Financial Analysis of Design 4 MW Mini-Hydro Power Plant In Cipelah, Bandung Regency

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Abstract: **Mini Hydro Power Plants (PLTM) have low operating costs compared to Diesel Power Plants (PLTD). Mini hydro uses renewable energy from water resources.Planning the PLTMH in Cipelah District includes Weir, Intake, Soothing Tub (Forebay), Rapid Pipe (Penstock), and selection of turbines. The power generated from the effective fall height is 71.3 m, and a discharge of 2 x 3.51 m3 / s is 4MW. With a maximum capacity per year of 35.04 MWH. Total Production to PLN per year 23.93 MWH.The calculation of the feasibility analysis for the construction of a Mini Hydro Power Plant obtained an investment value of 6,297,758USD. The interest rate used is 6%, the composition of the loan is 4,408,431 USD, and the equity is 1,889,328 USD. The IRR value of the PLTM CIpelah development plan is 20.58%, and the NPV value is USD 11,952,550 and the Payback Period is five years. The conclusion is that the Cipelah PLTM construction project is feasible to build.**

Keywords: **PLTM, Total Energy Production, Investment Value, Feasibility Value.**

I. INTRODUCTION

One of the energy sources is water resources. Water resources are a resource with various uses needed in everyday human life. The use of water also includes water to supply electrical energy, which is also a significant need. Limited electrical power is one of the problems. Efforts are needed to solve the problem, not to cause a crisis that can have a more substantial impact.

It is generally not economical to talk about the store and expand the network to remote areas regarding electricity supply. On the other hand, fossil fuel power plants for remote areas are usually not economical because the scale of the generation is too small. The cost of fuel is high. However, Electricity's provision must still carry out because it is an inevitable social investment in improving people's welfare.Installation of hydroelectric power plants or Microhydro Power Plants (PLTMH), especially in remote areas, still needs to be developed, seeing regions of Indonesia where much water has not to use optimally. There are stillmany remote areas in Indonesia that are not yet reaching by Electricity (PLN). Therefore, to meet the need for electric lighting in remote areas, creating a tool that can make hidden places cheap and environmentally friendly, namely the Microhydro Power Plant (PLTM). As an alternative to power plants, diesel (PLTD) which uses fuel oil, especially diesel, has higher operational costs than hydroelectric power plants (Mini Hydro Power Plant) PLTM is also environmentally friendly.

The government has also made laws and regulations that support investment in the PLTM sector, namely: Government Regulation No. 03 of 2005 concerning Electricity states that availability of primary energy for power generation, the use of local energy sources are the priority with the obligation to prioritize the use of renewable energy sources.The mini-hydropower plant with the plan to be built is in Cipelah Village, Rancabali District, Bandung Regency. The water source used as input for the power plant is the Cibuni River, where the mainstay discharge from the Cibuni river reaches 8.83 M3 / second.

Figure.1. Power plant location map

Electricity production from this mini-hydropower plant will later sell to PLN, with the total output sold to PLN per year of 23,930.56 MWH. Suppose it assumes that the production escalation is 80% of the total. In that case, the average electricity production sold to PLN is around 19,144,448 kWh per year.

II. METHODE AND FORMULA

The project is a series of activities to manage resources with a planned time and cost to benefit. Therefore, we need to evaluate whether it considers the time, prices, and uses before the project starts and after the task runs.

Because of the limitation of resources, choices make among the alternative competing uses and investments. Regarding how countries allocate their scarce resources, the organization has distinguished two chief social types with a planned economic system. An organization with a free-market financial system,however, no country in the real world is either entirely centrally planned or operates a completely pure free-market system. It can say that no economic system can

