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Original Research Article

Analysis of Investment Feasibility of 25mw Power Plant Development Project in Paper Factory in Karawang in Financial Aspects, Technology and Environmental

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Abstract

Electrical energy is a source of energy needed by industry. This study aims to analyze the feasibility of investing in the construction of a pulp and paper industry power plant in Karawang. Research in terms of aspects of technology, environmental impacts are compared in the application of old technology and new technology. Financial aspects with the capital budgeting method. From the results of studies in the aspects of Technology 29.66 Tons / h Coal can produce 25 MW of electricity and supply steam for paper production. While the old Boiler 28.6 Ton / h only supplies steam for paper production, so that the Power Plant Project is more efficient than production costs and multifunctional technology. From an environmental aspect the technology used for fly ash is using ESP. ESP can not only reduce Sox, Nox, Total Particulate can also eliminate HG and fine dust so that it is safe for the environment and financial aspects of calculations with a payback period showing 3.62 years or 3 years 7 1/2 months, by using a Discounted payback return period is 4.21 Year or 4 years 2.5 months, using a Net Present Value (NPV) of $ 32,513,596.83, using the Internal Rate of Return (IRR) method is 36.88%, and using the Profitability Index (PI) method is 2.29. After comparing with the eligibility criteria, it can be concluded that this project is feasible to be implemented.

Keywords: Power plant, pulp and paper, ESP, capital budgeting.

INTRODUCTION

In the company's year report there was an increase in demand for industrial paper where world trends in paper also experienced an increase in industrial paper. For this reason, the company changed several white paper machines into industrial paper, one of which was found in Karawang. Where in the engine change there is the addition of an electric energy source.

In the PT XYZ 3 factory in Karawang, all electrical energy using PLN data shows that in 2016 the amount of electricity was 79,763,659 Kwh, in 2017 it was 85,461,244 Kwh and in 2018 it was 82,841,305 Kwh. Likewise with the purchase of coal needed for combustion in order to produce steam so that steam / steam is used for paper production data shows that in 2016 was 237,473.9 tons in 2017 was 26, 3874.7 tons and in 2018 was 250,375.3 tons.

The engine upgrade project is estimated to increase the electricity supply by 8,822.88 KW which means an increase in 76,229,683.2 Kwh in one year due to the addition of production machines such as motors and other electrical devices in an increase of 762,29,683.2 Kwh there will be an increase in production costs due to internal consumption after upgrading the engine is estimated 18,410.99 KW or 18.42 MW which is needed for the supply of production from the data above, PT XYZ wants to invest by building a 25 MW Power Plant.

Based on these information, a feasibility study on the application of technology, environmental and financial impacts on the construction of a 25 MW power plant is carried out, namely the Net Present Value (NPV) capital budgeting method, the Internal

Rate of Return (IRR), the payback period (PP) Discounted payback period (DPP) and profitability index (PI). Where the financing of the 25 MW power plant project is from Capital Expenditure (Capex)

LITERATURE REVIEW

Investment

According to Bambang Mulyana and Eddy Nugroho [1] there is an investment which means the time dimensioning which is to hold assets today to get results in the future. Investment can also be interpreted as an activity of procurement of assets to build or increase the company's operating capacity.

According to Charle P. Jones [2] Investment can be defined as a commitment of funds for one or more assets that will be held over several time periods in the future. Investment is related to the management of wealth owned by investors, which are the sum of current income and the present value of all future income.

According to Bambang Mulyana and Eddy Nugroho [1]. There are several factors that influence a company's decision to make an investment, namely:

a. Finance. Companies must measure the feasibility of an investment based on financial considerations and principles as a basis for decisions.
b. Business strategy. Is the result of the formulation based on the company's vision and mission, company policies, and internal and external studies of the company because of these several things the company can find out the type of investment that must be carried out, the amount and time of implementation.
c. Market. Internally this factor is closely related to the company's strategy (for example, wanting to have the largest market share, while externally related to absorption and market potential. Investment for additional capacity must be based on market conditions, namely leeway and potential.
d. Regulation. The company must ensure that the investment to be carried out does not conflict with State regulations both in terms of business, licensing, use of foreign workers, the use of imported raw materials and others.
e. Technology. In the investment plan the company must consider the choice of technology that will be used so that it will not cause problems in the company's operations later.
f. Environment. In an investment plan the company must consider environmental factors both physical and social environment. The physical environment is related to the issue of pollution, while the social environment is related to local values or wisdom that applies around the investment location.

