# Analysis of capital budgeting investment projects substation 150 kV
# for the tires company

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**Abstract.** *T*he electricity consumption continues to increase, even in Indonesia, where its average electricity consumption rises 6.86 % anually.  In accordance with the ever-increasing production needs of companies needing more electrical power during these electrical disturbances which often occur due to power shortage. Therefore, the company proposes the investment of the construction of substations 150kV expecting to improve the reliability of electrical power supply. This research was conducted to analyze the value of investment carried out by tire companies make use of historical data and company forecasts by applying the technical method of economics to analyze its financial support. Based on the calculation result of the Payback period (PP) and Discounted Payback Period generates 5.35 years and 6.24 years.  Meanwhile, in the calculation of net present value (NPV) was obtained favorable results in the 6th year of IDR 40,944,770,640.32, setting an interest rate of 5%. In the calculation of the internal rate of return (IRR), the result of 5.5% concluded that the project return is higher than the minimum attractive rate of return (MARR) of the company by 5.17% of the interest rate applyied by Bank Indonesia. In addition to that based on the sensitivity analysis was gained that the lower the interest rate on this project, the faster the return on the investment, or vice versa. The overall analysis of the scenario stated that the investment is worth running as it benefits the company.

*Keywords*: Payback Period, Net Present Value, Internal Rate of Return (IRR), Capital Budgeting

## 1. Introduction

Indonesia was one of the biggest electricity consumer in Asia as projected in 2018 of 239.3 watts per hour (twh) and in 2027 will reach 433.8 twh, or experiencing the average growth of 6.86 % in the next ten years 2027, sales electricity for household consumption is estimated at the point of 183.6 twh, and industry at the point of 132.9 twh. Furthermore, 88.4 this spent for business purposes and 28.9 twh is spent for public consumption.   Owing to that reason more investment need to be made in building additional power station as well as maintaining electrical station to tackle the increasing usage of electrical power in Indonesia.  Investment are the vital activities, money costly and give long term impact to a continuation effort (Giatman, 2006).

The government will keep on promoting the industrial sector to compete with globally, this is due to the essential role of governments which sets this sector as a leading sector in encouraging the national economic growth as it takes the availability of sufficient electrical energy. To support it as one of the best sister company in Southeast Asia. It continues making an effort to develop various latest technology included in the process of developing the quality of the sister company which is capable of competing with the competitors.  In the process of making the sister company having sufficient power to fulfill the energy needed in the process of production.  Electrical power is a very crucial energy required in the production process.  Electricity consumption of  this company  has reached 92.152,5 kva *and the*  resources are based on energy and mineral resources no. 128 in the year of 2016  applied for companies whose  electricity consumption are above 30.000kva  which required to subscribe to use tariffs for  category 4 subscriber in the industrial sector.  Based on the data of production per year, the production process is improving in accordance with with its necessity to the climbing up demand of electrical power of the *companies.*   Hence electrical power companies consider main station as a means of development in fulfilling the needs.  However, in planning policy of developing main station, there has been no further economic feasibility study about development planning for the main station in 150 kV tire companies, as the construction of main station there has not yet been certainly giving   benefits for the company.

