

FINANCIAL FEASIBILITY ANALYSIS OF GUMANTI MICRO HYDRO POWER PLANT PROJECT

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Abstract - The limited electricity supply in Indonesia nowadays could results in condition where the social, economic growth in Indonesia is restrained. In Response, the government has created programs and policies regarding the electricity to encourage private sector to invest and build power plant development. PT. Sangriang Megasakti has the initiative to create a private micro hydro power plant named PLTM Gumanti. However, in order to establish the project, a feasibility analysis must be conducted in order to determine whether the project is feasible or not. Thus, this research is proposed to analyze the financial feasibility of Gumanti micro hydro project. In this case, research used financial tools in analyzing the project feasibility such as net present value, internal rate of return, payback period, profitability index, and economic value added. In calculating the tools and analyzing the results, several data of the project are required such as total capital expenditure of the project, the operational and maintenance expenditure, and the cash inflow from the electricity generated. The results from the financial feasibility analysis of the project are as follows: the net present value is IDR 45,606,095,418, the internal rate of return is 64%, the profitability index is 4.76, the payback period is 1 year 10 months, and the economic value added is IDR 21,705,617,081. The conclusion of the project is that project was good and feasible to develop. Moreover, the economic value added and rate of return shows that the project economically and financially are worth doing. As recommendation, the researcher recommends to create a letter of intent to conduct a good business and to negotiate the credit rate with the lenders, since the project has big rate of return and fast payback period.

Keywords: Feasibility Study, Micro Hydro Power plant, Project analysis

Introduction

Electricity crisis that occurred in Indonesia last recent year has become an issue that often becomes public discussion. Many parties stated that it is highly ironic to know that Indonesia which has a fairly abundant wealth of natural resources has not been able to provide adequate power supply for its citizen. Therefore, the government established a national electricity program of 35,000 MW, a strategic national program that is confirmed in the document of medium term national development goal year 2015-2019. However, the program of 35,000 MW needs vast investment fund which are above IDR 1,100 trillion. In order to keep balance the financial capability, PLN will build power plant by 10,000 MW. As for the rest, 25,000 MW will be offered to private companies or independent power producer.

Stated that the government have the policies and the national program that are encourage private sector to produce electricity that able to be distributed throughout the country, PT Sangriang Megasakti has the initiative to create a private micro hydro power plant named 'PLTM Gumanti' in order to produce sufficient energy to be sold to the nation. The power plant is named 'Gumanti' because it will be installed on Gumanti River. The Micro Hydro Generator itself has the capacity power of 6,900 kilo watt, which categorized into small hydro power group. The company will harness the potential source from the river that located in Solok regency, West Sumatera. The

Gumanti micro hydro power plant is specifically located in Labuak Bariak Village, Nagari Sariak Alahan Tigo, sub-district of Hiliran Gumanti, Solok regency. Therefore to get this project done, it takes amount budget to be invested. Given the condition that will come with full of uncertainty, it would require certain considerations. Therefore, feasibility study is required in order to start the project. Feasibility study consist of many aspects that should be studied and inspected its feasibility, so that the result of the study is used for making decision whether the business can be conducted, delayed, or even canceled.

Furthermore this study is to assess the economic value added of the project. The economic values added of this project are for:

- Utilize investor in order to lay investment in this project
- Assumption that give all parties information about the project

Research Objective

Based on the theses background and problem formulation, the objectives are stated as follows:

- Calculate the investment feasibility study with capital budgeting of the government-encouraged private project
- To determine whether the project are able to be continued, delayed, or canceled.
- Calculate the value of EVA and ERR

Theory Scopes and Limitations

Scope and limitations on this research are:

- The Project that became the object of this research is Gumanti Micro Hydro Project.
- The Project Evaluation are scoped only to Financial Feasibility Analysis

Literature Review

Hydro Power Brief Explanation

Micro hydro is a type of hydroelectric power that typically produces up to 30,000 kW of electricity using the natural flow of water. Principle of hydro power plant based on the water cycle principle, the continuous cycle in which water changes from water vapor in the atmosphere to liquid water through condensation and precipitation and then back to water vapor through evaporation, transpiration, and respiration. The components that mostly used in the micro hydro power plant are stated as follows:

- Intake
- Dam
- Sandtrap
- Forebay Tank
- Penstock
- Power House
- Tail race

Feasibility Study

A conducted feasibility study has the purpose to provide an overview of the primary issues related to a business idea. It determines whether the project idea is applicable and makes sense. A thorough feasibility analysis provides much information regarding the business plan. The cost of the project will be categorized in order to provide the basis information regarding the project and therefore could be analyzed by using financial instruments. Some of the cost categories are stated as follows:

- Investment Costs
- Operating Costs
- Revenue Projections
- Profitability Analysis

Financial Tools

Net Present Value

Net present value is the method used by most large companies to evaluate investment project. It is the value of a specific stream of future cash flows presented in today's value. NPV are used to determine whether a project is worth doing. The project that has positive value should be carried out, but negative present value should be rejected. Because a positive NPV means the combined present value of all cash inflows exceed the present value cash outflows. The formula stated as follows:

$$NPV = \frac{NCF_t}{(1+K)^t} - NCF_0$$

Where

NCF₀ = Initial cash outlay of project

NCF_t = net cash flow generated by project at time – t

N = life of the project

K = required rate of return

Decision Criteria:

If the NPV is greater than 0, accept the project

If the NPV is less than 0, reject the project

Internal Rate of Return

Internal rate of return are used for investor to judging the investment, the rate of return is how fast the money come back to the investor. On other words IRR is the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero (Moten, J: 2013). The higher IRR shows valuable the project. Internal rate of return is used to evaluate the attractiveness of a project or investment. The Formula is stated as follows:

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

IRR = Internal rate of return

CF_t = Cash Flow

t = time

Decision Criteria:

- If IRR > Weighted Average Cost of Capital, then the project is accepted
- If IRR < Weighted Average Cost of Capital, then the project is rejected

Payback Period

Payback Period is the period of time over which the accumulated cash flow will equal the initial outlays (Don Daynanda: 2002). The length of time required recovering the cost of an investment. The payback period of a given investment or project is an important determinant of whether to undertake the position or project, as longer payback periods are typically not desirable for investment positions. The formula stated as follows:

$$\text{Payback Period} = \frac{\text{Cost of Project}}{\text{Annual Cash Inflows}}$$

Decision Criteria:

- If the payback period is less than the maximum acceptable payback period, accept the project.
- If the payback period is greater than the maximum acceptable payback period, reject the project

Profitability Index

The profitability index is a tool in capital budgeting techniques, to provide the most long term value of the project. The value is expressed by the ratio. The formula of PI is written as follows:

$$PI = \frac{\text{Present of future cash flow}}{\text{Initial cash investment}}$$

Profitability Index Criteria:

- When PI is greater than 1.0, it means the present value of cash inflows is greater than the initial cash outflow

The Profitability index shows the relative profitability of any project, or the present value per dollar of initial cost. A project is acceptable if it's PI greater than 1.0, and the higher the PI, the higher the project ranking. (Brigham: 2010)

Economic Value Added

Economic value added or EVA is a measure that enables managers to see whether they are earning an adequate return (Stewart Bennet: 1991). EVA is calculating the maximization of Value Company in periodically with consideration of cost of capital or also referred as "economic profit". The formula for calculating EVA is as follows:

$$EVA = NOPAT - (WACC * CAPITAL)$$

Where:

NOPAT: Net operating profit after tax

WACC: Weighted Average Cost of Capital

CAPITAL: Total cash invested in the firm over its life, net of depreciation (Martin & Petty, 2001)

Research Methodology

Problem Identification

Problem Identification is a process that conducted the information. It's the first step to start the study, which can be done in many ways, such as reading literature review, acquiring information from the internet and observing real condition and having discussion with the project officer, lecture, and tutor. After that the researcher starts to identify the problem existing in which would be formulated into the research question. The research question is highly related with the research background.

Literature Review

After determining the stage of the problem, the next step is to determine the literature source and theoretical values which would be used as the basis of the research analysis. The literature review was done by gather the theory, definition, and other knowledge regarding to the objective of the research from textbooks, internet, journal, and theses, and so forth to get the needed information, which later will be put into the research thinking framework.

Data Collection

In order to start analyzing the problem, the research needs to obtain information available from the research object, which in this case, was the project of Gumanti Micro Hydro. There are two types of data that could be collected, which are primary data and secondary data. The primary data is the data acquired directly from the first party, while secondary data is the data acquired from the existing data that already disseminated.

