OPTIMIZATION OF PROJECT FINANCING SCHEME FOR THE DEVELOPMENT OF FLOATING SOLAR PHOTOVOLTAIC POWER PLANT PROJECT IN INDONESIA PRIVATE COMPANY

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ABSTRACT

Indonesia's government has set a target to utilize renewable energy at least 23% in 2025 and 31% in 2050 (RUEN, 2019). This study assessed the financial feasibility study of implementing a utility-scale for the Solar FPV Plant in Private Company A for long-term PPA contract. The shareholders have faced several issues recognized from the political, economic, and technical influence, which create uncertainty to develop the NRE Project. This research gives a clearance perspective for developing the NRE project. The author breaks down the optimized business scenario by conducting the Equity Financing Scheme with different alternative scenarios; Equity Loan (A), Shareholder Loan (B) & Bond issuance (C), followed by sensitivity analysis on the parameter of the effective interest rate, DER and EPC Cost, which are evaluated based on the simulation of 5.816 cents USD/kWh levelized cost of electricity. The analyses prove the feasible output from each-alternatives scenario. Scenario A results in USD 32,148,000 NPV, 12.73% IRR on Equity. Scenario B results in USD 55,523,000 NPV, 12.00% IRR on Equity. Scenario C results in USD 32,148,000 NPV, 12.73% IRR on Equity, which each alternative can generate optimum return.

Keywords: New Renewable Energy, Solar FPV Plant, Levelized Cost of Electricity, Equity Financing, Project Financial Profitability, Sensitivity Analysis

INTRODUCTION

Renewable energy technologies have experienced dramatic cost reductions in recent years, making them cost-competitive with fossil fuel sources in markets worldwide. The International Renewable Energy Agency reported that the weighted average global cost of electricity from solar PV has decreased by 77% between 2010 and 2018, due to 90% reduction of solar module prices. (IRENA, 2019).

Renewable energy is still considered as an expensive source of electricity in Indonesia, proven by the NREL study which stated that the average LCOE of solar power in Indonesia is the highest among ASEAN, reaching 165 USD/MWh and far below Burma with an average of 79 USD/MWh (IESR, 2019). Moreover, Indonesia's local solar manufacturing capacity is fewer than other countries, which can be categorized as small manufacturers, specifically 500 MW in production capacity.

In 2019, Indonesian local modules are categorized as not tier-1 manufacturers where the average price is 0.47 USD/Wp. This price is way higher than imported tier-1 modules from China and Europe, that is around 0.25-0.37 USD/Wp (IESR, 2019).

On the other hand, Indonesia's labor cost is quite low, with a minimum salary of 3.5-9 USD/day, depending on the region. For the mid-level engineers, the average salaries are 24-75 USD/day. The labor cost take account for less than 10% of CAPEX, and estimated around 40-45% of total OPEX in Indonesia (IESR, 2019). However, developing the Solar PV Plant in Indonesia is still remarkably expensive, hence no large scale of more than 10 MW solar projects are in place in Indonesia. For example, the generation cost for the 5 MW Solar PV Plant Project in Kupang was around 25 cents USD/kWh in 2014, which is higher than the average cost in any other countries, less than 5 cents USD/kWh (IESR, 2019). This condition affects how Indonesia's electricity system is projected in the future, the direction and decision making of energy policies, and the country's attractiveness from investors to invest, hence this research is suitable to be conducted in Indonesia.

According to RUEN, the realization of renewable energy is targeted at 23% by 2025. But in 2019, it only reached 8.55%. (MEMR, 2019). **Table 1** explains further about the correlation between potency and realization of Indonesia Renewable Energy.

Table 1. Renewable Energi Potency

No	Type	Potency	Realization
1	Geothermal	25.4 GW	1.95 GW
2	Bioenergy	32.6 GW	1.86 GW
3	Solar	207.8 GWp	0.15 GWp
4	Hydro	94.3 GW	5.42 GW
5	Wind	60.6 GW	0.08 GW
6	Tidal	17.9 GW	-

Source: MEMR, 2019 & RUEN, 2019

According to the Law Number 30 of 2009 concerning Electricity, primary energy sources that originate either domestically and/or from abroad must be optimally utilized to ensure a sustainable supply of electricity and utilization of renewable energy resources is prioritized. By definition, renewable energy is an energy that comes from renewable sources, such as geothermal, wind, bioenergy, sunlight, water and falls. To support this, Company A offers Premium Renewable Energy services and opportunities for both public and industries to actively contribute in developing renewable energy. Company A has a particular target to achieve 23% NRE-based power plants in energy mix by 2025 following the RUEN strategic and planning. One of the main challenges and concern in developing renewable energy project is the pricing scheme. The staging tariff scheme is divided into two periods. In the first twelve years, the selling price of electricity from renewable energy will be quite high. But in the next period, due to the uncertain political and economic situation, it will affect the tariff or remain unchanged until contract ends.