Feasibility study

According to suad husna and suwarsono Muhammad [3] Business feasibility study research on whether or not a business projects (usually an investment business project) is carried out successfully.

Capital Expediture, Operational Expediture & Aktiva Expediture

According to Lawrence J. commitment and chad J zutter [4] Capital Expediture is the expenditure of funds by companies that are expected to generate benefits over a period of time greater than 1 year. Operational Expediture is expenses that produce benefits received in 1 year. Fixed Expediture assets are capital expenditures, but not all capital expenditures are classified as fixed assets.

Capital bugeting

According to chad J. zutter and Scott b smart [5] Capital budgeting is the process of evaluating and choosing long-term investments that contribute to the company's goal of maximizing owner's wealth.

According to Eugene f. brigham and Michael c. ehrhardt [6]. Capital budgeting is a planned summary of the entire project analysis process and decides which will be accepted and thus included in the capital budget.

There are 5 commonly used methods for investment, that is

1. Payback Peeriod (PP)

According to Lawrence J. Gitman and Chad J Zutter [4] is the time it takes for a company to cover the initial investment in a project, calculated from the Cash Inflow used formula:

$$PP = \frac{Investment\ Value}{Net\ Cash\ Flow} \text{ x 1 year} \quad (1)$$

According to Lawrence J. gitman and chad J zutter [5] Decision criteria in the PP Method are when the return period is used to make a accept-reject decision, the following decision criteria apply:

a. If the return period is less than the maximum acceptable return period. Accept the project.
b. If the return period is greater than the maximum acceptable return period, reject the project.

Discounted payback period (DPP)

According to Bambang Mulyana and Eddy Nugroho [1] this method is a modification of the repayment method so that it is slightly different from the payback period method, namely by including the time value of money method.

The completion steps are

a. Calculate the length of discounted cash flow for return on investment.
b. Set the investment payback period.
c. if item (a) is smaller than item (b), it means that the investment plan is feasible, but if on the contrary, the investment plan is rejected

As a guide in making decisions on the proposal of an investment, the information that must be considered is:

a. initial investment notated with C_0
b. year cash flow to – i which is notated with C_1 where i can 1,2,3,…n
c. Period of return of investment notated with t.
d. the age of the project is n, can be greater than t or can be also smaller than t,
e. PV total cash flow during the n investment period

$$PV = \frac{C_1}{(1+R)^1} + \frac{C_2}{(1+R)^2} + \cdots \frac{C_n}{(1+R)^n} = \sum_{i=1}^{n} \frac{C_1}{(1+R)^i} \quad (2)$$

Discounted payback period calculated based on how long the value of item (e) exceeds the value of item (a) if the value of item (e) is smaller than item (a), and then the investment proposal is rejected.

Net Present Value (NPV)

According suad husna and suwarsono Muhammad [3]. This method calculates the difference between the present value of investment and the present value of net cash receipts (operational or terminal cash flow) in the future.

Formula

NPV = Present value of cash inflows – initial investment (3)

$$NPV = -C_o + \frac{C_1}{(1+R)^1} + \frac{C_2}{(1+R)^2} + \cdots \frac{C_n}{(1+R)^n} \quad (4)$$

Or summarized into

$$NPV = -C_o + \sum_{i=1}^{n} \frac{C_1}{(1+R)^i} \quad (5)$$

Where is

C_o = Initial Investment
C_i = year cash flow to i
i = project age, from year i to n
R = discount rate

However, the most commonly used formulas are

$$NPV = \sum_{i=0}^{n} \frac{C_i}{(1+R)^n} \quad (6)$$

Where is

C_o = Initial Investment
C_i get ≥ 0 or ≤ 0, if
$C_i \geq 0$ or positive, means the cash inflow is greater than the investment
$C_i \leq 0$ atau negative, means the cash inflow is smaller than the initial investment
i = project age, from year i to n
R = discount rate

The criteria contained in the NPV method are

a. If the NPV> 0, the investment proposal is accepted.
b. If the NPV <0, the investment proposal is rejected.
c. If NPV = 0, the value of the company is fixed even if the investment proposal is accepted or rejected.