work without any state intervention or/and some production activities undertake by the state. Yet even in the US, the command principle has some sway. That is why, like almost all developing countries, the national governments of the economies in transition must take a role in formulating and evaluating investment projects. Of course, the mix of private and public sector investment varies from country to country. Either direct investment in the public sector or imposing controls on private investment or domestic taxes, tariffs, subsidies, and the rationing of scarce resources, the government is generally in a position to guide the development and restructuring of the economy in the country [1][1]. Project analysis is a method to evaluate an investment proposal itself and making convenient and reasonable choices among alternatives conveniently and comprehensively[2][2]. A good investment project must include mainly costs and benefits of the investment and some other features of a proposal such as analysis related to input and output markets, location of the production unit, capacity, and technology. On the other hand, projects must analyze and evaluate to obtain some common yardstick, make decisions about realization and financing, and choose among alternative project proposals and their ranking. We can put into four categories the way of analysis and evaluation of a particular investment project from the different viewpoints as follows [3][3].

i. Technical evaluation
ii. Financial analysis
iii. Economic analysis iv. Risk, uncertainty, and sensitivity analysis

In this article, particular importance has been given on the financial analysis while providing a brief explanation about others, at least what their means are

The financial analysis deals primarily with earning considerations of a project [4][4]. It is concerned whether the project will secure the funds it will need and repay and whether it can be financially viable or profitable. Financial analysis is examining commercial or private profitability from the firm's economic viewpoint. Therefore, financial accounting is helpful to investors interested in financing and for entrepreneurs who own the project. In financial analysis, we will calculate some measures to determine the profitability and repayment capability of the projects. These measures are base on the estimated costs and benefits of the projects and so-called financial cost-benefit analysis.

Since an investment project is a proposal to be realized in a proposed future, the prices will discuss. Indeed, the rate of inflation does not only affect the future cash flows but also affect the cost of capital, i.e., discounting rate

Cost of capital

We need an appropriate discount rate to discount cash flows using discounted measures and use it as a yardstick compared with the calculated estimates. We can put this rate directly or indirectly. If funds use in investment were borrowed, the interest rate on borrowed money would now operating as the cost of capital. When non-borrowed funds are using, the cost of the capital may be best measured in an indirect way using opportunity cost [5][5]. The opportunity cost to a firm defineshow the help would have earned its most profitable alternative use. Devoting funds to a specific project, an investor is giving up other alternatives. Even if the investor has only one choice, he can put his money in a savings account. In this case, the interest rate of the savings account would be the opportunity cost.

The "cost of capital" is a necessary benchmark in picking the fair allowed rate of return. The cost of capital is the expected rate of return in capital markets on alternative investments of equivalent risk. The cost of debt capital is relatively straightforward to assess, but determining the cost of equity capital is much harder[6][6]

Cash flows and derivation of the cash flow table

The generation of project cash flows is crucial for both project managers and project owners. During project implementation, the cash flow is vital for assessing working capital requirements since the difference between project expenditures and payments determines the necessary capital reserves. Furthermore, an accurate cash flow is required to conduct project cost-benefit analysis, determine project financing requirements, and perform earned value analysis [7][7].

Discounted measures of the project worth are base upon the cash flow table, which consists of investment and operating costs as outflows, gross benefits as inflows, covering the whole economic life of the project

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[6]*BenteVilladsenMichaelJ.VilbertDanHarrisA.Lawrence Kolbe, Risk, and Return for Regulated Industries, Academic Press, Science Direct, 2017.*
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Tabel .1. Example of Cash Flow

DESCRIPTION			YEAR'S (-1.5) USD	YEAR'S (-1) USD	YEAR'S-1 (USD)	YEAR'S-2 (USD)	YEAR'S-3 (USD)
InFlow :							
Loan			7,818,322		0	0	0
Equity			3,350,709		0	0	0
Net Income				0	1,160,417	1,694,282	2,283,811
Depreciation				0	439,100	439,100	439,100
Total Inflow			11,169,031	0	1,599,517	2,133,382	2,722,911
OutFlow :							
			25%	72%			
Investment			2,792,258	8,041,702	0	0	0
Loan Repayment	10	Year	111,690	643,336	1,272,396	1,272,396	1,272,396
Total Outflow			2,792,258	8,041,702	1,272,396	1,272,396	1,272,396
Inflow – Outflow					327,121	860,986	1,450,515
YEAR BEGINNING CASH					0	327,121	1,188,108
YEAR ENDING CASH					327,121	1,188,108	2,638,623