Data Processing

The data processing steps is the step where the raw data categorized into some more understandable framework. After that, the data will more meaningful information needed for the analysis. From the data collected, there are mainly divided into three categories which are operational and maintenance expenses, investment expenditure. The data of engineering aspect are given from the engineering feasibility team then will be processed by the researcher. Then both of the output will be combined into projected cash flow.

Data analysis

The secondary data that have been attained will be used for the calculation of the project's feasibility. The analysis includes the calculation of the initial investment, NPV, IRR, Profitability Index, Payback Period, projected Cash flow and cost benefit analysis.

Conclusion & Recommendation

After getting the collective data, the last step is creating the conclusion. The result from the conclusion will answer the research question and the purpose of question. And then give the recommendation about the condition of the project throughout this study.

Feasibility Study Analysis

Technical analysis

The power produced from Gumanti power plant will be stated by the company's engineers as follows:

Table 1. Power Production

Water Debit (m ³ /sec)	Turbine Efficiency	Generator Efficiency	Gearbox Efficiency	Total Efficiency	Power Produced (kW)
7.66	0.900	0.950	1.000	0.855	703.364

Table 2. production capacity

Production capacity	
Power generated (kW)	703.36
Electricity Produced (kWh)	6,900
Daily Electricity Produced (kWh)	165,600
Monthly Electricity Produced (kWh)	4,968,000
Annual Electricity Produced (kWh)	60,444,000

Based on the analysis of the micro hydro power plant, the total production per year is 60,444,000. But it is still gross value, because there are costs of transmission loss and annual electricity cost for personal use. The real production to be sell to PLN is $60,444,000 - (5\% * 60,444,000) - 438,000 = 56,983,800$ kWh per year.

Project Financial Analysis

From the calculation gathered from the theses, the total capital expenditures will be total IDR 45,606,095,418, the costs is acquired from the sum of the projects building expenditures, mechanical/electrical expenditures, and contingencies. From there, we will calculate the financial feasibility. The Brief Project Capital Are stated as follows

Table 3. initial Investments

INITIAL INVESTMENTS	
Amdal And Licensing	IDR 900,000,000
Land	IDR 500,000,000
Building / Civil Construction Expenditures	IDR 11,876,449,716
Mechanical and Electrical Expenditures	IDR 27,299,535,000
contigencies	IDR 1,784,102,027
tax	IDR 4,146,008,674
Total	IDR 45,606,095,418

Business Development

In doing the calculation of feasibility study for PT. Sangriang Megasakti, authors used development scenario. In calculating the feasibility of the business, author use three statements: base production, increasing production by increased water discharge of 5%, and decreasing production by decreased water discharge of 5%. This statement is caused by the level of water discharge that moves in the Gumanti River that may change during project execution. The result of the calculation of the indicator variable as financial feasibility by considering three scenarios can be seen in the table below:

Table 4. comparisons of three scenarios

Scenario	IRR	NPV	PI
Optimistic	67%	IDR 183,961,210,776	5.03
Basis	64%	IDR 171,596,312,915	4.76
Pessimistic	60%	IDR 159,231,415,054	4.49

After seeing the comparison of three scenarios, they show a good sign, because:

- The IRR in the three scenarios shows that the value of IRR is greater than WACC of the project which are 13.3% this means that we should accept the project
- NPV as the best single measure of profitability. From three scenarios it shows a positive value NPV, which means that the company will earn return greater than its cost.
- Profitability index measure the company's project risk, the result shows that all of the value are greater than 1.0, which means the project are acceptable

WACC Calculation

Table 5. WACC calculation

WACC Calculation				
Capital Structure	Capital Source	Weight	Cost	Weighted Cost
Debt	Bank Mandri	60%	10.13%	6.1%
Equity	PT. Sangriang Megasakti	40%	17.97%	7.2%
Total		100%	WACC	13.3%

The result of WACC calculation will further be used for the project discounted rate

- The cost of equity are calculated using capital asset pricing model (CAPM), using the data of government bond of 30 years, beta value from calculation of comparable company, and risk premium Indonesia of 9.25%.
- The cost of debt is calculated using cost of debt formula. The interest rate given by bank is 13.5% and the given corporate tax are 25%

Operational Costs

From the calculation gathered from the theses, the total operation cost during the Gumanti micro hydro project are IDR 300,862,691,291. That costs is a sum from 30 years of annual salary costs, maintenance costs, water retribution costs, and overhead costs. The table Stated As follows:

Table 6. Annual Total Operational Costs

Year	Total Operational Cost	Year	Total Operational Cost
1	IDR 3,945,986,977	16	IDR 8,950,741,647
2	IDR 4,150,801,497	17	IDR 9,492,463,952
3	IDR 4,368,934,519	18	IDR 10,071,621,009
4	IDR 4,601,316,322	19	IDR 10,690,940,700
5	IDR 4,848,945,394	20	IDR 11,353,356,634
6	IDR 5,112,893,591	21	IDR 12,062,024,019
7	IDR 5,394,311,695	22	IDR 12,820,336,747
8	IDR 5,694,435,412	23	IDR 13,631,945,843
9	IDR 6,014,591,821	24	IDR 14,500,779,332
10	IDR 6,356,206,328	25	IDR 15,431,063,682
11	IDR 6,720,810,162	26	IDR 16,427,346,917
12	IDR 7,110,048,448	27	IDR 17,494,523,543
13	IDR 7,525,688,909	28	IDR 18,637,861,426
14	IDR 7,969,631,245	29	IDR 19,863,030,793
15	IDR 8,443,917,238	30	IDR 21,176,135,489
Total		IDR 300,862,691,291	

Revenue Stream

From the calculation gathered from the theses, the total operation costs during the Gumanti micro hydro is working are IDR 1,241,865,275,304. The calculation is using assumptions of operational hours of 8760 and escalation price of 3%. The electricity produced is 438,000 kWh annually. The price of electricity for sale is IDR 787.2 per kWh. This price is acquired from the decision of regulation by ministry of energy and mineral resources (ESDM) No 31 year 2009 article 2. And the sale of the electricity is reduced with the operational costs. The Table of Revenue is stated as follows:

Table 7. Total Annual Operating Cash Inflow

year	Operating Cash Inflow	year	Operating Cash Inflow
1	IDR 40,911,660,383	16	IDR 43,051,565,972
2	IDR 40,706,845,863	17	IDR 42,509,843,667
3	IDR 40,488,712,841	18	IDR 41,930,686,609
4	IDR 41,602,060,459	19	IDR 42,871,436,148
5	IDR 41,354,431,386	20	IDR 42,209,020,213
6	IDR 41,090,483,190	21	IDR 41,500,352,828
7	IDR 42,195,166,389	22	IDR 42,348,911,405
8	IDR 41,895,042,672	23	IDR 41,537,302,310
9	IDR 41,574,886,263	24	IDR 40,668,468,821
10	IDR 42,660,956,099	25	IDR 41,393,261,915
11	IDR 42,296,352,265	26	IDR 40,396,978,680
12	IDR 41,907,113,979	27	IDR 39,329,802,054
13	IDR 42,961,988,390	28	IDR 39,891,193,939
14	IDR 42,518,046,055	29	IDR 38,666,024,572
15	IDR 42,043,760,062	30	IDR 37,352,919,876
Total		IDR 1,241,865,275,304	

Cash Flow

The cash flow are initially calculated from cash inflow which are electricity produced and beginning equity and investment loan and cash outflow from capital, operation and maintenance expenditure of the project will be resulted in the table below:

Table 8. Total Project Cash flow

year	total project cash flow	year	Total project cash flow
0	0	16	IDR 446,496,944,408
1	29,016,863,454	17	IDR 477,011,741,774
2	28,508,685,336	18	IDR 507,147,333,526
3	28,512,445,897	19	IDR 536,877,515,338
4	29,464,083,839	20	IDR 567,266,221,827
5	29,480,482,928	21	IDR 597,191,237,162
6	29,504,669,749	22	IDR 626,620,185,327
7	30,508,054,791	23	IDR 656,643,124,496
8	30,551,373,304	24	IDR 686,097,937,299
9	30,606,326,202	25	IDR 714,944,566,659
10	30,241,370,455	26	IDR 744,298,551,185
11	29,986,147,771	27	IDR 772,955,137,447
12	29,713,680,971	28	IDR 800,864,700,070
13	30,452,093,059	29	IDR 829,167,237,013
14	30,141,333,424	30	IDR 856,612,155,399
15	29,809,333,229	total	IDR 883,137,900,498

