INVESTMENT ANALYSIS OF GAS TURBINE COMBINED CYCLE TO REDUCE THE PRODUCTION COST OF PT XYZ USING MONTE CARLO SIMULATION

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ABSTRACT

PT ABC as a public electricity company always effort optimally to improve operating efficiency to maintain optimal production costs. Currently, one of the ongoing electricity purchase agreements between PT ABC and IPP (Independent Power Producer) is with PT XYZ. To improve the efficiency of the PT XYZ Power Plant, it is necessary to build a Gas Turbine combined cycle that can increase thermal efficiency up to 50% which is only 31% previously. However, before the project is implemented, it is necessary to carry out a financial analysis and risk assessment to assess the feasibility of investing in the Gas turbine combined cycle and to determine the electricity tariff in the power purchase agreement (PPA) as well. This study aims to determine the investment analysis of gas turbine combined cycle to reduce the production cost of PT XYZ through analyses the most sensitive variable to the feasibility study of the project and carry out risk assessment using monte carlo simulation. This investment analysis will start with the calculation of project investment costs (CAPEX) and operation and maintenance costs (OPEX), then make a financial statement projection by applying the time value of money principle to determine the projected cash flows obtained during the 20-years according to the agreement period. Furthermore, financial analysis is carried out using capital budgeting techniques and consideration of PT ABC Management which sets a maximum Electricity tariff of Power Purchase Agreement (PPA) is IDR 683.67/kWh. Then with PT XYZ's capital cost of 7.8%, it turns out that the investment can generate a Net Present Value (NPV) of IDR. 473,747,024,187, IRR Project of 12.27%, payback period of 7 years and 10.9 months, discounted payback period of 13 years and 11.2 months and the profitability index of 1.53 times.The risk assessment will be carried out on significant parameters through sensitivity analysis and monte carlo simulation. Risk analysis show that the probability of NPV is smaller than zero is 5.84% and the probability of IRR Project is lower than the WACC is 5.08%.

Keywords:capital budgeting analysis, monte Carlo simulation, risk assessment, Electricity tariff of power purchase agreement, best alternative to a negotiated agreement (BATNA)

INTRODUCTION

To improve the cost structure of a company, identification is needed to see the main components that have a significant effect on these cost changes. As a company that has an integrated business license from upstream to downstream which includes generation, transmission, distribution, and customer service, PT ABC continues to strive to improve operating cost efficiency. The main component in the structure cost at PT ABC is the production cost of the power plant. With the development of electricity technology, it is hoped that the production cost of the power plant will continue to improve and be efficient.

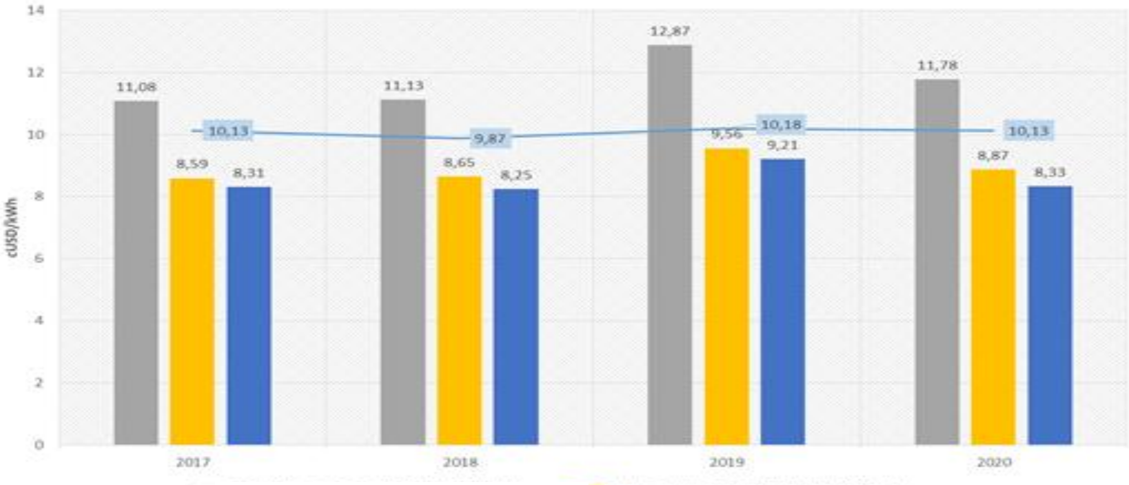
The COVID-19 pandemic has an impact on PT ABC, one of which is the sales of electricity which has relaxed by 0.68% (*year on year*). This condition caused several IPP plants to be unable to operate optimally according to the volume agreed upon in the Power Purchase Agreement (PPA). Currently, the composition of the power plant owned by PT ABC is only 20% and the remaining 80% belongs to the IPP Power Plant.