Net Present Value

Net present value (NPV) is the most straightforward discounted cash flow measure of a project. NPV is simply the total current value of the project's net cash flows computed by discounting the net cash flows over its life with a given appropriate interest rate. The NPV formula calculates the Present Net Value (NPV) of a series of cash flows based on a specified discount rate. We can explain NPV in a recipe as follow :

NPV = F / [(1 + i)^n]

Where,

PV = Present Value

F = Future payment (cash flow)

i = Discount rate (or interest rate)

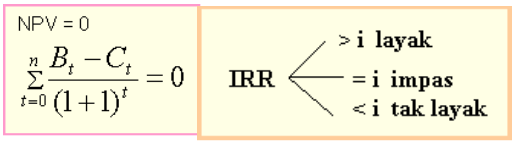
n = the number of periods in the future the cash flow is

Internal Rate of Return

A third common way of using discounted cash flows for measuring the worth of a project is the internal rate of return (IRR). It is a discount rate that makes the net present value of a project equal to zero. This discount rate gives various names; the "solution rate,""the yield," or "the marginal efficiency of investment" (Rehber 1998). Unfortunately, there is no formula for directly finding the internal rate of return. That is why we do not have an efficient system that will give us the correct answer on the first try.

We are forcing to resort to trial and error. It is one way of calculating net present value, using progressively higher interest rates until the net present worth becomes negative. Then we interpolate to arrive at the IRR. The interest rate (i) at that time is called the IRR

Figure.2. Formulation of IRR



Evaluation of Criteria for a Single Project

For a single project, the net present value must be equal or more than zero for the acceptance of the project, i.e., NPV must be positive. According to its net current worth, if a project is acceptable according to its net present value, it can also be accepted in according. In the case of an alternative project are available, projects having an internal rate of return above the opportunity cost of capital can be acceptable. In addition, they could be rank in order of the value of the internal rate of return (The lowest one is termed the "cutoff rate"). But in mutually exclusive projects, direct comparison of IRR can lead to wrong investment choice. To avoid erroneous evaluations, you can either discount the difference in net cash flows from alternative projects or by using the NPV criterion.

III. RESULT

Basic Assumptions

To simulate the calculation of the financial feasibility of a Mini Hydro Power Plant, in this case, the CipelahMini Hydro Power Plant with a capacity of 4 MW which includes two turbines, each 2 x 2 MW, it is necessary to have basic assumptions that are contextual following the general investment parameters prevailing in Indonesia, that is :

1. The investment planning projection period is 15 years

2. VAT at 10% and PPH at 25%, The interest rate that using as the basis for calculating bank loan interest rates is 14%
3. The Grace Period or the construction period of the CipelahMini Hydro Power Plant is assumed to be two years, so the PLTM will only operate in the 3rd year
4. The selling price of Electricity to PLN is 12 cents dollars at a rupiah exchange rate of Rp.14,000, so the selling price of Electricity to PLN reaches a cost of USD 0.12, - / KWH (up to 8 years) and USD 0.75, - / KWh
5. The amount of electric power sold to PLN from the CipelasMini Hydro Power Plant 2x 2 MW is an average of 23,939 MWH.
6. The investment scheme that applies is 30% is Owner Equity, and 70% is a Bank Loan, with a loan period of 8 years.
7. Cost of Land Acquisition Where the area of land acquired is 10 Ha, the land acquisition price is IDR 50,000 / M2
8. Non-construction costs that are entering into the EPC cost calculation are 5% of the EPC value
9. Licensing Fees and Legal Compliances (0.9%), Cost of Compiling FS, DED and EPC Compliances (2.7%), 0.17% Test and Commissioning Fee, Financing Cost in the form of Bank Provision Fee of 1.2%