## 2. Method

Giatman, 2006 mentioned that investment is important activities that money costly and reflects the long term continuation of the venture. Using mining techniques the right decision is needed to be made to avoid the mistake occurred. One decision making technique is conducted upon doing a feasibility study. An investment according to Suad and Suwarno, a feasibility study of 2000 projects was a study of whether or not a project of this investment can be implemented and will at the same time benefits the company. In a feasibility study, capital budgeting is the right method to be applied that deals with good financial investment in identifying and in making a choice as well as convincing on the investors to go on to the next project. According to Novie, 2012 capital budgeting is a method(s) to be used to analyze the feasibility of a project/kind of investment in the long term to be performed by the company and is expected to create benefit for more than a year. When upon implementing the decision the company must be able to establish the current conditions and the possibility of spending the funds in the future. According to Novie, 2012 Capital Budgeting is a method used to analyze the feasibility of a project/type of investment in the long term that will be done by the company and is expected to produce benefits more than one year. When the decision is about to be applied the company must be able to set the current condition and possible expenditure of funds in the future. In this planning conducting a financial analysis of the value of investments which could be done to raise the company's income annually that is the construction of project 150kV main substation. Once the analysis is made conclusion of all the research activities is made. Detail could be seen in the following research methodology diagram.
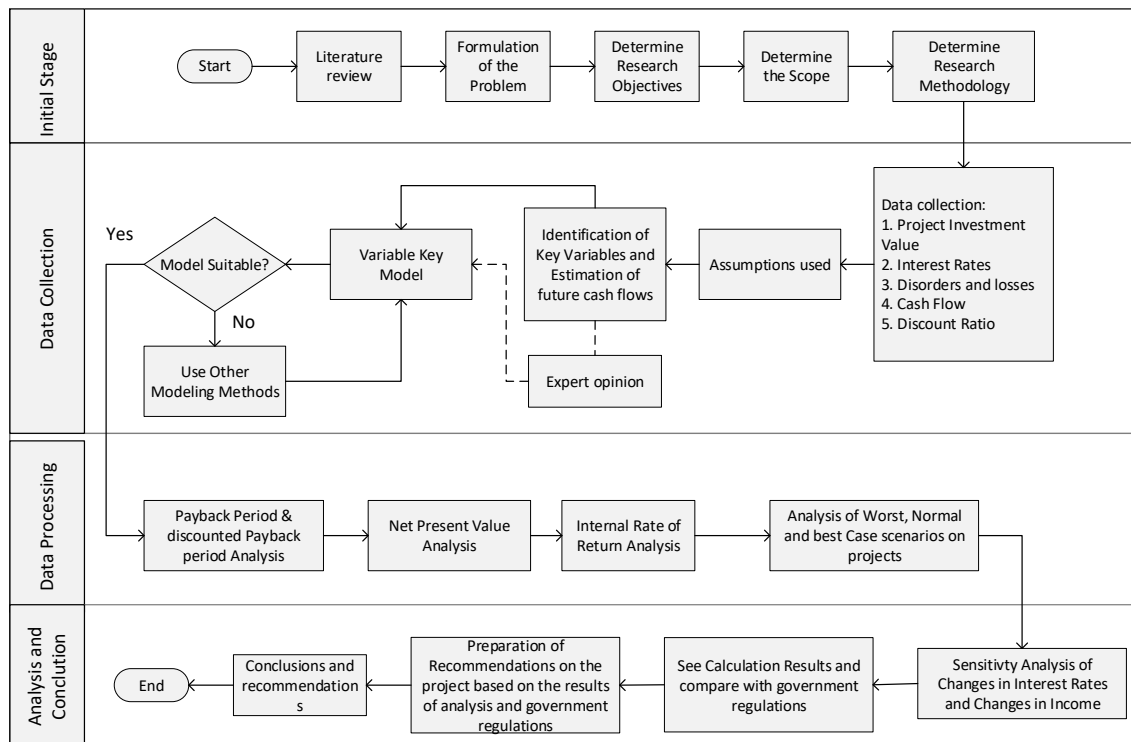


**Figure 1 Research methodology diagram.**

The method for conducting a capital budgeting analysis consists of several alternatives such as payback period, discounted (payback period), net present value and internal rate of return, In order to convince the investors is done scenario analysis of the best possible analysis and the probability of the worst with a changing ratio of income by 5% from the current forecast,as well as further analysis of sensitivity with changes in the interest rate and change of income in a certain period.

## 3. Results and Discussion

### Cash flows in

Incoming cash flows are a flow of funds received as an advantage of the investment. In this paper, the author assumes incoming cash flows are using an average of saving of electricity usage costs in 5 years backward. There are two types of assumptions that are obtained by cash flows in the following energy-saving potential table:

**Table 1  Potential electricity savings/year**

| Energy | Energy Use Yearly | Unit | Saving Cost Yearly |
|---|---|---|---|
| Electrical | 360.167.980 | kWh | Rp 17.725.191.416 |

Source: Data Processing, 2020

The table shows that the cash flows received from energy savings are made only if the construction of the 150 kV substation reaches IDR 17,725,191,416 per year. I addition to that incoming cash flows should be based on the company's net profit for the last 4 years. Over the last 4 years, the company has been experiencing ups and downs in obtaining profits, with the data collected using least square method for 4 years backwards to predict the change of net profit over the next few years. The details of the data and forecasting can be seen in the Table 2.