With the Take or Pay (TOP) based Agreement (PPA) scheme, PT ABC is exposed to the risk of paying to the IPP according to the Agreement, but some of IPP's electricity production cannot be sold due to declining demand.

Currently, the PT XYZ Power Plant is operating to meet peak load needs with a utility factor of 30-70%. The small utility factor of the PT XYZ Power Plant is due to its poor fuel efficiency, so it requires relatively large operating costs compared to other IPP. With high operating costs, the PT XYZ plant could not compete with other IPP.

For the 2017-2020 period, PT XYZ's production costs are in the range of 11.08 -12.87 USD cents/kWh. Meanwhile, for other Independent Power Producers, the production cost is 8 -9.5 USD cents/kWh, so it can be concluded that PT XYZ is relatively wasteful and uncompetitive. Meanwhile, the average selling price of PT ABC to consumers in the same period is around 9.87 – 10.18 USD cents/kWh so it can be said that any electrical energy produced by PT XYZ will result in losses for PT ABC. For a more detailed explanation, see table 1 below.

Table 1 : Production Cost of PT XYZ VS Electricity Tariff of PT ABC



LITERATURE REVIEW

Financial Analysis

Financial analysis is an analytical tool used to evaluate the economic viability of an investment. It consists of evaluating the financial condition and operating performance of the investment and forecasting its future condition and performance. A final decision is dependent on two specific factors, expected return and risk. So a Financial Analysis is a means for examining those two factors.” (Fabozzi and Peterson, 2003)

Levelized cost of electricity

The levelized cost of energy (LCOE), also referred to as the levelized cost of electricity or the levelized energy cost (LEC), is a measurement used to assess and compare alternative methods of energy production. The LCOE of an energy-generating asset can be thought of as the average total cost of building and operating the asset, per unit of total electricity generated over an assumed lifetime. Available at https://www.corporatefinanceinstitute.com (Accessed March 20, 2021)

$$\text{LCOE} = \frac{\sum_{t=1}^{n} \frac{(I_t + (O\,\&\,M)_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

E_t	= The Amount of electricity produced in MWh, assumed constant ;
I_t	= Total Capital Cost in year t ;
$O\&M_t$	= Operation and Maintenance Cost in year t ;
F_t	= Fuel Cost in year t ;
$(1+r)^t$	= The discount factor year t (Reflecting Cost of Capital)
r	= Cost of capital Project
n	= Duration of agreement

Weighted Average Cost of Capital (WACC)

The following formula is used to calculate WACC

$$WACC = (\frac{E}{V} \times R_e) + (\frac{D}{V} \times R_d \times (1 - Tc))$$

Where :

E = Market value of the firm's equity
D = Market value of the firm's debt
V = E + D
R_e = Cost of equity
R_d = Cost of Debt
Tc = Corporate tax rate

Capital Budgeting

According to Will Kenton and Margaret James in Oct 11, 2020, there are several capital budgeting techniques that will be used to analysis the Financial Analysis for the project in this study. Here are several capital budgeting techniques:

- **Net Present Value**
  Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV is used in capital budgeting and investment planning to analyze the profitability of a projected investment or project.
  Accept or Reject Decisions : *Accept a project if its NPV is greater than or equal to zero; otherwise, reject.*

- **Internal Rate of Return**
  The internal rate of return (IRR) of a project is that discount rate for which the project's NPV equals zero. The IRR is "internal" in the sense that represents the average rate of return earned from the funds invested in the project itself. A project's IRR does not reflect the returns earned on the funds after the release of the project.

  There are two types of IRR, Project IRR which represents the financial performance of the project and equity IRR which represents the return on injected equity and both IRR were calculated as follow

$$0 = NPV = \sum_{t=1}^{t} \frac{C_t}{(1 + IRR)^t} - C_o$$

Where :

C_t = Net cash inflow during the period t

C_o = Total initial investment costs

IRR = The internal rate of return

t = The number of time periods

Accept or Reject Decisions : *Accept a project if its IRR is greater than or equal to the project's hurdle rate or capital cost ; otherwise, reject.*

- **Discounted Payback Period**

  The discounted payback period is a capital budgeting procedure used to determine the profitability of a project. The basic method of the discounted payback period is taking the future estimated cash flows of a project and discounting them to the present value. This is compared to the initial outlay of capital for the investment.
  Accept or Reject Decisions : *Accept a project if its DPB occurs during its life (i.e, is less than or equal to n periods) ; otherwise, reject*

- **Profitability Index**

  The profitability index (PI), alternatively referred to as value investment ratio (VIR) or profit investment ratio (PIR), describes an index that represents the relationship between the costs and benefits of a proposed project. It is calculated as

the ratio between the present value of future expected cash flows and the initial amount invested in the project. A higher PI means that a project will be considered more attractive.
Accept or Reject Decisions : *Accept a project if its PI is greater than or equal to one (1) ; otherwise, reject.*

Risk Assessment

Capital budgeting decisions are made based on projected future revenues and expenses. Income and expense projections are based on assumptions, benchmarking, management adjustments etc. Furthermore, investment decisions depend on the accuracy of the assumptions made despite the fact that there is a risk of deviating from these assumptions. Thus, risk assessment is needed to mitigate uncertainty, ambiguity and variation as a consideration in decision making and prepare a contingency plan to minimize the risk of irregularities.

