fuel cost, HSD, fixed and variable O&M, general administrative expenses, depreciation, amortization where relevant, and tax. The analysis is limited to stand-alone acquisition cash flows over the remaining 2026–2045 project horizon, while broader system-level benefits are treated qualitatively. The main feasibility criteria are positive NPV, IRR above the relevant WACC, BCR greater than one, and discounted payback within the remaining operation horizon. The NPV is calculated as shown in equation (1).

$$NPV = \sum CFt\ (1+r)t\ n\ t=1\ -CF0 \quad (1)$$

The IRR is the discount rate that makes NPV equal to zero as shown in equation (2).

$$0 = NPV = \sum CFt\ (1+IRR)t\ T\ t=1\ -CF0 \quad (2)$$

These indicators are then compared across acquisition structures and timing scenarios.

*C. Sensitivity and Monte Carlo Simulation*

Sensitivity analysis is used to identify value drivers before probabilistic modeling. Monte Carlo simulation is then applied to the best alternative acquisition model, which is share purchase base case, because this

alternative produces the strongest deterministic base-case value and requires further downside-risk validation. The simulation uses 20,000 iterations in Excel with Oracle Crystal Ball. Five uncertain variables are modeled: availability factor (AFA), coal price, foreign exchange rate, Indonesia inflation, and U.S. inflation.

Table I.
*Probability distribution assumptions*

| Model Variables | Distribution Type | P5 | P50 | P95 | Mean | SD | Data Source |
|---|---|---|---|---|---|---|---|
| AFA (%) | BetaPert | 60 | 85 | 95 | n/a | n/a | PPA |
| Coal Price (Rp) | BetaPert | 759.093 | 818.403 | 845.722 | 809.002 | 36.439 | Actual historical transaction |
| FX (Rp/US$) | Lognormal | 16.776 | 17.009 | 17.965 | 17.214 | 431 | JISDOR Bank Indonesia |
| ID Inflation (%) | Lognormal | 1,95 | 3,71 | 10,28 | 4,55 | 2,78 | World Economic Outlook |
| US Inflation (%) | Lognormal | 0,46 | 2,19 | 4,52 | 2,54 | 1,52 | World Economic Outlook |

Beta PERT is used for variables with bounded operational or price ranges, while lognormal distribution is used for macroeconomic variables because their values are positive and may experience right-skewed shocks.

## IV. FINDINGS AND DISCUSSION

*A. Historical Financial Condition*

The historical financial analysis indicates that the target IPP is financially distressed. The revenue decreased from IDR 877.2 billion in 2019 to IDR 549.2 billion in 2024, with the profitability turning negative in 2020. In 2024, the company posted a net loss of IDR 421.3 billion and negative equity of about IDR 1.10 trillion.

Table II.
Historical ratio analysis of PT XYZ, 2019–2024

| Category | Ratio | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| Liquidity | Current Ratio | 0,2x | 0,6x | 0,2x | 0,4x | 1,4x | 1,2x |
| Liquidity | Quick Ratio | 0,0x | 0,3x | 0,0x | 0,0x | 0,4x | 0,5x |
| Profitability | Gross Profit Margin | 16,6% | 40,1% | (144,5%) | (106,9%) | (18,5%) | (17,3%) |
| Profitability | Operating Margin | 15,3% | 38,0% | (195,5%) | (203,8%) | (30,5%) | (18,8%) |
| Profitability | Net Profit Margin | 3,3% | 7,2% | (613,6%) | (1601,8%) | (41,7%) | (76,7%) |
| Profitability | Return on Assets (ROA) | 0,5% | 0,8% | (7,1%) | (13,9%) | (3,2%) | (7,7%) |
| Profitability | Return on Equity (ROE) | 4,2% | 6,9% | (79,3%) | 975,9% | 32,0% | 47,4% |
| Activity | Asset Turnover | 0,2x | 0,1x | 0,0x | 0,0x | 0,1x | 0,1x |
| Activity | Inventory Turnover | 52,1x | 16,8x | 5,9x | 9,6x | 26,3x | 10,4x |
| Solvency | Debt-to-Equity Ratio | 7,0x | 6,7x | 15,7x | (11,1x) | (8,0x) | (4,8x) |
| Solvency | Interest Coverage Ratio | 0,6x | 1,4x | (0,8x) | (0,4x) | (0,7x) | (0,5x) |

The ratio analysis shown in Table II confirms that PT XYZ was in financial distress during the observation period. Profitability was deteriorating, the equity was negative after 2022, and the interest coverage was always below the sustainable level, indicating the limited internal capacity to finance reliable operations and debt service. This confirms that the transaction should not be treated as a normal asset purchase; it is a distressed asset decision requiring due diligence, liability protection, and post-acquisition turnaround.