Electricity Production and Projection of Electricity Sales to PLN

As a first step in calculating financial feasibility, what needs to be figuring is the volume of electrical power that is generating and sells to PLN, which is as follows:

Tabel .2. Production of Electricity and electric power sold to PLN

No.	Description	Capacity Turbine	Yearly Production (Mwh) Turbine 1	Turbine 2
I.	Coefisien Faktor From Water Production			
1	Max Production Capacity		17,520.00	17,520.00
2	Yearly Production		17,204.97	9,533.08
	Coefisien Factor (CF)		76%	
II.	Coefisien Faktor Plant			
1	Max Production Capacity	2 X 2 MW	17,520.00	17,520.00
2	Energy Reduction (Assumsi)			
	- Availability Factor PLN (95%)		860.25	476.65
	- Maintenance (5 %)		860.25	476.65
	- Own Uses 40 Kw (0,5%)		86.02	47.67
3	Production to PLN		15,398.45	8,532.11
4	Total Production For PLN Annualy			23,930.56
	Coefisien Factor (CF)		68%	

Source: Author analysis

Next, calculate the projected calculation of electricity sales to PLN for 20 years, where the price scheme follows the direction of the price set by PLN as the primary user of Electricity produced, as in the following table:

Tabel .3. Projection of Electricity Sales for 20 Years

	TH - 1 (Rp)	TH - 2 (Rp)	TH - 3 (Rp)	TH - 4 (Rp)	TH - 5 (Rp)	TH - 6 (Rp)	TH - 7 (Rp)	TH - 8 (Rp)	TH - 9 (Rp)	TH - 10 (Rp)
	0.0%	0.0%	100%	100%	100%	100%	100%	100%	100%	100%
PENJUALAN (Kapasitas 2 X 2 MW)	0	0	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559
HARGA PENJUALAN (per KWh)	0	0	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
NILAI PENJUALAN (Rp)	0	0	40,203,339,851	40,203,339,851	40,203,339,851	40,203,339,851	40,203,339,851	40,203,339,851	40,203,339,851	40,203,339,851

	TH - 11 (Rp)	TH - 12 (Rp)	TH - 13 (Rp)	TH - 14 (Rp)	TH - 15 (Rp)	TH - 16 (Rp)	TH - 17 (Rp)	TH - 18 (Rp)	TH - 19 (Rp)	TH - 20 (Rp)
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PENJUALAN (Kapasitas 2 X 2 MW)	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559	23,930,559
HARGA PENJUALAN (per KWh)	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050
NILAI PENJUALAN (Rp)	25,127,087,407	25,127,087,407	25,127,087,407	25,127,087,407	25,127,087,407	25,127,087,407	25,127,087,407	25,127,087,407	25,127,087,407	25,127,087,407

Source: Author analysis

Civil Construction Costs and Mechanical and Electrical Costs
Calculation of Civil Construction costs and Mechanical and Electrical Costs are the main things that calculated to carry out a financial feasibility simulation, where the cost component includes the following details:

Tabel .4. The amount of civil and mechanical, and electrical construction costs for Cipelah Mini Hydro Power Plant

CIVIL WORKS		**3,734,129**
1	PREPARATORY WORK	24,496
2	WEIR and INTAKE WORKS	307,412
3	MUD POOL WORK	67,295
5	WATERWAY WORKS	1,851,731
6	SETTLING POOL WORKS	206,640
7	PENSTOCK WORKS	261,631
8	POWER HOUSE WORKS	802,464
9	ACCESS ROAD WORK	183,106
10	COMPLETE BUILDING WORK	29,355
MECHANICAL , ELECTRICAL & DISTRIBUTION		**1,765,129**

Source: Author analysis

Land Acquisition Costs and Non-Construction Costs for CipelahMini Hydro Power Plant Development

Tabel .5. Land Acquisition Costs and Non-Construction Costs for Cipelah PLTM Development