RESEARCH METHODOLOGY

Research Design

In this study, most identified projects will use a quantitative approach. However, as a complementary material for consideration in business situation analysis, a qualitative approach is also used.

Data Collection

For this study, the author should collect the data to determine financial assumptions in order to conduct investment analysis of the project undertaken in this study. The data needed is divided into two categories, which are primary data and secondary data. Primary data is the kind of data that is collected directly from the data source without going through any existing sources. It is mostly collected specially for a research project and may be shared publicly to be used for other research. Primary data is often reliable, authentic, and objective in as much as it was collected with the purpose of addressing a particular research problem. It is noteworthy that primary data is not commonly collected because of the high cost of implementation. The primary data is conducted through a meeting with PT XYZ, Consultant Study and Internal data of PT ABC. Meetings with PT XYZ have been held several times and have been started since April 2019 to discuss the scope of work, the assumptions used in calculating the tariff and power output that will be generated from this project. The study result from the consultant includes the investment cost of this project which is obtained from Market Price, a similar benchmark project and Engineering adjustments. Internal PT ABC data is used to see the current operational and utility capabilities of the power plant.

Secondary data is the data that has been collected in the past by someone else but made available for others to use. They are usually once primary data but become secondary when used by a third party. Secondary data are usually easily accessible to researchers and individuals because they are mostly shared publicly.

In addition to the primary data, the author also conducts a secondary data collection by looking for reference books and articles that have correlations with the project from the library and the internet to support the analysis, such as theoretical data, exchange rates and Government regulation such Regulation of The Minister of Energy and mineral resources No 10-year 2017 (MEMR Regulation No 10 year 2017) concerning the main points in the Power Purchase Agreement.
Analysis Method

In data management, the approach used is a quantitative approach which is carried out through two approaches, namely capital budgeting and risk assessment. In capital budgeting, the results obtained will be evaluated using four techniques, namely net present value, internal rate of return, discounted payback period, and profitability index. The risk assessment is carried out with sensitivity analysis and Monte Carlo simulation, where an explanation of each method can be seen below.

Before doing a capital budgeting analysis, it is necessary to calculate the Levelized cost of electricity (LCOE) as input from the analysis.

RESULT AND DISCUSSION

A. Problem statement and research issues

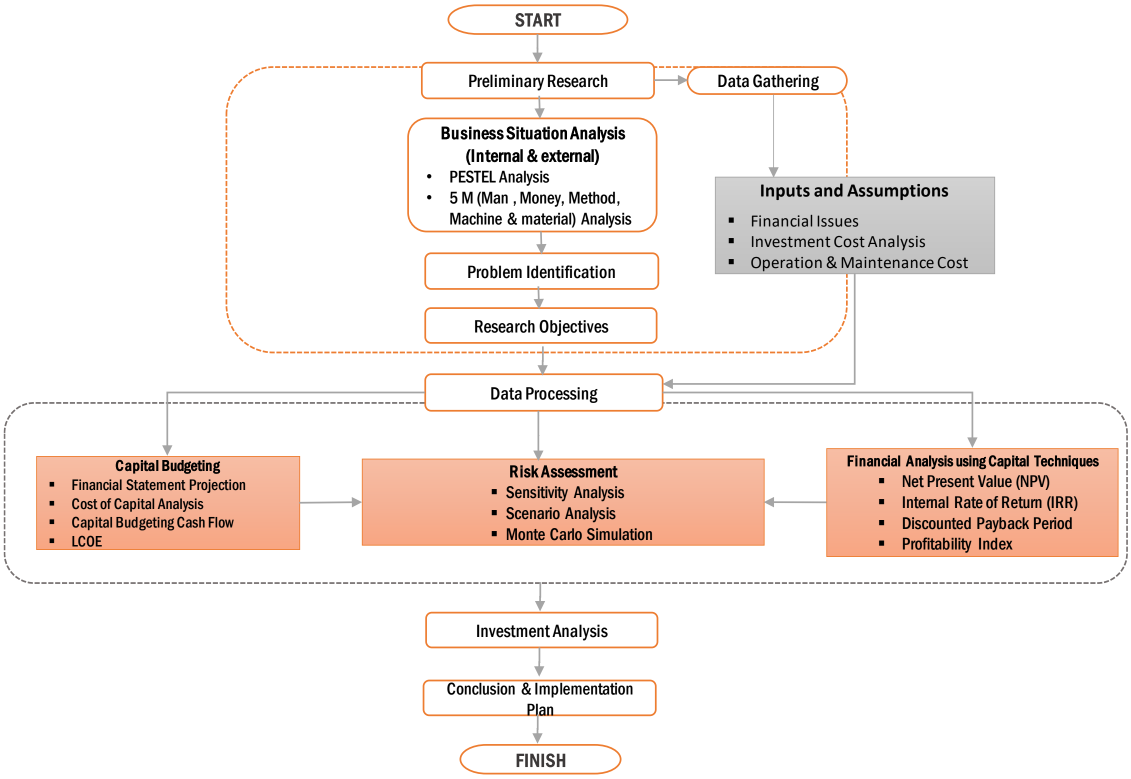
Before the project is implemented, it is necessary to carry out a financial analysis and risk assessment to assess the feasibility of investing in the gas turbine combined cycle and to determine the electricity tariff in the power purchase agreement (PPA) as well. Based on the foregoing, there are several issues:

1. The PT XYZ plant has relatively expensive production costs compared to other IPP's.
2. PT XYZ production costs are more expensive than the selling price of PT ABC to its customers so that PT ABC loses every time it sells electricity generated from PT XYZ.
3. To reduce the production costs of the PT XYZ plant, investment is needed to build a Gas Turbine combined cycle, but can the Production Cost after building Gas Turbine combined cycle lower PT ABC's electricity tariff?

B. Conceptual Framework

This study is conducted to ensure that by carrying out the Gas Turbine combined cycle Development at the Existing PT XYZ Power Plant, it has an impact on reducing PT ABC production costs. In addition, through the development of a financial model based on the concept of the capital budgeting technique, information will be obtained for PT ABC to obtain a fair price based on a predetermined investment cost. The price will then be used as a reference for conducting PPA Tariff Negotiations with PT XYZ. Based on these conditions, the authors carried out the Conceptual Framework as shown below:

Figure 1: Conceptual Framework

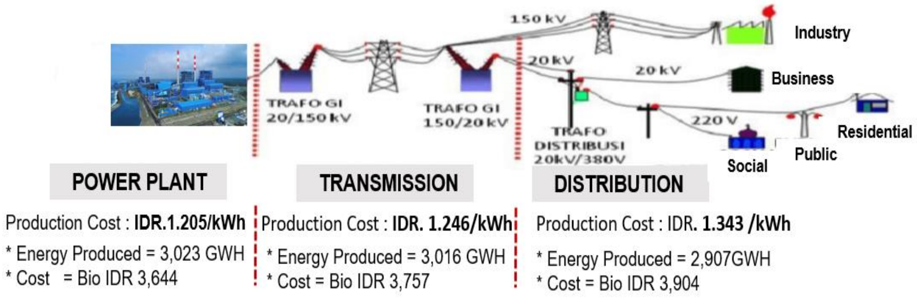


This study is to examine *Investment Analysis of Gas Turbine Combined Cycle* that is intended to reduce The Production Cost of PT XYZ's Power Plant. The ultimate intent is to determine if the investment under the base scenario is worth considering. The study commences with identifying the PT ABC's problem.

C. Cost Structure of PT ABC

The cost structure of PT ABC is dominated by the cost of the Power Plant system. To optimize the cost structure, it is necessary to carry out cost efficiency on the upstream side. PT ABC in providing the Power Plant system, collaborates with 3rd parties through a power purchase scheme with a minimum payment obligation namely take or pay (TOP) mechanism. The following figure explains the cost structure of PT ABC starting from Power Plant, Transmission, and Distribution. Here is Production cost of PT ABC

Figure 2: Production Cost of PT ABC in 2020 based on function



D. Analysis of Business

Based on internal and external analysis, a SWOT (Strength, Weakness, Opportunities and Threat) and TOWS Matrix analysis is compiled. From the TOWS Matrix analysis, in order to take advantage of opportunities and minimize the weaknesses of PT ABC, one of the efforts and programs that need to be done **is to optimize Independent Power Producer (IPP) costs**. One of the programs that will be carried out related to the optimization of IPP costs is to reduce PT XYZ's Production Costs. This is done with the consideration that currently the PT XYZ plant has a relatively poor operating cost efficiency compared to other IPPs. To increase this efficiency, the efforts made are to change the operating system based on Open Cycle to Closed Cycle. In connection with this, a Financial Analysis with a Capital Budgeting Method Approach is required.

E. Project Investment Cost

The total project investment cost is obtained from a study conducted by a consultant hired by PT ABC. In estimating Investment Costs, reference and benchmark data used are based on reference data for similar Power Plant that have the same capacity or close to capacity. If the reference used has a different capacity, the capacity adjustment will be made using the "Cost-size Scaling" formula and if the reference for a similar Power Plant used is using data within a certain period of time, adjustments will be made for inflation and difference in exchange rates.