Internal rate of return (IRR)

According to Bambang Mulyana and Eddy Nugroho [1]. This method is an approach to calculate the interest rate that can equalize the present value of all cash inflows with the cash flow of an investment. The principle of this method is used to calculate the real rate of return and look for it using trial and error because the yield is obtained from investment cash flow, not from external factors, then this yield is called IRR

Formula

$$IRR = \sum_{t=0}^{n} \frac{A_1}{(1+r)^t} \quad (7)$$

Information

A_t = cash flow for the period t.
r = the interest rate that will make the present value of the proceeds equal to the investment value (capital outlays)
n = the last period of expected cash flow

The criteria contained in the IRR method are

a. If IRR> discount rate, then the investment proposal is accepted
b. If IRR < discount rate, then the investment proposal is rejected

Profitability Indeks (PI)

According to Bambang Mulyana and Eddy Nugroho [1] The PI method, also called desirability index, is a method that calculates the ratio of PV cash flow after initial investment (Proceeds) divided by the amount of initial investment (outlays). The formula used for the PI method.

$$PI = \frac{PV\ cash\ flow\ after\ initial\ investment}{Initial\ Investment} \quad (8)$$

Kriteria yang terdapat pada metode PI adalah

a. If PI > 1, then the investment proposal is accepted
b. If PI < 1, then the investment proposal is rejected
c. If PI = 1, No problem projects are accepted / rejected

FRAMEWORK

In general and the simple framework for this research can be described as follows.

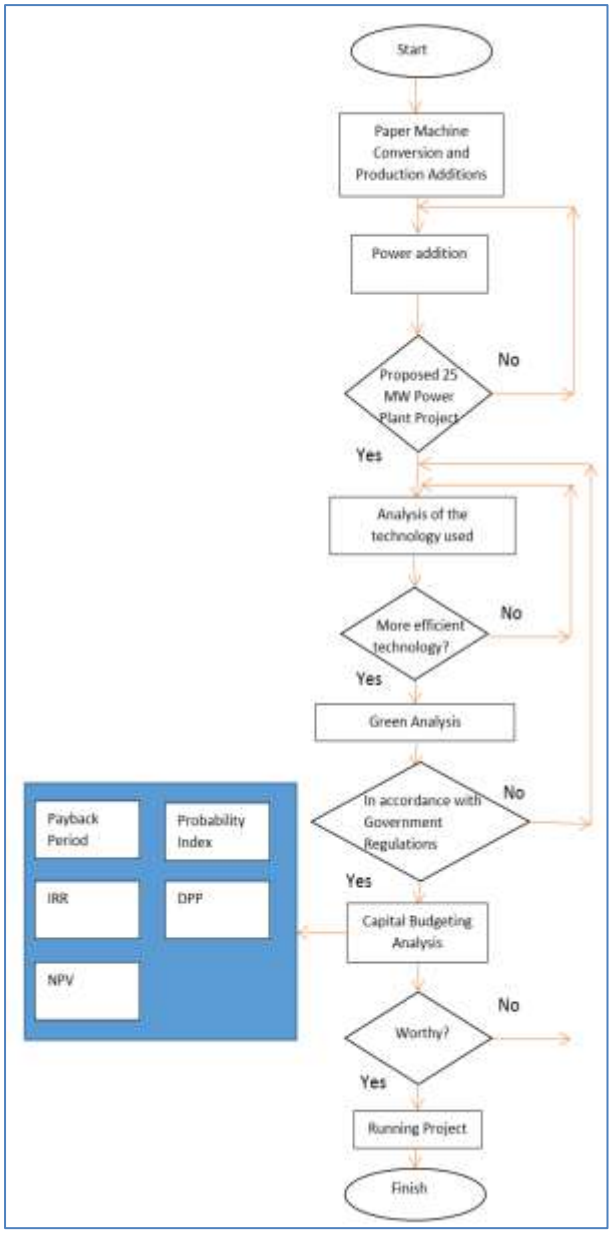

Fig-1: Tesis Framework

In this thesis research, the study will be analyzed with environmental aspects, namely the technology used and from the financial aspect with the capital bugeting method. From the amount of price projections obtained, will be analyzed for the Payback Period (PP), Discounted Payback Period (DPP), Net present value (NPV), Internal Rate of Return (IRR), and Profitability Index (PI). Likewise with technologies that are used in an environmentally friendly manner so that development can be rated "worthy" or "unworthy" projects for the long term.