No	DECRIPTIONS	COST
1	LAND AQUISTION	$ 357,142.86
2	PERMIT AND LEGAL COMPLIANCES	$ 57,577.65
3	FS, DED AND EPC COMPLIANCES	$ 172,732.95
4	TEST AND COMISIONING	$ 10,714.29
5	BANK PROVISION & FINANCIAL ARRANGEMENT	$ 81,286.09

Source: Author analysis

Total Budget Plan for CipelahMini Hydro Power Plant EPC

Tabel .6. Comprehensive Budget Plan for CipelahMini Hydro Power Plant Development

No	Work Descriptions	Amout of Cost (USD.)
A	B	D
LAND AQUISITION		357,143
PERMIT AND LEGAL COMPLIANCES		57,578
FS , DED AND EPC COMPLIANCES		172,733
TEST AND COMISIONING		10,714
COST OF CAPITAL (BANK PROVISION & FINANCIAL ARRANGEMENT		81,286
CIVIL WORKS		3,734,129
1	PREPARATORY WORK	24,496
2	WEIR and INTAKE WORKS	307,412
3	MUD POOL WORK	67,295
5	WATERWAY WORKS	1,851,731
6	SETTLING POOL WORKS	206,640
7	PENSTOCK WORKS	261,631
8	POWER HOUSE WORKS	802,464
9	ACCESS ROAD WORK	183,106
10	COMPLETE BUILDING WORK	29,355
MECHANICAL , ELECTRICAL & DISTRIBUTION		1,765,129
VAT (10%)		441,358
TOTAL		6,297,758

Source: Author analysis

Operational Cost of PLTM Cipelah

After knowing the number of investment costs for the construction of the Cipelah Mini Hydro Power Plant, the next step is to calculate the estimated operational costs of the PLTM operational activities if they are finished in building and after that, for more details, see the following table:

Tabel .7. Details of the operational costs of the CipelahMini Hydro Power Plant

NO	DESCRIPTION	UNIT	VOL	UNIT COST	VALUE
1	Technical & Administration				624,000,000
a	Chief Operator	Rp / Thn	1.0	5,500,000	71,500,000
b	Operator	Rp / Thn	3.0	4,500,000	175,500,000
c	Technician	Rp / Thn	4.0	3,500,000	182,000,000
d	Administration	Rp / Thn	3.0	2,500,000	97,500,000
e	Security	Rp / Thn	3.0	2,500,000	97,500,000
2	Management				455,000,000
a	Direktur	Rp / Thn	1.0	15,000,000	195,000,000
b	Manajer	Rp / Thn	2.0	10,000,000	260,000,000
3	Maintenance	Rp / Thn		1,017,014,014	1,017,014,014
4	Insurance	Rp / Thn	1	75,000,000	75,000,000
5	Retribusi Daerah	Rp / Thn	23,020,559	10	230,205,594

Source: Author analysis

Loan Repayment Scheme from the CipelahMini Hydro Power Plant Development

Based on the assumptions previously mentioned, the return on investment scheme base on the investment value, which includes 70% of the total costs incurred. It bears an interest fee of 14%, with a repayment period of the loan is 15 years.

Tabel .8. Investment Return Scheme Table

INVESTATION PAYMENT SCHEME'S PLTM 2X 2 MW				
70% Loans from Banking Sectors (Tenor 8 Years)				Unit : USD.
YEARS	LOANS	INTEREST	LOAN INSTALLMENT	TOTAL PAYMENTS
0	4,408,431	-	-	-
1	3,963,021	264,506	445,410	709,916
2	3,490,886	237,781	472,135	709,916
3	2,990,424	209,453	500,463	709,916
4	2,459,933	179,425	530,490	709,916
5	1,897,613	147,596	562,320	709,916
6	1,301,554	113,857	596,059	709,916
7	669,732	78,093	631,823	709,916
8	0	40,184	669,732	709,916
9	0	0		
10	0	0		
11	0	0		
12	0	0		
13	0	0		
14	0	0		
15	0	0		