The calculation of investment costs includes the following scope:

- Civil Works
- Mechanical Works
- Electrical Works and Instrumentation Control
- Others Cost

The calculation of Project Investment Cost can be seen in table 2.

Table 2: Project Investment Cost of Steam Turbine

No	Description	Investment Cost (USD)
1	Civil Works	6,326,236
2	Mechanical Works	34,347,300
3	Electrical, Instrumentation, Control and 150 kV Substation	21,899,175
4	Interest During Construction	4,398,509
5	Others	863,557
TOTAL		**67,834,777**

F. Financial assumption

The financial assumptions that will be used as the basis for preparing the financial model for the base scenario are as follows:

Table 3: Financial assumption of base case scenario

No	Description	Unit	Value	Remarks
1	Price Gas	USD/MMBTU	6.00	Refer to MEMR Regulation NO. 91K /MEM/12 year 2020
2	Tax Rate	%	25	Corporate Tax Rate
3	Exchange Rate	USD/IDR	14,000	Average in January 2021
4	Debt Portion	%	70	follow the provisions of the lenders
5	Terminal Growth	%	1	Residual of asset life time
6	Interest Rate p.a	%	8.00	In IDR
7	Grace Period	Months	24	Refer to Construction Period
8	Repayment Period	Years	10	According to PT XYZ Information
9	Contract Period	Years	20	Base agreement of PT ABC and PT XYZ

G. Capital Budgeting Analysis (using capital budgeting techniques)

The table 4 below will briefly describe the financial evaluation of the proposed investment for the project discussed in this Study:

Table 4: PT XYZ's Financial Analysis

No	Method	Result	Rule	Decision
1	NPV (Million IDR)	473,747	Accept if > 0	Accept
2	IRR Project (%)	12.27	Accept if > WACC	Accept
3	IRR Equity (%)	13.10	Accept if > Cost of equity	Accept
4	Payback Period (PBP)	7 years & 10.9 months	Accept if < Contract Period	Accept
5	Discounted Payback Period (PBP)	13 years & 11.2 months	Accept if < Contract Period	Accept
6	Profitability Index	1.53	Accept if > 1	Accept

Based on the recapitulation table above, by applying the capital budgeting techniques it is shown that all financial investment indicators are positive then in terms of financial aspects, this investment decision is very good to take. Thus, if it is conducted, this project investment is certainly capable of providing benefits to the company. However, there may be changes to the parameter estimation in the calculation of investment, which cannot be known in advance at this time.

Therefore, anticipation needs to be done on things that maybe beyond the initial estimates and affect the profit decline of this project. For that reason, risk assessments will be done through sensitivity analysis and Monte *Carlo* simulation that applied to parameters which are considered crucial have the potential to change, and also directly can affect the profits earned by the Company.

H. Sensitivity Analysis

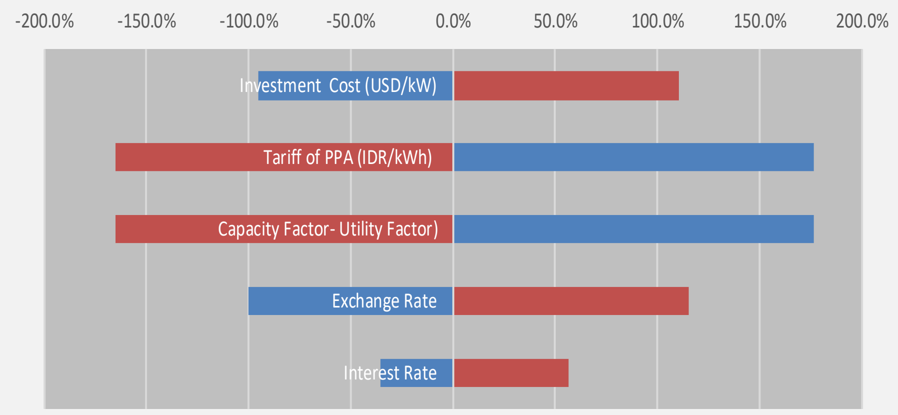
The sensitivity of the analysis is tested against changes in the NPV Project and IRR Project, if the input assumptions are changed. For example, if the long-term debt interest rate changes up or down by 20%, then it is reviewed whether these changes have an impact on changes in NPV of +/- 20%. If the change is above 20%, the "long-term debt interest rate" parameter has an influence or sensitivity on the feasibility of this project.