RESEARCH METHODOLOGY

In the preparation of this thesis, researchers will use information and data consisting of primary data and secondary data. Primary data obtained directly from the source, namely from the company. Researchers conduct observations and direct observations to companies located in Karawang to obtain the required information. In addition, researchers also conducted interviews by asking questions and answers about the company's operations. Directly with PT XYZ 3 internal management, namely the Project Coordinator Head, Production Division, Electric Division and Boiler Division. As well as interviews with other relevant parties. Secondary data obtained in the form of company operational data. Such as the amount of investment costs, operational costs, proposal contractors and others.

Some steps and methods of analysis carried out in conducting this research are as follows

1. Make assumptions about the project operation plan based on primary and secondary data that have been obtained both in the application of technology, environmental and financial impacts.
2. On the aspect of applying technology. Comparing old and new technology.
3. On the aspect of environmental impact. Compare the effects of using old technology and new technology.
4. In the financial aspect, the cost of operating the 25 MW Power Plant for 1 year is the costs incurred for 1 year. Operations consist of purchasing coal within a period of 1 year, assuming labor costs and assuming the need for part maintenance spending within a period of 1 year. Other operational costs are not discussed.
5. Conduct quantitative and qualitative analyzes of project feasibility by using the capital budgeting method.

a) Payback Period

The criteria contained in the PP method are

- If the PP is shorter than the economic life of the project, the proposal is accepted
- If the PP is longer than the economic life of the project, the proposal is rejected

b) Discounted payback period (DPP)

The criteria contained in the discounted payback period method are

- If the DPP is shorter than the economic life of the project, the investment proposal is accepted.
- If the DPP is longer than the economic life of the project, the investment proposal is rejected.

c) Net Present Value (NPV)

The criteria contained in the NPV method are

- If NPV> 0, then investment proposal is accepted.
- If the NPV <0, the investment proposal is rejected.
- If NPV = 0, the company value remains even if the investment proposal is accepted or rejected.

d) Internal rate of return (IRR)

IRR percentage is not obtained directly, but through trial and error trial and error by finding the NPV value at a certain interest rate chosen randomly

and then the results are compared with investment costs. After that the interpolation is done by using the interpolation formula,

The criteria contained in the IRR method are

- If IRR> discount rate, the investment proposal is accepted.
- If IRR < discount rate, the investment proposal is rejected.

e) Profitability Indeks (PI)

The criteria contained in the PI method are

- If PI> 1, the investment proposal is accepted
- If PI <1, the investment proposal is rejected.

6. Make conclusions and recommendations based on the analysis that has been done. The data processing method used in this thesis uses the Microsoft Excel 2010 program.