Source: Author analysis

Projected Profit and Loss Report on the Construction of the CipelahMini Hydro Power Plant

Tabel .9. Projected Profit and Loss Report on the Construction of the CipelahMini Hydro Power Plant

PROJECTION OF INCOME STATEMENT PLTM CIPELAH 2 X 2 MW ESTIMATED VALUE FOR SELLING PRICES USD 0.12,-/KWh																
DESCRIPTIONS	POWERPLANT OPERATIONAL COST															
	YEARS - 0 (USD)	YEARS - 1 (USD)	YEARS - 2 (USD)	YEARS - 3 (USD)	YEARS - 4 (USD)	YEARS - 5 (USD)	YEARS - 6 (USD)	YEARS - 7 (USD)	YEARS - 8 (USD)	YEARS - 9 (USD)	YEARS - 10 (USD)	YEARS - 11 (USD)	YEARS - 12 (USD)	YEARS - 13 (USD)	YEARS - 14 (USD)	YEARS - 15 (USD)
ELECTRICITY SELLING VALUE	0	0	0	2,297,334	2,297,334	2,297,334	2,297,334	2,297,334	2,297,334	2,297,334	2,297,334	1,435,834	1,435,834	1,435,834	1,435,834	1,435,834
COST																
- Technical & Administration Cost	0	0	0	44,571	46,800	49,140	51,597	54,177	56,886	59,730	62,716	65,852	69,145	72,602	76,232	80,044
- Management Cost	0	0	0	32,500	34,125	35,831	37,623	39,504	41,479	43,553	45,731	48,017	50,418	52,939	55,586	58,365
- Building Maintenance Cost	0	0	0	37,341	39,208	41,169	43,227	45,389	47,658	50,041	52,543	55,170	57,929	60,825	63,866	67,060
- M&E and Electricity Distribution Ma	0	0	0	8,827	9,269	9,732	10,219	10,729	11,266	11,829	12,421	13,042	13,694	14,379	15,097	15,852
- Cost of Insurance	0	0	0	5,357	5,357	5,357	5,357	5,357	5,357	5,357	5,357	5,357	5,357	5,357	5,357	5,357
- Retributions	0	0	0	239	239	239	239	239	239	239	239	239	239	239	239	239
- Payment of Bank loans Interest	0	709,916	709,916	709,916	709,916	709,916	709,916	709,916	709,916	0	0	0	0	0	0	0
- Depresiation dan Amortisation	0	0	0	617,871	617,871	617,871	617,871	617,871	617,871	617,871	617,871	617,871	617,871	617,871	617,871	617,871
Total Cost	0	709,916	709,916	1,456,623	1,462,785	1,469,255	1,476,049	1,483,182	1,490,672	788,621	796,878	805,549	814,653	824,212	834,250	844,789
EARNING BEFORE TAXES	0	-709,916	-709,916	840,710	834,548	828,078	821,285	814,151	806,662	1,508,713	1,500,455	630,285	621,181	611,621	601,584	591,045
TAXES		0	0	210,178	208,637	207,020	205,321	203,538	201,665	377,178	375,114	157,571	155,295	152,905	150,396	147,761
EBIT		-709,916	-709,916	630,533	625,911	621,059	615,964	610,614	604,996	1,131,535	1,125,341	472,713	465,885	458,716	451,188	443,284

Source: Author analysis

The Investment Payback Period for the Construction of the CipelahMini Hydro Power Plant

Tabel .10. The Investment Payback Period for the Construction of the PLTM Cipelah