Payback Period

Table 9. Payback period

Payback Period			
Year	Accumulated Cashflow		
0	0	15	IDR 446,496,944,408
1	IDR 29,016,863,454	16	IDR 477,011,741,774
2	IDR 57,525,548,790	17	IDR 507,147,333,526
3	IDR 86,037,994,686	18	IDR 536,877,515,338
4	IDR 115,502,078,526	19	IDR 567,266,221,827
5	IDR 144,982,561,454	20	IDR 597,191,237,162
6	IDR 174,487,231,203	21	IDR 626,620,185,327
7	IDR 204,995,285,994	22	IDR 656,643,124,496
8	IDR 235,546,659,298	23	IDR 686,097,937,299
9	IDR 266,152,985,500	24	IDR 714,944,566,659
10	IDR 296,394,355,955	25	IDR 744,298,551,185
11	IDR 326,380,503,726	26	IDR 772,955,137,447
12	IDR 356,094,184,697	27	IDR 800,864,700,070
13	IDR 386,546,277,755	28	IDR 829,167,237,013
14	IDR 416,687,611,179	29	IDR 856,612,155,399
		30	IDR 883,137,900,498
		Payback Period	1.6

The payback period analysis provides the indication of both risk and the liquidity of the project. According to the table data above, the project enters the payback line in year 2. A short payback means:

- The investment fund will be unlocked for many years; hence the project is significantly liquid.
- The payback period is quite fast that it could be achieved within less than 2 years. The projected cash flows are relatively good. Hence, the project is significantly low-risk.

Economic Value Added

The economic value added or EVA is used to analyze the project whether it earns a pure economic profit. The pure economic profit has the meaning that the profit of the project is higher than the expected given particular line of business. The project has positive economic added value in all of the year. This means that this project is worth doing and the project thoroughly earns more than its cost of capital each year. It also has the significant economic benefit that boosts the value of the project.

Conclusion and Recommendation

Investment Feasibility Study

From the financial feasibility study, it is resulted that the researcher generated a capital budgeting outcome about current condition. The funding and financial condition of the project was good and feasible to develop. These are the financial summaries of the following conditions:

- Micro hydro power plant investment = IDR 45,606,095,418
- Electricity Price to be sold to PLN = IDR 787.2 /kwh
- Internal Rate of Return = 64%
- Net Present Value = IDR 171,596,312,915
- Payback Period = 1 year 10 months
- Profitability Index = 4.76

Project Feasibility

It is shown that the project has a very big rate of internal rate of return, which means the project will be paid off within than a year. In overall the project shows good signs.

Economic Value Added

The Economic Value Added (EVA) calculation shows a positive result, it means the project are economically and financially are worth doing, and the project earns more than its cost of capital each year.

Economic Value Added	
Net Operating After Tax	IDR 27,754,526,168
WACC	13.3%
Capital Expenditure	IDR 45,606,095,418
Economic Value Added	IDR 21,705,617,081

Recommendation

After the observation and data analysis of the project, the author made several recommendations to PT. Sangriang Megasakti. Researcher suggests that the company should try to establish the company project as fast as possible, to avoid price change of the initial expenses. This recommendation could be reach by following some of these steps below. the First of all since we do a serious business, the first step is to make a letter of intent, a letter of intent will help the buyer and seller, in this case are PT Sangriang Megasakti and PLN, intend to move forward with good faith of business towards developing the projects. This letters of intent also serves the third parties (the money lenders) that PLN and PT. PT Sangriang Megasakti have a serious business and good completion in business. Also, PT. Sangriang Megasakti Should immediately registers them self in Rencana Usaha Peyediaan Tenaga Listrik (RUPTL) year 2015 – 2024 so the proposal will be assessed and approved by PT. PLN immediately. Secondly, negotiate with the lenders, in this case the private bank corporation, to gain a lower rate of interest or at least the interest assumed in the research. This project should be able to convince the bank corporations, since it has big rate of return at fast payback period. This problem occurs because when a not well known medium sized company

proposed a multi billion project, the bank will have small trust towards them and fear of not getting their money back to them. The situation therefore will lead to a higher interest rate given by the lenders to the company. PT. Sangriang Megasakti should convince the money lenders that their project able to produce constant electricity income that could reach the breakeven point in a short run. Besides establishing the project as fast as possible, the debt of the project could be adjusted into 70% and equity 30%. By using that ratio, the WACC will only slightly increase, resulted in slight change in Net Present Value, Internal Rate of Return, Profitability index, and Payback Period. The project will remain feasible while the company could decrease their down payment. Further Research that could be conducting following this Feasibility Study of Gumanti Micro Hydro project is the sensitivity analysis, which factors affect the most into the project. All the statement above will impact to the performance of the project, if the company implements the project business then it is expected to run properly.

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