**Table *2*  Company's *net profit* and cash flow in the next few years**

| Year | Net Profit (IDR) | Year | Net Profit (IDR |
|---|---|---|---|
| 2014 | | 2025 | 56.953.857.964 |
| 2015 | | 2026 | 57.001.987.423 |
| 2016 | | 2027 | 56.950.793.440 |
| 2017 | | 2028 | 56.855.846.394 |
| 2018 | 61.399.756.000 | 2029 | 56.940.621.305 |
| 2019 | 55.337.107.200 | 2030 | 56.937.312.140 |
| 2020 | 55.947.941.440 | 2031 | 56.921.143.320 |
| 2021 | 56.761.340.128 | 2032 | 56.913.730.790 |
| 2022 | 57.206.763.354 | 2033 | 56.928.201.889 |
| 2023 | 57.330.581.624 | 2034 | 56.925.097.035 |
| 2024 | 56.516.746.749 | 2035 | 56.922.043.258 |

Source: Annual Report Company

### Cash outflows

Cash outflows are costs incurred either (incurred) at the time of investment or disbursed annually to maintain the performance of an asset. The construction of the 150 kV substation which was projected to replace the function of the 20kV substation is currently supplied by PLN. Construction costs for 150kV substations is in the sum of IDR 245,700,000,000. The price includes the material delivery mobilization, and is assumed to include tax, while the annual operational and maintenance costs for the facility can be safely removed from the calculation due to the small amount (<1%) compared to investment. The details are as follows:

**Table 3  Investment costs (cash outflow)**

| No. | Work item | Cost (IDR) |
|---|---|---|
| 1. | Technic consulting services | 9.450.000.000,- |
| 2. | Civil works | 15.660.000.000,- |
| 3. | The main high voltage equipment | 47.250.000000,- |
| 4. | Power transformer (with accessories) | 70.470.000.000,- |
| 5. | Mechanical and electrical (HV) installation | 15.862.500.000,- |
| 6. | Mechanical and electrical installation (MV) | 79.717.500.000,- |
| | Total | 245.700.000.000,- |

Source: Internal Company, 2020

Upon completing the description of  the assumptions used in this study and the value of cash inflows and outflows, the analysis of calculations using the Capital Budgeting method is  conducted as a basis for making decisions whether the investment of 150kV substation construction projects is feasible or not.

**Technical Economics Analysis Feasible.**
**Payback period and discounted payback period**
The payback period is basically referring to how fast the sum of the investment can be returned.   The faster the time to return the investment fund, the better it is as it can minimize the risks and uncertainties that will occur in the future. The calculations for the payback period for the 150kV substation construction project can be seen in the Table 4.

In the 0 year period the value of the investment was IDR 245,700,000,000 and had not yet benefited from cash flow. Cumulative cash flow can be obtained by adding the cumulative cash flow in the previous year with the cash flow of the following year. This will result in the reducement of the investment capital issued at the beginning of a long period of time and will show positive results. From the table above it can be seen that in the 5th year the cumulative cash flow produced a positive value. This shows that the payback period of this investment is more than 2 years, but less than 15 years. So to determine how much the payback period of this investment, it can be done in the following ways:

$$\text{Payback Period} = 5 \text{ Year} + \frac{(57.331.749.676 - 36.889.574.007)}{57.331.749.676} = 5.35 \text{ Year}$$

**Table 4  Calculation of payback period**

| Period | Year | Cash Flow | Cash Flow Cumulative |
|---|---|---|---|
| 0 | | 245.700.000.000 | -245.700.000.000 |
| 1 | 2019 | 55.338.275.252 | (190.361.724.748) |
| 2 | 2020 | 55.949.109.492 | (134.412.615.256) |
| 3 | 2021 | 56.762.508.180 | (77.650.107.076) |
| 4 | 2022 | 57.207.931.406 | (20.442.175.670) |
| 5 | 2023 | 57.331.749.676 | 36.889.574.007 |
| 6 | 2024 | 56.517.914.801 | 93.407.488.808 |
| 7 | 2025 | 56.955.026.016 | 150.362.514.824 |
| 8 | 2026 | 57.003.155.475 | 207.365.670.299 |
| 9 | 2027 | 56.951.961.492 | 264.317.631.791 |