RESEARCH MODEL

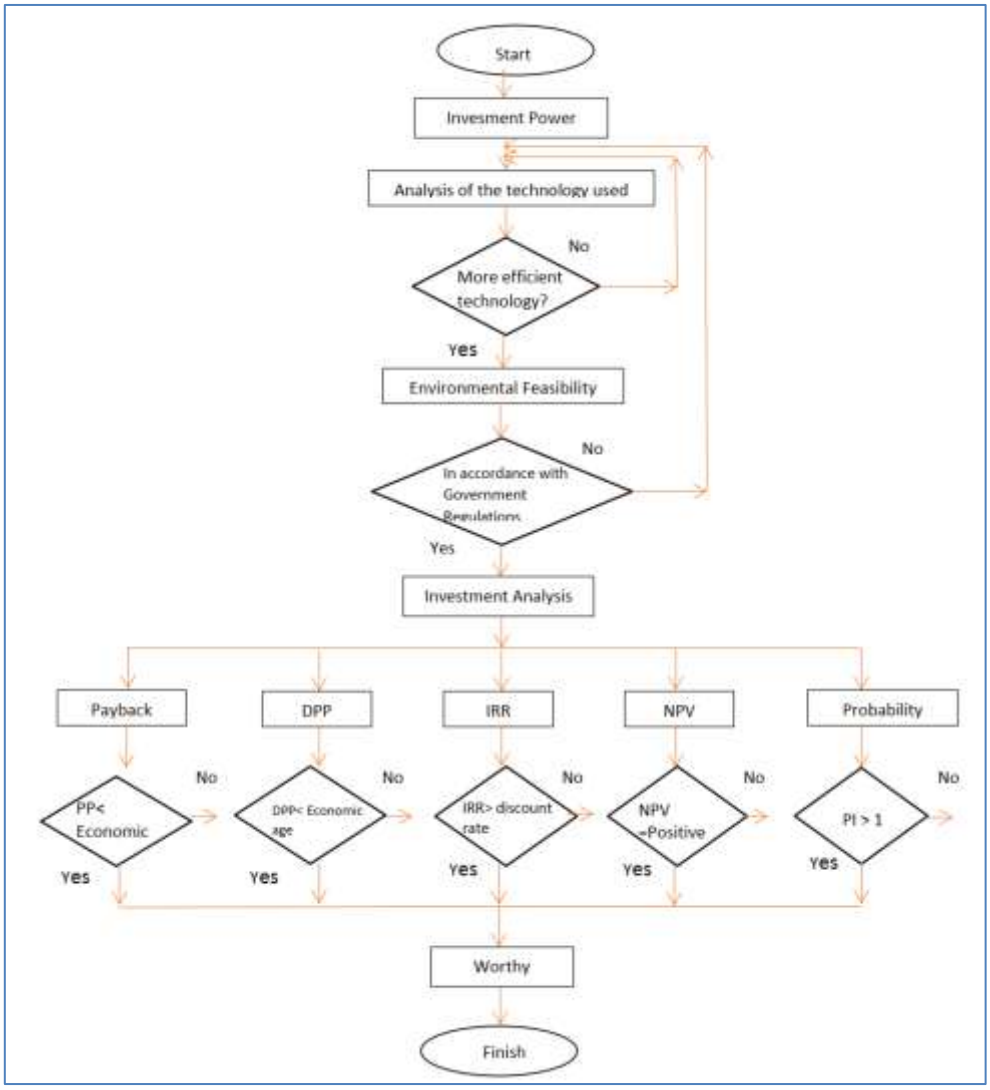

Fig-2: Research Model

RESULTS AND DISCUSSION

Discussion of Technology Aspects

Table-1: Technology Aspect Comparison of Old and New Boilers

No		Old Boiler	New Boiler
1	Type Boiler	CFB	CFB
		• Supply Steam for Production	• Supply Steam for Production • Supply Steam to Turbine to power a power plant
2	Coal consumption	28.6 Ton/hour	29.66 Ton/hour
3	Cost	22211681.39 USD/year	15,289,773.95 USD/year

From Table-1. it can be seen that the technology in the new boiler is more efficient because 29.66 tons/hour Coal can produce 25 MW of electricity and steam supply for paper production compared to the old boiler 28.6 tons /hour only to supply steam for paper production. Also seen is the cost to finance production in terms of electricity and coal purchases is more efficient 15,289,773.95 USD/Year compared to the old technology of 22211681.39 USD/Year because besides coal removal there is also electricity purchase for production.

Discussion of Environmental Aspects

Table-2: Aspects of environmental impact Comparison of Old Boilers and New Boilers

No		Old Boiler	New Boiler
1	**Type Duscolector**	**Multi Cyclone**	**ESP**
		• Sox = 226 mg/m3 • Nox = 511.5 mg/m3 • Total Particulate = 47.5 mg/m3 • Still removing fine dust	• Sox = < 150 mg/Nm3 • Nox = < 250 mg/Nm3 • Total Particulate = < 50 mg/Nm3 • Removing HG • Removing fine dust
2	Chimney	30 meter	100 meter
3	Waste Water	No There	6 to 9 pH
4	CEMS Analyzer	No There	There

From Table-2. it can be seen that the environmental impact on technology on new boilers is more friendly. The type of dustcolector used by new boilers is ESP type of new technology used for boilers which can not only reduce Sox, Nox, and Total Particulate as well as eliminate HG and fine dust so it's safe for the environment. Likewise with chimney or higher chimney the higher the chimney the better because the process of dilution of concentration in the air is getting better and the distribution will travel longer distances thereby reducing the negative impact on decreasing air quality. Next there is also the addition of wasted water which can be removed water around 6-9 pH.

FINANCIAL ASPECT ANALYSIS RESULTS

Capital Expediture

In determining the budget of a project, a study must be carried out by engineers and the calculation of engineering, construction and purchase of goods resulting from the calculation of capital expenditure carried out by engineering with a total of 25.07 MUSD.

Operating costs

In the construction of a power plant, it is necessary to know the operational costs in the proposal submitted by the contractor to produce 25 MW of electricity and steam. The main raw materials needed, namely coal below, are data from the contactor.