Based on sensitivity analysis and using the Tornado chart, there are several parameters that have sensitivity to changes in NPV and IRR, namely:

- Interest Rate
- Exchange Rate
- Capacity Factor- Utility Factor)
- Tariff of PPA (IDR/kWh)
- Investment Cost (USD/kW)

Tornado chart is used to show the level of sensitivity of uncertain factors affecting Investment Project Analysis. In this case, the Tornado Chart can show which factor is the most sensitive. The following figures show the tornado chart for NPV and IRR.

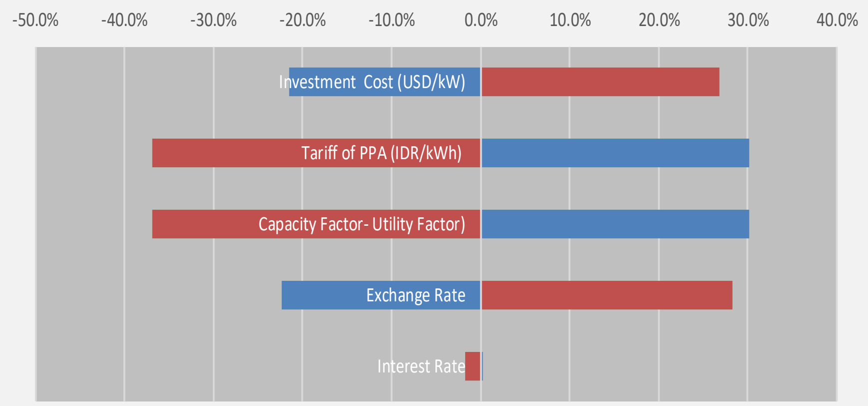
Figure 3: PT XYZ's NPV Tornado Chart



	Interest Rate	Exchange Rate	Capacity Factor- Utility Factor)	Tariff of PPA (IDR/kWh)	Investment Cost (USD/kW)
Percentage +20% Swing	-35.5%	-100.2%	176.7%	176.7%	-95.3%
Percentage -20% Swing	56.5%	115.2%	-165.1%	-165.1%	110.5%

Figure 3 shows the tornado chart profile for NPV that Capacity Factor and Tariff of PPA are the most sensitive parameters.

Figure 4: PT XYZ's IRR Project Tornado Chart



	Interest Rate	Exchange Rate	Capacity Factor- Utility Factor)	Tariff of PPA (IDR/kWh)	Investment Cost (USD/kW)
Percentage +20% Swing	0.2%	-22.3%	30.1%	30.1%	-21.5%
Percentage -20% Swing	-1.8%	28.3%	-36.9%	-36.9%	26.8%

Figure 4 shows the tornado chart profile for IRR Project that Capacity Factor and Tariff of PPA are the most sensitive parameters. Meanwhile, **for the interest rate, it is not sensitive** because when there is a change in the up and down assumption of 20%, the change in IRR is less than 20%.

I. Scenario Analysis

From the results of the sensitivity analysis, scenario analysis is then carried out on changes in the parameters that have been determined in the sensitivity analysis. Scenario Analysis is carried out on 3(three) conditions, namely:

- Worst Case
  Worst case is the worst possible case according to existing historical data. This scenario is obtained by calculating the worst data against the average data that has ever occurred. This scenario can also be expressed as the farthest negative deviation from the existing average data.
- Base case
  The base case is a moderate scenario or a scenario based on the greatest possibility (most likely) that has ever occurred based on historical data.
- Best Case

The best case is the best scenario that has ever happened according to existing historical data. This scenario is performed by calculating the best data against the average data that has occurred. This scenario can also be expressed as the farthest positive deviation from the existing average data from the scenario assumption above, the following is capital budgeting analysis. Here is PT XYZ'S Scenario Analysis:

Table 5: PT XYZ's Scenario Analysis

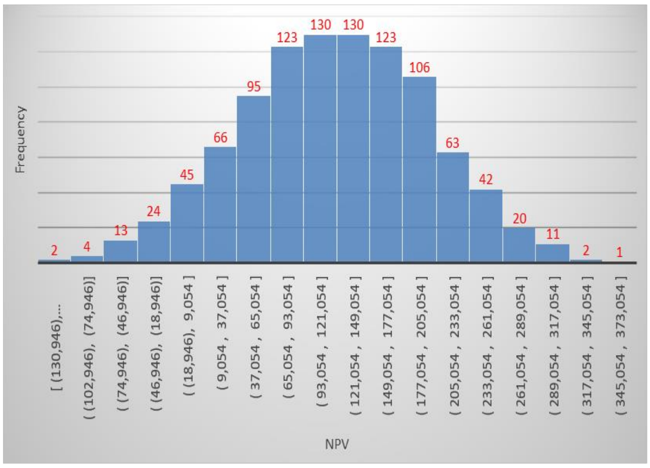
Parameter	Worst Case	Base Case	Best Case
Interest Rate	8.21%	8.00%	7.15%
Exchange Rate	16,148	14,000	13,650
Capacity Factor (Utility Factor)	50.0%	85%	88.0%
Tariff of PPA (IDR/kWh)	546.93	683.67	820.40
Investment Cost (USD/kW)	1,515.08	1,377.34	1,239.61
NPV (Million IDR)	(460,655)	473,747	981,161
IRR Project	4.20%	12.27%	16.91%
PBP (Payback Priod)	> 20 Yrs	7 Yrs & 11 Months	5 Yrs & 7 Months
Discounted PBP	> 20 Yrs	13 Yrs & 11 Months	7 Yrs & 2 Months
Profitability index	0.59	1.53	2.23
Range of NPV (Million IDR)		IDR 1,441,816	