Source: Data Processing, 2020

In theory the payback period for an asset purchase is accepted if the payback period is still below the economic life of the asset in this case because this development is a long-term project that will be useful as long as the company is still operating then the economic life is assumed to be going on. Based on the investment company policy, the 150kV main substation project can be returned at maximum rate when entering the 5th year. Judging from the results of the payback period above, it can be accepted.

**Discounted payback period**
This method was developed to prepare for facing unwanted net investment that has been issued. Basically, the faster time to return an investment, the better it can be as it can minimize the risk and the uncertainty which might occur occur (in prior to the discounted payback period. This shows that the discounted payback period of this investment requires more than 2 years, but less than 10 years with an interest rate of 5% and this reference is based on the interest rate set by the Indonesian bank. Based on the calculation then to ascertain the payback period of this investment, they can be done in the following ways:

**Table 5  Calculation of discounted payback period**

| Period | Year | Interest Rate (P/F,5%, t) | Cash Flow Value Now (IDR) | Cash Flow Cumulative (IDR) |
|---|---|---|---|---|
| 0 | | | | (245.700.000.000) |
| 1 | 2019 | 0,95 | 52.703.119.288 | (192.996.880.712) |
| 2 | 2020 | 0,91 | 50.747.491.603 | (142.249.389.109) |
| 3 | 2021 | 0,86 | 49.033.588.753 | (93.215.800.356) |
| 4 | 2022 | 0,82 | 47.065.106.745 | 46.150.693.611) |
| 5 | 2023 | 0,78 | 44.920.926.041 | (1.229.767.570) |
| 6 | 2024 | 0,75 | 42.174.538.211 | 40.944.770.640 |
| 7 | 2025 | 0,71 | 40.476.873.647 | 81.421.644.287 |
| 8 | 2026 | 0,68 | 38.581.979.385 | 120.003.623.672 |
| 9 | 2027 | 0,64 | 36.711.742.174 | 156.715.365.846 |
| 10 | 2028 | 0,61 | 34.905.274.725 | 191.620.640.571 |
| 11 | 2029 | 0,58 | 33.292.684.921 | 224.913.325.492 |
| 12 | 2030 | 0,56 | 31.705.476.305 | 256.618.801.797 |

Source: Data Processing, 2020

From the table above, it can be seen that in the 6th year the cumulative cash flow generates a positive value. This shows that the discounted payback period of this investment took more than 2 years, somehow less than 10 years. So to determine the lenghth the payback period of this investment. They  can be done in the following ways:

$$Payback\ Period \quad = 6\ year + \frac{(42.174.538.211 - 40.944.770.640\ )}{42.174.538.211} = 6.03\ year$$

**Net Present Value**
If the net present value (NPV) of an investment is higher or equal to zero (0) then the investment is said to be feasible, but if the NPV is negative then the investment is not feasible. Here are the results of the NVP calculation using the 5% interest rate.

NPV = $(C1/1+r)+(C2/(1+r)^2)+(C3/(1+r)^3)+(C4/(1+r)^4)+(C5/(1+r)^5+ (C6/(1+r)^6) - C0$

NPV = $((55.338.275.252/1+0.05)+(55.949.109.492/1+0,0)^2+(56.762.508.180/1+0,05)^3+(57.207.931.406/1+0,05)^4 +(57.331.749.676/1+0,05)^5+(56.517.914.801/1+0,05)^6)-245.700.000.000$

NPV  = $(52.703.119.288+50.747.491.603+49.033.588.753+47.065.106.745+44.920.926.041+42.174.538.211)- 245.700.000.000$

NPV  = 286.644.770.640,32 – 245.763.064.034

NPV  = 40.944.770.640,32

The calculation results above is taken from the assumption that the NPV in the 6th year produced is positive with a value of Rp 40,944,770,640.32 with an interest of 5%.