*B. Deterministic DCF Result*

The deterministic DCF indicates that all evaluated acquisition alternatives meet the minimum financial criteria. The share purchase base case produces the highest year-0 NPV, while the year-3 share purchase scenario produces the highest absolute NPV. The year-3 asset purchase based on the PPA purchase option shows the strongest financial efficiency, with the highest IRR and BCR and the shortest discounted payback period. Although all alternatives, as shown in Table III are feasible, the payback periods remain long. Thus,

deterministic feasibility does not eliminate risk. The result should be interpreted together with sensitivity and probability analysis, particularly because small changes in operating performance may significantly change cash flows over the long horizon.

Table III.
Comparative DCF results across acquisition alternatives and timing scenarios

| Option | Scenario | NPV (Bil. Rp) | IRR (%) | BCR | Payback (years) |
|---|---|---|---|---|---|
| Share Purchase | Base | 831,51 | 7,73 | 1,14 | 16,54 |
| Share Purchase | Year 3 | 921,27 | 8,32 | 1,18 | 14,63 |
| Asset Purchase PPA | Base | 489,90 | 7,41 | 1,10 | 17,56 |
| Asset Purchase PPA | Year 3 | 831,10 | 8,80 | 1,20 | 14,01 |
| Asset Purchase Appraisal | Base | 486,28 | 7,38 | 1,09 | 17,64 |
| Asset Purchase Appraisal | Year 3 | 557,78 | 7,82 | 1,12 | 15,55 |

*C. Sensitivity Analysis*

The sensitivity analysis identifies AFA as the most critical operational variable. A reduction in availability from the 85% base assumption significantly reduces NPV and may lead to negative value. This is consistent with CFPP IPP economics, where revenue recovery and fuel efficiency are highly dependent on plant availability and dispatch readiness. Investment cost, WACC, exchange rate, and coal price are also material, but AFA has the most direct impact on the acquisition value. The implication is that acquisition feasibility depends not only on negotiating the transaction price but also on restoring and sustaining the reliability of operating the plant. Therefore, the acquisition should be conditional on a credible O&M improvement plan, coal supply assurance, forced outage reduction, and availability governance.

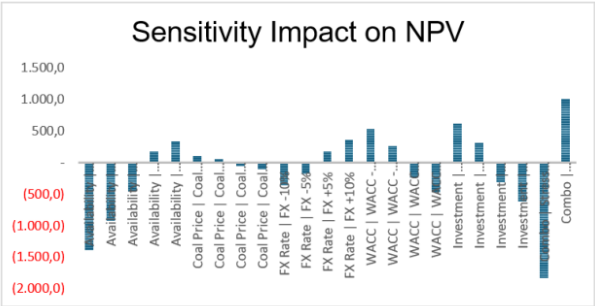



Figure. 3
Deterministic sensitivity impact of key variables on project NPV

Figure 3 summarizes the deterministic sensitivity test. The largest downside effects arise from lower availability factor assumption, particularly AFA at 65% and 75%, and from the downside combination scenario. Upside cases are generated when AFA improves and when the acquisition price or cost of capital becomes more favorable. This result supports the use of AFA as the primary operational risk variable in the probabilistic model.

*D. Monte Carlo Result*

Monte Carlo simulation changes the interpretation of the DCF result. The deterministic share purchase NPV is IDR 831.51 billion, but the stochastic mean NPV declines to IDR 422.77 billion and the median NPV is IDR 504.69 billion. The project still shows value creation on an expected basis, but the probability of negative NPV is 23.98%, which is material for a strategic acquisition decision.

Table IV.
Monte Carlo Output Summary

| Metric | Result |
|---|---|
| Deterministic NPV | IDR 831,51 bn |
| Mean Stochastic NPV | IDR 422,77 bn |
| Median NPV | IDR 504,69 bn |
| Probability NPV > 0 | 76,02% |
| Probability NPV < 0 | 23,98% |
| P5 NPV | −IDR 789,67 bn |
| P95 NPV | IDR 1.408,06 bn |