J. Monte Carlo Simulation

Considering that this project will be carried out for 20 years and there are several parameters that are possible to change and sensitivity to changes in NPV and IRR such as: interest rate, exchange rate, utility factor and Investment cost then to measure how likely this project is to fail, random simulations of these variables are needed. By doing a random simulation, it is hoped that it will provide a description the risk of this project.

The iteration calculation is then repeated 1,000 times by using a combination of value changes on each parameter, which are obtained randomly. Both the NPV and IRR, each of these will then be processed into a histogram and will be analyzed to determine the descriptive statistics of the calculation results from the simulation, also the level of errors that may occur when the investment is implemented. Here is the NPV analysis:

Figure 5: NPV Distribution from monte Carlo simulation



Descriptive Statistics	
Min	(127,311.41)
Max	352,820.15
Mean	121,210.14
Standard Deviation	77,291.84
Median	123,861.98
Kurtosis	(0.34)
Skewness	(0.10)
Prob NPV<0 (Worst Case)	5.84%

From figure 5, the histogram resulted from the probabilistic analysis using *Monte Carlo* simulation shows that from 1,000 iterations, the probability of negative NPV is 5.84% and the remaining 94.16% is positive, with a probability of 64.8% that the NPV got a lower value than Mio IDR 163,105 (as a result of the initial calculation – base case- without terminal value), but still positive. Moreover, the largest frequency is contained in the NPV with a value that is lower than the initial calculation (base case without terminal value) with a probability of 70.6%. Meanwhile, through descriptive analysis, if viewed from the mean or median, the value resulted is lower than the initial NPV. This is a bad thing, though this data has a deficiency due to the high value of standard deviation.

Here is NPV Probability according to the base case and best case without Terminal Value.

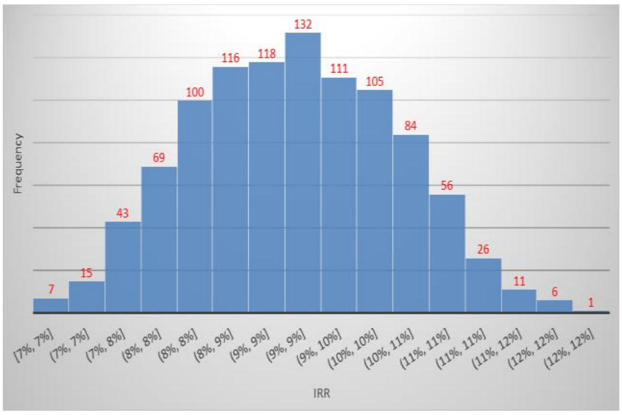
Table 6: *NPV Probability from monte Carlo simulation*

Probability > Best Case	
Standard Deviation	77,291.84
Mean	121,210.14
X	618,447.60
Z	6.43
Z (X < Best Case)	100%
Z (X > Best Case)	0%

Probability > Base Case	
Standard Deviation	77,291.84
Mean	121,210.14
X	163,105.36
Z	0.54
Z (X < Base Case)	70.6%
Z (X > Base Case)	29.4%

In addition to the NPV, probabilistic analysis with *Monte Carlo* simulation is also performed on the IRR Project. Here is the IRR Analysis:

Figure 6: IRR Project Distribution from monte Carlo simulation



Descriptive Statistics	
Min	6.3%
Max	12.1%
Mean	9.2%
Standard Deviation	1.0%
Median	9.2%
Kurtosis	(0.24)
Skewness	(0.07)
Prob IRR< WACC (Worst Case)	5.1%

The histogram resulted from the probabilistic analysis using *Monte Carlo* simulation shows that from 1,000 iterations, the probability of IRR Project is lower than WACC is 5.08% and the remaining 94.92% is upper than WACC (which is at 7.80%), with a probability of 72.62% that the IRR Project got a lower value than 9.97% (as a result of the initial calculation- base case-No Terminal Value), but still upper than WACC. Moreover, the largest frequency are contained in the IRR with a value that lower than the initial calculation (base case without terminal value) with a probability of 77.7%.

Here is IRR Project Probability according to base case and best case without terminal value.