## Internal rate of return

The IRR calculation of the proposed 150kV substation investment project development can be seen from the calculation below with a minimum attractive rate of return (MARR) of 5.17% according to the benchmark interest rate at Bank Indonesia.

i = 15%

NPV = (C1/1+r) + (C2/(1+r)2) + (C3/(1+r)3) + (C3/(1+r)4) + (Ct/(1+r)5) − C0

NPV=((55.338.275.252/1+0,15)+(55.949.109.492/1+0,1)$^2$+(56.762.508.180/1+0,15)$^3$+(57.207.931.406/1+0,15)$^4$
    +(57.331.749.676/1+0,15)$^5$+(56.517.914.801/1+0,15)$^6$)−245.700.000.000

NPV=(48.119.223.652+42.304.681.618+37.321.502.509+32.708.152.617+28.503.431.405+24.433.749.251)−
    15.170.855,9

NPV = 213.390.741.052−245.700.000.000

NPV = - 32.309.258.948,08

To find out how many% IRR reaches 0, the following inter polarity calculation is needed.

**Table 6 Calculation of IRR inter polarity**

| Difference in Discount | Difference in PV | Difference in PV with OI |
|---|---|---|
| 5% | 286.644.770.640,32 | 286.644.770.640,32 |
| 15% | 213.395.161.525,07 | 245.700.000.000 |
| 10% | 73.249.609.115,24 | 40.944.770.640,32 |

Source: Data Processing, 2020

IRR = 5% + (40.944.770.640,32 / 73.249.609.115,24) x 10%

IRR = 5% + 0.5%

IRR = 5.5%

Based on the calculation table above, the proposed internal rate of return on investment for the 150kV substation construction project is set to be 5.5%. This is better when compared to the BI Rate of 5.17% which is the company's standard to determine the desired rate of return. Indirectly said that with funds from bank loans with an interest rate of 5.5% it turns out to be more profitable upon using it for investment in the construction of this 150kV substation project.

## Scenario analysis

Scenario analysis is an analysis carried out by including the possibility of assumptions when the best conditions and when the worst conditions are applied. This analysis is carried out to anticipate an uncertain future condition due to the instability of the variables which affect an investment proposal. Scenario analysis is done by comparing the three conditions namely the best / optimistic conditions, normal conditions and the worst/pessimistic conditions. In the case of investment in the 150kV substation construction project, the variable that is likely to change according to economic conditions is the price of energy used, and those are electricity and company cash flow.

### Optimistic Scenario (Best Case) & Pessimistic (Worst Case) Analysis

In an optimistic condition it is assumed that if production conditions are stable or increase then the company's income will increase by 5% for normal production, this means that when the company's revenue used rises, the cash inflows will increase. This value is used as the basis for creating cash flow in an optimistic condition. If that happens the analysis is done using the Capital Budgeting technique as it was done under normal conditions. In an optimistic condition, it is assumed that if production conditions decline, the company's income will decrease by 5% from normal production.

**Table 7  Results of scenario analysis calculations**

| Scenario | Payback Period (Year) | Discounted Payback Period (Year) | Decision |
|---|---|---|---|
| Optimistic Conditions (+ 5%) | 5,15 | 5,76 | To be accepted |
| Normal condition | 5,35 | 6,03 | To be accepted |
| Pessimistic Condition (-5%) | 5,58 | 6,33 | To Be accepted |

Source: Data Processing, 2020

Based on the results of the calculation of scenario analysis carried out by comparing three conditions namely the best/optimistic conditions, normal conditions and the worst/pessimistic conditions, it is stated that with these three conditions investment of 150kV substation construction projects is still feasible if using the 5% assumption because it is still under the period of 10 years.