Table-3: Coal Consumption in Project Proposals

No.	Unit	Number
Capacity	MW	1×C25
Run hours annual	h	8000
Generated power annual	10^8kwh	2.0
steam Supplied annual(0.7MPa,266℃)	t	4.8×10^5
Heat energy Supplied annual	MJ	1.48×10^9
Coal consumption annual (90%)	T	237280
Bagasse consumption annual	T	18000

From table 3. above, it is known that to produce 25 MW, 237280 tons are needed for 8000 hours and can produce 0.7MPa and 266 ^{o}C in the amount of 4.8x10^{5} tons. From the calculations it can be concluded that to get 25 MW, 29.66 tons / h are needed. The price of coal is USD 53 per ton which is usually used to produce steam. So the cost price for producing 25 MW of electricity is 29.66 x 53 = 1571.98 USD / h. so for one year it takes 1571.98 USD / h x 8766 h = 13,779,976.68 USD. As for the costs or fixed costs that are needed for operational and maintenance (O&M) such as labor, spare parts and oil. In the results of interviews with management, it was Rp. 200,000,000.00 in one month. Can be calculated in 1 year then 12 x Rp. 200,000,000.00 = Rp. 2, 4000,000,000.00 Rp. 12,961.74 X Rp. 2,400,000,000.00 = 185160.3 USD. In an interview with the management of the operation even though there is a power plant itself. The factory or mill must also rent 1.4 MW of electricity for lighting purposes. So we can calculate the cost for electricity and utility electricity 1.4 MW x Rp. 1,400 Kwh = Rp. 17,169,600,000.00 or 1,324,636.97 USD in 1 year. So the cost of fixed costs in 1 year is = 13,779,976.68 USD + 185,160.3 USD + 1,324,636.97 USD = 15,289,773.95 USD in this calculation does not use variable costs.

Calculation of capital budgeting

In the calculation of capital budgeting can be determined whether the project is feasible or not feasible the project is run in financial terms.

Payback period

The calculation of capex in investment is 25,070,000.00 USD. The average KWH amount of electricity usage from 2016 to 2018 is 82,688,736 KWH.

Table-4: Total and Average electricity consumption

Total KWH				
	2016	2017	2018	Average
Total	79,763,659.00	85,461,244.00	82,841,305.00	82,688,736.00

This means that the average electricity expenditure in 2016 to 2018 is Rp. 115,764,230,400 / Rp. 12,961.74 = 8,931,736 USD

The average number of Tons of Coal to produce Steam from 2016 to 2018 for production is 250,574.63 Tons.

Table-5: Total and Average coal consumption

Total (TON)				
	2016	2017	2018	Average
Total	237,473.90	263,874.70	250,375.30	250,574.63

This means that the average cost of tonnes of coal from 2016 to 2018 to produce steam is 250,574.63 tons x 53 USD = 13,280,455.39 USD, so the average number from 2016 to 2018 electricity and coal expenditure is 8,931,736 USD + 13,280,455.39 USD = 22,212,191.39 USD.

$$PP = \frac{Initial\ Investment}{Net\ Cash\ Flow} \text{ x 1 year}$$

Net cash flow for return on investment is 22,212,191.39 USD - Fixed Cost = 22,212,191.39 USD - 15,289,773.95 USD = 6,922,417.44 USD

$$PP = \frac{25{,}070{,}000.00\ USD}{6{,}922{,}417.44\ USD} \text{ x 1 year}$$

PP = 3.62 year or 43.4 month

Within a period of 3.62 years or 3 years 7 1/2 months the investment returns if using the cost of purchasing electricity and purchasing coal for steam is reduced by the cost of producing electricity and steam when the power plant is running.

Discounted payback period (DPP)

Cash flow agreed for investment replacement is 6,922,417.44 USD per year Discount rate 6.12 %

$t_1 = \frac{6{,}922{,}417.44\ USD}{(1+0.0612)^1}$ = 0.94 x 6,922,417.44 USD = 6,523,197.74 USD

$t_2 = \frac{6{,}922{,}417.44\ USD}{(1+0.0612)^2}$ = 0.89 x 6,922,417.44 USD = 6,147,001.26 USD

$t_3 = \frac{6{,}922{,}417.44\ USD}{(1+0.0612)^3}$ = 0.84 x 6,922,417.44 USD = 5,792,500.25 USD