Table 7: IRR Project Probability from *monte Carlo* simulation

Probability > Base Case	
Standard Deviation	1.03%
Mean	9.21%
X	9.97%
Z	0.76
Z (X < Base Case)	77.7%
Z (X > Base Case)	22.3%

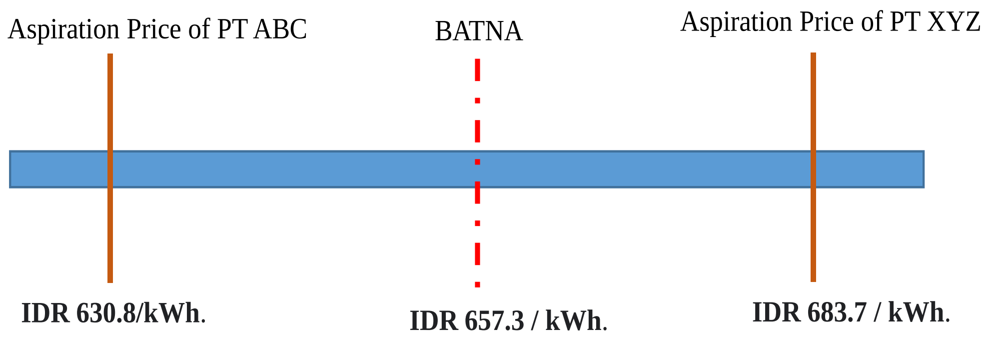
Probability IRR < WACC	
Standard Deviation	1.02%
Mean	9.19%
X	7.80%
Z	(1.64)
Z (X < Base Case)	5.08%
Z (X > Base Case)	94.9%

K. Electricity Tariff Negotiation

Based on the Capital Budgeting Analysis in TABLE 3 and risk assessment with monte carlo simulation , there is still a ZOPA (*Zone of Possible Agreement*) for negotiations because the project failure probability rate is relatively small, namely 5.84% using the NPV method and 5.08% using the IRR method. With this probability, **the confidence level** of the success of this project is around 95%.

With the assumption that scenario I(WACC + 5% of Margin) cannot be accepted by PT XYZ considering the possible risks that PT XYZ will cover in the next 20 years, the *Best Alternative to a Negotiated Agreement (BATNA)* that PT ABC can offer is the middle value of scenarios I and II (base case scenario), namely IDR 657.3 / kWh.

Figure 7: Best Alternative to a Negotiated Agreement from scenario I & II



By assumption that the negotiation agreement occurs at Best Alternative to a Negotiated Agreement (BATNA) with tariff is IDR 657.3 / kWh, PT XYZ's Production Cost is as follows**:**

Table 8: PT XYZ's Production Cost after project Implemented

Description	SCPP (Current Condition)	CCPP (Steam Turbine)	SCPP +CCPP (After Project Implemented)
Tariff :			
Component A (IDR/KWh)	312.2	490.0	373.7
Component B (IDR/KWh)	65.8	121.9	85.2
Component C (IDR/KWh)	1092.0	-	646.8
Component D (IDR/KWh)	15.4	45.3	25.8
Total (IDR/kWh)	**1,485.4**	**657.3**	**1,131.4**

Based on the table 8, there is a decrease in the Production Cost of PT XYZ by 23.8% and then according to the PT ABC tariff of IDR 1,418 / kWh, the spread margin that will be obtained by PT ABC under the BATNA scenario is 9%.

CONCLUSION AND RECOMMENDATION

Conclusions

1. In accordance to the result of capital budgeting calculation, it is inferred that the investment project of Gas Turbine Combine cycle under base scenario is feasible to execute. This is reflected in positive NPV of Million IDR 473,747, IRR Project greater than the WACC (12.27% > 7.80%), IRR Equity greater than the cost of equity (13.10%> 12.01%) and PI ratio 1.53 above 1. Not to mention that the Payback Period is 7 years and 10.9 months and discounted payback period is 13 years and 11.2 months. Besides that, **based on the 95% confidence level analysis**, the results show that the lower limit for NPV is still above 0 and the IRR is above the WACC so that this project is feasible to execute
2. Based on the Capital Budgeting Analysis and risk assessment according to base case scenario, there is still a ZOPA (Zone of Possible Agreement) for negotiations because the project failure probability rate is relatively small, namely 5.84% using the NPV method and 5.08% using the IRR method. With this probability, the confidence level of the success of this project is around 95%.
3. Based on the calculation of capital budgeting and risk assessment, it can be concluded that the Gas Turbine Combine cycle investment project with the BATNA scenario is feasible from the perspective of PT ABC and PT XYZ.

Recommendation

PT ABC can carry out negotiation to PT XYZ is through the BATNA scenario with the PPA electricity tariff of IDR. 657.3 / kWh instead of IDR 683.67 /kWh according to the base case scenario.

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