TABLE CALCULATION OF INVESTATION PAYBACK PERIOD
PLTM CIPELAH 2 x 2 MW

YEARS-KUMULATIF	YEAR	CASH OUT (USD)	CASH IN (USD)		NET CASH FLOW (USD)	KUMULATIF NET CASH FLOW
			NET PROFIT	DEPRECIATION		
0	0	6,297,758	0	0	-6,297,758	-6,297,758
1	1	0	0	0	0	-6,297,758
2	2	0	0	0	0	-6,297,758
3	3	0	1,458,582	617,871	2,076,453	-4,221,306
4	4	0	1,452,420	617,871	2,070,291	-2,151,015
5	5	0	1,445,949	617,871	2,063,821	-87,194
6	6	0	1,439,156	617,871	2,057,027	1,969,833
7	7	0	1,432,023	617,871	2,049,894	4,019,726
8	8	0	1,424,533	617,871	2,042,404	6,062,130
9	9	0	2,126,584	617,871	2,744,455	8,806,585
10	10	0	2,118,326	617,871	2,736,197	11,542,783
11	11	0	1,248,156	617,871	1,866,027	13,408,809
12	12	0	1,239,052	617,871	1,856,923	15,265,732
13	13	0	1,229,492	0	1,229,492	16,495,224
14	14	0	1,219,455	0	1,219,455	17,714,680
15	15	0	1,208,916	0	1,208,916	18,923,596

Pay Back Periode	5 YEARS 1 MONTH

Source: Author analysis

Value of Financial Feasibility (IRR and NPV) of CipelahMini Hydro Power Plant Development

Tabel .11. Value of Financial Feasibility (IRR and NPV)

TABLE CALCULATION OF IRR & NPV
PLTM CIPELAH 2 x 2 MW

YEAR	CASH OUT (USD)	CASH IN (USD)		ET CASH FLOW (USD	DISCOUNTED CASH FLOW (USD)	
		NET PROFIT	DEPRECIATION		19%	21%
0	6,297,758	0	0	(6,297,758)	(6,297,758)	(6,297,758)
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	1,458,582	617,871	2,076,453	1,232,200	1,172,103
4	0	1,452,420	617,871	2,070,291	1,032,389	965,806
5	0	1,445,949	617,871	2,063,821	864,843	795,692
6	0	1,439,156	617,871	2,057,027	724,366	655,432
7	0	1,432,023	617,871	2,049,894	606,600	539,801
8	0	1,424,533	617,871	2,042,404	507,886	444,487
9	0	2,126,584	617,871	2,744,455	573,500	493,614
10	0	2,118,326	617,871	2,736,197	480,483	406,718
11	0	1,248,156	617,871	1,866,027	275,360	229,234
12	0	1,239,052	617,871	1,856,923	230,266	188,525
13	0	1,229,492	0	1,229,492	128,120	103,161
14	0	1,219,455	0	1,219,455	106,785	84,561
15	0	1,208,916	0	1,208,916	88,959	69,281
				Total	**553,998**	**(149,342)**

I R R	20.58%	√
MARR ASSUMPTION =	6%	
NPV (4%)	$ 189,253.04	√

Source: Author analysis

Tabel .12. Resume Financial Feasibility Analysis

ELECTRICITY SELLING PRICES	USD 0.12,-/KWH	
Investations Value	USD	6,297,758
Loans	USD	4,408,431
Owner Equity	USD	1,889,328
Depresiation & Amortisation	USD	617,871
Bank Interest Value		15.00%
IRR		20.58%
NPV	USD	189,253
PBP Duration		5 Years , 1 month
Decisions		FINANCIALLY FEASIBLE

Source: Author analysis

IV. CONCLUSION

1. The conclusions of the research related to the Financial Analysis for the Development of the Cipelah Mini Hydro Power Plant are as follows:
2. The Cipelah PLTM can continue with a financial feasibility level in the form of an IRR of 20.58% and an NPV of USD 189,253. Also,a Payback period of investment is only five years.
3. The most significant cost component of PLTM Cipelah construction is the Civil and Mechanical Electrical costs, which reached USD 5,499,257.
4. Depreciation and Amortization Value of buildings and equipment and engineering and procurement activities are USD 617,871.
5. The annual operational cost of the PLTM Cipelah operation plan is USD 122,811.
6. The Loan-Equity composition applied in this study has been able to produce a feasible financial feasibility calculation

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