An increase in the share of renewable energy will eventually lead to changes in the electricity supply structure. The change is that the power market moves from "OPEX to CAPEX" as it has high capital expenditures and low operating expenses. This straight implication can increase investment risk for power procedures, which is usually considered risk-averse and discourage investors or lead to high capital costs due to the risk premium. The purpose of this research is to create a core competency in Company A as the shareholder in the Floating Solar Photovoltaic Power Plant Project with 145MWac capacity and 175MWp total peak energy output.

Furthermore, the author would like to emphasize and provide a straight alternative solution by using the Equity Financing Scheme to maximize the return with a different alternative scenario, which is Equity Loan (A), Shareholder Loan (B) & Bond issuance (C), followed by a sensitivity analysis on the parameter of the Effective Interest Rate, Debt to Equity Ratio, and EPC Cost, which are evaluated based on the simulation of 5.816 cents USD/kWh of Levelized Cost of Electricity.

Therefore, this research is conducted to answer several issues in the developing of Solar Photovoltaic Project in Indonesia, where the financial feasibility is needed to build this Project due to high capital investment, also which factor is the most sensitive, and which equity financing strategy is the most suitable to apply in this Project.

LITERATURE REVIEW

Unlike the conventional IPP thermal power plants using fossil fuel as the primary source of energy, which operated as base-load Power Plants (with high-capacity factor, generally 80%), the operation model of this Solar FPV Plant is more uncertain or called intermittency power plant (IRENA, 2019). It needs certain reassurance related to revenue in the repayment of loans to the lenders and generating acceptable returns to the stakeholders. In the financial analysis, it's assumed that this Solar PV Project will operate as a peaker power plant with constant Capacity Factor at 16.68% every year. Capacity Factor (CF) for a PV project is the ratio of the energy produced by the PV plant in a year to the energy it can produce at rated capacity. Moreover, according to the Indian Ministry of New and Renewable Energy data on the Solar PV power plant, the normative CF taken for Solar FPV project is 16.25% (Goswami, 2019).

Financing for the new renewable energy project is quite similar to other infrastructure assets; it's either by implementing a corporate finance structure or project finance structure (Steffen, 2020). In the present, Independent Power Producer in Indonesia usually financed the fossil fuel-based power plant using the traditional way, since they have been categorized as a large firm, they have the ability and sources to use corporate finance. On the other hand, it is a different scenario for NRE projects which require larger capital cost, they possibly need to attract potential investors or financial institutions to give cash injection with collateral guarantee, which this system is called project finance. Moreover, in 2015, project finance was being used widely in more than half of all new investments in NRE projects that spread across the world and higher shares in OECD countries. In 2008, Europe and the US were the majority of countries that applied NRE investment by using project finance and accounted for 45% of all financing (Steffen, 2018).

External and Internal Analysis

PESTLE Strategic

1. Political Factors

Based on the Government Regulation No. 79 of 2014 regarding Nationality Energy Policy, the target for utilization of renewable energy is leastwise 23% in 2025 and 31% in 2050 which then implemented in Electric Supply Business Plan 2019 – 2028 by Company A. For that particular purpose, Company A with the government support is obligated to buy the electricity from power plants that utilize renewable energy sources with the regulated tariff. If electricity generation cost in the local electricity systems higher than national electricity generation cost, then the maximum tariff shall be 85% from the local electricity system. But if the local electricity system is same or below national electricity generation cost, then the price shall be based on an agreement between both parties. This can be achieved with community participation and government support in this Renewable Energy development, which complies with the NRE supply chain's model structured stipulated in RUEN.

2. Economic Factors

In the prevailing situation, energy becomes the critical factor that affects economic growth in a country. Energy productivity has a linear correlation with the amount of Gross Domestic Product (GDP). The current Covid-19 pandemic enormously affects all sectors without exception. There was an inevitable deterioration in financial sectors also. It damaged the supply and demand chains concurrently, leading to massive unemployment and bankruptcy that results in unavoidable declining of consumption and productivity, to the lowest point imaginable. The World Bank predicted that the global economic growth will be reduced to the

point of most profound global reduction in eight decades, which is 5.2% in exact number (World Back, 2020). The OECD Economic Outlook also projected Global GDP to decrease by 4.5% this year, before slowly increasing by 5% predicted in 2021 (OECD, 2020). Indonesia has entered economic recessions by the third quarter of 2020, which manifested in an extreme plummeting of GDP to minus 5.32% and 3.49% respectively. Strict health protocol policy and lockdowns have drawn significant downturn to productivity. It also could further diminish the labor supplies due to its high fatality rate and reduced number of jobs available that could add more impairment to this economic catastrophe.