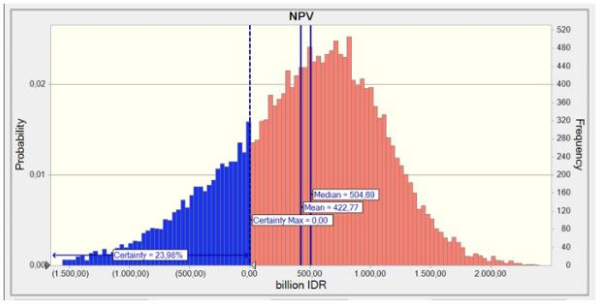



Figure 4
Probability of Negative NPV

Figure 4 shows that 23.98% of simulated outcomes fall below zero NPV. Hence, although the mean and median values remain positive, the acquisition cannot be interpreted as risk-free. The result provides a downside-risk indicator for management before entering the transaction. In addition, only 28.84% of the Monte Carlo trials generate an NPV higher than the deterministic base-case value of IDR 831.51 billion. This indicates that the deterministic valuation represents an optimistic outcome rather than the central expected result, thereby reinforcing the need to interpret the acquisition decision using risk-adjusted indicators such as downside probability, certainty interval, and key variance drivers.

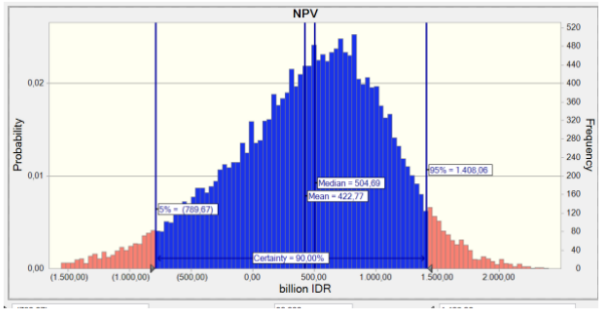



Figure 5
Monte Carlo NPV Distribution with 90% certainty interval

Figure. 5 complements the downside view by presenting the 90% certainty interval. The interval extends from negative IDR 789.67 billion to positive IDR 1,408.06 billion, implying material dispersion around the central estimate. This range can be used as a risk-adjusted reference for pricing discipline and transaction negotiation.

Table V.
Contribution of key uncertainty variables to NPV variance

| Variable | Contribution |
|---|---|
| Availability factor | 47,3% |
| Indonesia inflation | −25,8% |
| U.S. inflation | 24,8% |
| FX / JISDOR | 1,9% |
| Coal price | −0,3% |

Previous studies [7], [8], and [9] demonstrate that Monte Carlo simulation can reveal valuation dispersion and downside exposure that may not be captured by deterministic analysis alone. However, these studies primarily examine renewable generation, generic energy systems, or other infrastructure investments, whereas the present study applies an integrated DCF and Monte Carlo approach to the acquisition of an operating distressed coal-fired IPP from an offtaker utility's perspective. This study also extends the IPP - PLN feasibility context discussed in [2] by comparing acquisition structures and linking risk-adjusted valuation to liability protection and post-acquisition operational turnaround requirements.

*E. Managerial Implications*

Three implications arise. First, the acquisition should be positioned as a conditional acquisition rather than a straightforward approval. The transaction is value-creating only if reliability turnaround is credible. Second, the risk-adjusted NPV range should define the maximum acceptable acquisition price and the required protection clauses, including representations, warranties, indemnity, escrow, or price adjustment mechanisms. Third, the share purchase structure provides attractive value but must be balanced against historical liability risk. If legal due diligence cannot isolate such risks, asset purchase alternatives may become more attractive despite lower base-case value.

*F. Study Limitations*

This single-case study has limited generalizability. The valuation covers stand-alone acquisition cash flows for the 2026–2045 project horizon; broader system-reliability and replacement-cost effects are treated as strategic considerations rather than direct project cash flows. Monte Carlo estimates depend on the available historical data and selected probability-distribution assumptions.

## V. CONCLUSION

This study evaluates the financial feasibility and risk-adjusted attractiveness of acquiring a distressed 2 x 100 MW coal-fired IPP in East Kalimantan. The deterministic DCF shows that all acquisition alternatives are financially feasible. The share purchase base case produces NPV of IDR 831.51 billion, IRR of 7.73%, BCR of 1.14, and discounted payback period of 16.54 years. The year-3 share purchase scenario produces the highest overall NPV of IDR 921.27 billion. Monte Carlo simulation has demonstrated that deterministic DCF overstates attractiveness in the absence of explicit consideration of uncertainty. After 20,000 iterations, the mean NPV declines to IDR 422.77 billion, with 23.98% probability of negative NPV. The acquisition is therefore feasible but risk sensitive. AFA is the dominant risk driver, making operational reliability the main prerequisite for value preservation. The contribution of this paper lies in integrating deterministic valuation and probabilistic risk analysis for a distressed coal-fired IPP acquisition from an offtaker utility's perspective in an emerging market. The framework can help utilities make more robust acquisition decisions by combining NPV, IRR, BCR, sensitivity drivers, downside probability and managerial risk mitigation into a single decision process.

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