$t_4 = \frac{6{,}922{,}417.44\ USD}{(1+0.0612)^4}$ = 0.79 x 6,922,417.44 USD = 5,458,443.50 USD

$t_5 = \frac{6{,}922{,}417.44\ USD}{(1+0.0612)^5}$ = 0.74 x 6,922,417.44 USD = 5,143,652.00 USD

Total discounted cash inflows for 5 periods is 29,064,794.75 USD. The fourth total discount is 23,921,142.75 USD

Initial investment - total discounted cash flow until the fourth period is 25,070,000.00 USD - 23,921,142.75 USD = 1,148,857.25 USD

Thus the investment development period is

4 + (1,148,857.25 USD / 5,458,443.50 USD) = 4, 21 Years or 4 years 2.5 months

Net Present Value

$$NPV = -C_o + \sum_{i=1}^{n} \frac{C_1}{(1+R)^i}$$

Table-6: NPV Calculation Table

Years to	cash flow	DiscFactor 6.12 %	PV.Cach Flow	PV. Cash In Flow comulative
0	$6,922,417.44	1	$6,922,417.44	$6,922,417.44
1	$6,922,417.44	0.94	$6,523,197.74	$13,445,615.18
2	$6,922,417.44	0.89	$6,147,001.26	$19,592,616.44
3	$6,922,417.44	0.84	$5,792,500.25	$25,385,116.69
4	$6,922,417.44	0.79	$5,458,443.50	$30,843,560.19
5	$6,922,417.44	0.74	$5,143,652.00	$35,987,212.19
6	$6,922,417.44	0.70	$4,847,014.70	$40,834,226.89
7	$6,922,417.44	0.66	$4,567,484.64	$45,401,711.53
8	$6,922,417.44	0.62	$4,304,075.24	$49,705,786.77
9	$6,922,417.44	0.59	$4,055,856.80	$53,761,643.57
10	$6,922,417.44	0.55	$3,821,953.26	$57,583,596.83

$= -C_o + 68203139.97$ USD

= - 25,070,000.00 USD + 57,583,596.83 USD

= 32,513,596.83USD

From the NPV calculation, it is known that the power plant construction project has a positive value so this project is feasible to run or be received because it will provide benefits to the company by minimizing production costs.

Internal rate of return (IRR)

The IRR method is defined as a discount rate that equates the present value of the project's future cash flows with the initial project expenditure. IRR calculation is usually done by trial and error to calculate the present value of future cash flows using several discount rates so that an interest rate is found that causes the project NPV to zero.

$$IRR = \sum_{t=0}^{n} \frac{A_1}{(1+r)^t}$$

Table-7: Table IRR calculation with Disc Factor 36%

Years to	cash flow	DiscFactor 36 %	PV. Cach Flow	PV. Cash In Flow comulative
0	$6,922,417.44	1	$6,922,417.44	$6,922,417.44
1	$6,922,417.44	0.74	$5,090,012.82	$12,012,430.26
2	$6,922,417.44	0.54	$3,742,656.49	$15,755,086.75
3	$6,922,417.44	0.40	$2,751,953.30	$18,507,040.05
4	$6,922,417.44	0.29	$2,023,495.07	$20,530,535.12
5	$6,922,417.44	0.21	$1,487,864.02	$22,018,399.15
6	$6,922,417.44	0.16	$1,094,017.67	$23,112,416.81
7	$6,922,417.44	0.12	$804,424.75	$23,916,841.57
8	$6,922,417.44	0.09	$591,488.79	$24,508,330.36
9	$6,922,417.44	0.06	$434,918.23	$24,943,248.59
10	$6,922,417.44	0.05	$319,792.81	$25,263,041.40
			Total Present cash flow	$25,263,041.40
			Initial Investment	$25,070,000.00
			Net Present Value	$193,041.40