3. Social Factors

In Indonesia, the energy planning and management for the long run is known as the National Energy General Plan (Rencana Umum Energi Nasional/RUEN). In 2018, Indonesian population was around 265 million people. It is predicted to grow until up to 282.5 million in 2025 and reaches 325.4 million in 2050 (RUEN, 2020). There's a correlation between human and energy that creates advanced culture hand in hand (White L, 1943). As in this current situation, the power generation development relies in many stakeholders that have different roles, authority, and contribution to Indonesia's power generation development.

4. Technological Factors

Nowadays, the Internet of Things "IoT" became the primary source to unlock every possibility and potential related to every business stream. In Indonesia, there are many possibilities in establishing a new business model, whether private or state-owned, embracing the disruptive technologies that come from start-up companies as the new threat. IoT is only one kind of disruptive technologies example; several other things can accelerate the impact of digitals in Indonesia are mobile internet, cloud technology, big data, and advanced analytics may hold the industrial business in the long run.

The technology parameter of renewable energy strongly correlates with the cost of electricity fare price and is proven by looking at the market price reduction of the technology. At the beginning of 2019, with various commercial solar PV products, solar panel installation costs range between $0.25% up to $0.419/Watt (IRENA, 2019). Therefore, electricity aggregate generation from PV Project will have better competitiveness than fossil fuel-based electricity if the Indonesian Government create a suitable law/provisions.

5. Legal Factors

Constant changes in law seem to be affecting the energy sector, especially when it comes to Renewable Energy Project, because every time the government sets a new regulation, it is also responsible to provide concrete and realistic plans in this Renewable Energy sector. The laws will establish some of the policy supports that are required by renewable energy sector to take off, such as the incentive schemes or the priority of renewable resources in the energy mix (IESR, 2019). According to that, Indonesian government has conducted and set the regulation policy that manages the national energy implementation under Law No. 79 of 2014, where the government has introduced several major changes in the energy sector. In accordance with the MEMR regulation No. 55 of 2018 above, Company A is responsible to create certain tariff in every region in Indonesia.

6. Environmental Factors

Indonesia produced about 3.4 lbn tons of CO2 gas emissions in 205 according to Postdam Institute for Climate Impact Research (PIK) Indonesia. To respond to that, Indonesia has aimed to cut emissions by 29 – 41% expectantly by 2030. Reducing the total amount of emission has become an essential and principal point in developing energy. According to the OECD National Accounts Statistics database, the carbon intensity of power generation in Indonesia is remarkably high. It is estimated ranging around at 600 to 800 gCO_2/kWh (OECD, 2018) as shows in **Figure 1**. Renewable energy project offers a preferable benefit for this particular purpose because it has an environment friendly and sustainable design as its eminent feature. It produces less carbon emission that results in a more ecologically beneficent compared to those fueled by fossil energy.

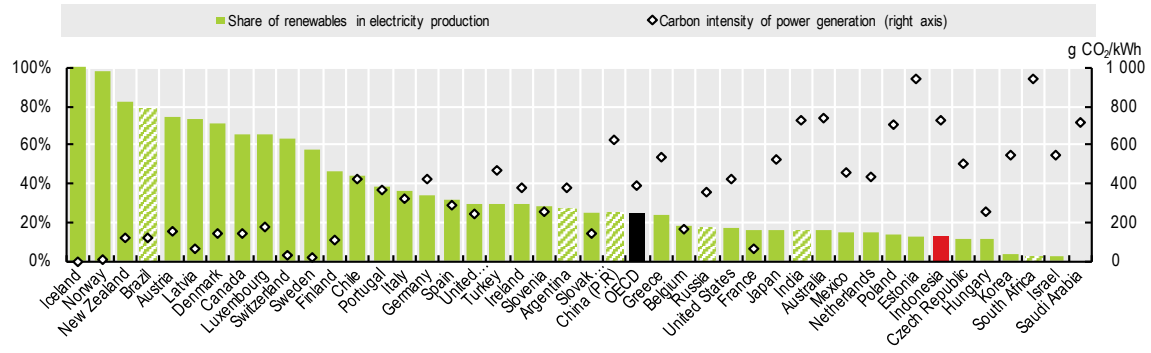

Figure 1. Share of Renewables in Electricity Production (Left Axis) and Carbon Intensity of Electricity Production (Right Axis), OECD and G20 Countries, 2017

Source: IEA, 2018; OECD, 2018

SWOT Analysis

The transition from conventional fossil energy to renewable energy is driven not only by economical factor but also several other factors such as rapidly falling capital costs, technical influence, and concerns around the climate change and local pollution.