**Sensitivity Analysis**
This analysis is based on changes in interest rates to the length of return on capital to break even, these changes can be seen in the following graph.
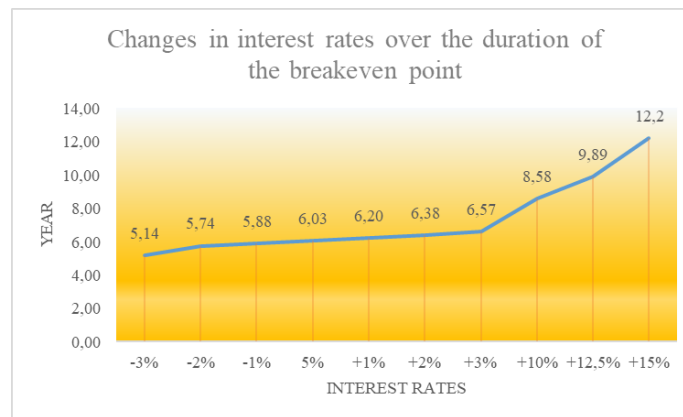


**Figure 2  Analysis of sensitivity to changes in interest rates on return period.**
Source: Data Processing, 2020

Based on the sensitivity analysis shows that the lower interest rates applied on this project, the faster the return period on investment for the project. It goes the same with the higher the interest rate used for this project, the longer the return on investment. It can be seen in the graph above. It shows that the interest rate which increased above 10 % has the potential to experience the returns of above 10 years time, meaning that if it refers to company policy is not feasible, therefore the expected interest rate of companies should be below 18% if you want to refer to company policies with the returns period below 10 years.

## 4.  Conclusion

Upon the completion of calculating the capital budgeting technique to assess the feasibility of the proposed 150kV substation construction project investment in the tire company, they can be concluded as follow:

1.  The proposed investment of a 150kV substation construction project in a tire company is really needed because the electricity consumption of this company has reached 92,152.5 kVA which according to the Minister of Energy and Mineral Resources Regulation No. 28 of 2016 companies are required to subscribe using industry 4 tariffs if electricity consumption is above 30,000 kVA  Investing a 150kV substation project in a tire company is surely required as it is profitable for the company. At present electricity consumption is used based on category 3 tariffs namely MV/I-3 consumer tariffs with a 20kV electricity subscription  with the value of IDR1,208 per kWH to category 4 namely HV/I-4 consumer tariffs with a 150kV electricity subscription of IDR 1,191 per kWH, with

this difference  the company has a potential of saving cost in the sum of  IDR 17,256,614,267. In addition, it is expected that the investment of 150kV substation construction projects in tire companies can improve the company's electricity reliability so that it can reduce the process of production failure due to power supply disruptions and power shortages in fulfiling production needs.

2.  The feasibility of the proposed investment of 150kV substation construction projects in this tire company is "feasible to run" proven by the analysis of the calculations that have been carried out to get good results for all methods. The payback period analysis method and the discounted payback period method produce a period of 4.14 years and 6.24 years, respectively.  Where both the feasibility can be accepted because the time limit for the return of investment issued is still under the policy of management which is to say in10 years time. Whereas in the calculation of net present value (NPV) ,a positive result is obtained in the 6th year  in the sum of  IDR 40,944,770,640.32, using a 5% interest rate like this,  positive result shows that this investment proposal does provide direct benefits for the company. From the calculation of the internal rate of return (IRR) is getting a result of 5.8%. Hence it can be concluded that the project return is greater than the minimum attractive rate of return (MARR) with the value of 5.17% which (the company) has been set by the company based on the BI interest rate reference. Analysis of calculations that have been carried out include using the Benefit Cost Ratio method with the point of of 0.98, which shows the  bad  value of benefits (is not good) if it is less than 6 years period of time, but will then improve into the 7th year and so on.

3.  Based on scenario analysis conducted using three condition scenarios, namely positive conditions, normal conditions, and pessimistic conditions, the results of calculations using the payback period method is optimistic conditions are 4.12 years and in pessimistic conditions, is 4.58 years, both stated that  the proposal this investment is acceptable. Discounted payback period in a positive condition is 5.65 years, and in a pessimistic condition is in 6.66 years, the results also state that investment is acceptable. Overall this scenario analysis showed that that the investment is feasible to run because it brings profits directly to the company. This analysis can be used as a reference and consideration for investing in a 150kV substation project in a tire company.

4.  Based on the results of calculations, Sensitive analysis, is faster in the project investment returns, as well as if there is less income or allocation of funds used for this project is lengthened. However, if you look at the company policy, then this project is feasible because the return on investment is still under 10 years period of time.

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