Table-8: Table IRR calculation with Dic Factor 37%

Years to	cash flow	DiscFactor 37 %	PV.Cach Flow	PV. Cash In Flow comulative
0	$6,922,417.44	1	$6,922,417.44	$6,922,417.44
1	$6,922,417.44	0.73	$5,052,859.45	$11,975,276.89
2	$6,922,417.44	0.53	$3,688,218.57	$15,663,495.46
3	$6,922,417.44	0.39	$2,692,130.35	$18,355,625.80
4	$6,922,417.44	0.28	$1,965,058.65	$20,320,684.45
5	$6,922,417.44	0.21	$1,434,349.38	$21,755,033.83
6	$6,922,417.44	0.15	$1,046,970.35	$22,802,004.17
7	$6,922,417.44	0.11	$764,211.93	$23,566,216.11
8	$6,922,417.44	0.08	$557,818.93	$24,124,035.04
9	$6,922,417.44	0.06	$407,167.10	$24,531,202.14
10	$6,922,417.44	0.02	$128,349.77	$24,659,551.91
			Total Present cash flow	$24,659,551.91
			Initial Investment	$25,070,000.00
			Net Present Value	-$410,448.09

$$r = P_1 + (C_1 \frac{P_2 - P_1}{C_2 - C_1})$$
$$= 36 + (\$193{,}041.40 \frac{37-36}{\$410{,}448.09 - \$193{,}041.40})$$
$$= 36 + 0.88$$
$$r = 36.88$$

From the interpolation or calculation above, we get a value of 36.88% which will make the present value of the future cash flow of the project the same as the initial investment value of the project, in other words the project NPV will be zero. An interest rate of 36.88% will result in a zero NPV meaning that this project has a rate of return (IRR) of 36.88%, far higher than the level of capital costs which is only 6.12%.

Profitability Indeks (PI)

This method compares the present value of the cash flow PV after the initial investment using NPV with the initial investment expenditure

$$PI = \frac{PV\ cash\ flow\ after\ initial\ investment}{Initial\ investment}$$

The present value of cash flows after the initial investment for 10 years is $ 57,583,596.83 Present value of investment expenditure of $ 25,070,000.00

Furthermore, the Profitability Index can be calculated as follows

$$PI = \frac{\$\ 57{,}583{,}596.83}{\$\ 25{,}070{,}000.00} = 2.29$$

Based on the calculation of the ratio of the net value of income and expenses that are discounted at an interest rate of 6.12% is 2.29. PI value is greater than the net value of the initial investment or expenditure, so this project can generate profits.

Table-9: Results from Financial Aspects

No	Method	comparation	Information
1	payback period	3 years 7 1/2 months <10 years	Worthy
2	Discounted payback period	4 years 2.5 months <10 years	Worthy
3	Net Present Value	$ 32,513,596.83 USD > 0	Worthy
4	Internal rate of return	36.88% > 6.12%	Worthy
5	Profitability Indeks	2.29 > 1	Worthy

From table 9. it can be seen that with the capital budgeting method that the construction of power plant projects is feasible to run. With a payback period and a discounted payback period compared to 10 years because 10 years is a time of major technology upgrades and maintenance. On Net present Value is positive then it is worth running. At an internal rate of return greater than the value of the interest rate, then it will be implemented. At profitability index greater than 1 means greater than the initial investment, then the project is feasible to run.

CONCLUSIONS

The results of the feasibility analysis on the investment of the construction of a 25 MW power plant in PT XYZ 3 which is used to supply Electric Energy and supply Steam for Paper production needs from the aspects of Technology, environmental impact and financial aspects as follows: (1) The technology used is more efficient 29.66 Ton / h Coal can produce 25 MW of electricity and supply steam for paper production compared to the old Boiler 28.6 Ton / h only to supply steam for paper production. From the cost of production financing in terms of electricity and coal purchasing, it is more efficient 15,289,773.95 USD / Year compared

to the old technology of 22211681.39 USD / Year. (2) The environmental impact on technology in new boilers is more friendly because the type of dustcolector is ESP technology that is not only able to reduce Sox = <150 mg / Nm3, Nox = <250 mg / Nm3, Total Particulate = <50 mg / Nm3. so also can eliminate HG and fine dust so it is safe for the environment. Likewise, higher chimneys or chimneys can reduce air quality reduction. The presence of a CEMS Analyzer (online emission monitoring system) can measure the level of emissions contained in the power plant environment. There is also the addition of Waste Water before Domestic wastewater, chemical water; Waste water from the coal handling system is discharged into the river to reach pH water to 6-9. (3) With a payback period and discounted payback period compared to 10 years because of 10 years is a time of major technology upgrades and maintenance. At Net present Value $ 32,513,596.83 USD> 0 is positive then it is worth running. At an internal rate of return 36.88%> 6.12% greater than the value of the interest rate, it is feasible to run. At profitability index 2.29> 1 greater than 1 means greater than the initial investment, the project is feasible to run.

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