But there are also many opportunities to develop this project, as it aims to help the government to achieve the energy demand and electricity target stated at RUEN and RUPTL. Many foreign investors or international financial institution also interest to be involved in NRE project. The whole SWOT Analysis of this project is thoroughly summarized in **Table 2** below.

Table 2. SWOT Analysis

OPPORTUNITIES	**THREATS**
There are still few developers capable to provide Solar Panel through reservoir It is proven that grounded Solar PV still dominant in Indonesia.	Due to the limitation in technology factors, which is categorized as small tier manufacturers, Indonesia will always depend on OECD technology with more competitive price.
The energy capital for Solar FPV Project has fall to 77%.	Local Banks still think it's too risky toinvest in Indonesia's Renewable Energy Project.
The NRE Realization is still low in Indonesia, which potentially attract strong influence from Government to execute the NRE Project in accordance with 23% RUEN Target in 2025.	Using the local PV manufacturer seems to be risky due to Foreign Banks requirement should provide international certifications.
STRENGTHS	**WEAKNESS**
Indonesia has an advantage in Solar Irradiation as the resource for Floating Solar Power Plant.	High Generation Cost to develop Solar PV Plant in Indonesia.
Indonesia is an archipelago country which has become a potential factor to develop Floating Solar Power Plant.	There is limitation of knowledge from the local people, which reflects the low minimum salary in Indonesia.
Power Plant with Low carbon emission and friendly environmental design.	Intermittency in Solar Power Plant need to be resolved
Supported by government proven in the increasing NRE target as stipulated on RUEN and RUPTL	
Company A as the off-taker might reduce the risk for the NRE developers	

METHODS

The conceptual framework for answering the research question is shown in **Figure 2**. This framework explains the process of the research to solve the problems in developing Floating Solar Photovoltaic Power Plant Project. It is divided into three major steps, which are preliminary study, external and internal analysis, and data analysis. The first step in this research is preliminary studies, which will explain the major issue and the business condition of developing the Floating Solar Photovoltaic Power Plant Project in Indonesia Private Company A. Furthermore, after the business and project conditions are identified, the next step is to analyze its external and internal factors. The external factor consists of the political, economic, sociological, technological, legal, and environmental factors that will affect the future's business condition. The external analysis also will be explained with SWOT analysis. The second analysis is sensitivity analysis. This provides information about any possible changes in the situation that will further affect the project. The final analysis is done by implementing several equity-financing schemes and comparing each of those schemes. This analysis will show the project financing condition of Company A as the shareholder that acquire capital injection to cover its equity portion from Strategic Partner by using Equity Loan, Shareholder Loan, and Bond.

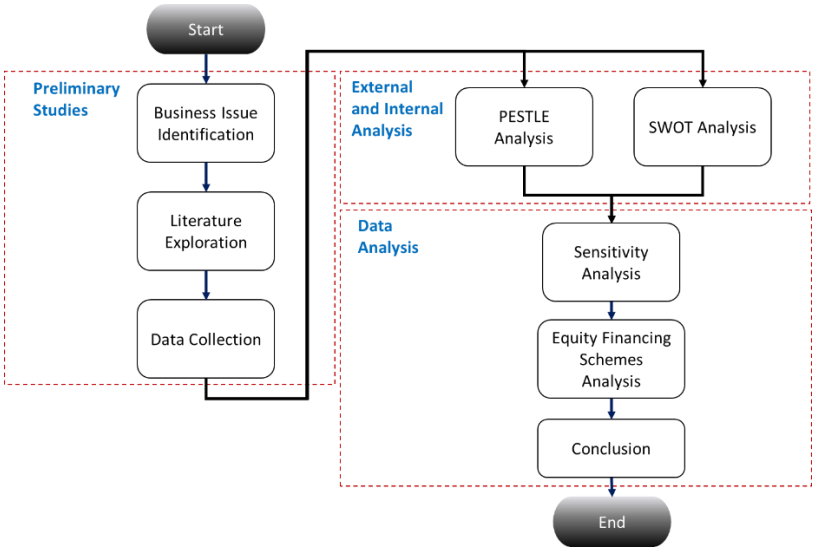

Figure 2. Conceptual Framework of Study

Net Present Value

Using Net Present Value (NPV) is one kind of capital budgeting techniques to evaluate Project Investment. Company A commonly uses this method to execute large enormous capital amount of the Power Plant projects. This method has a simplified intuition because, in the common practice, investors or financial institutions expect a return on the money form their investments, so the borrower or Project Company, in this case, Company A & Strategic Partner, should reconsider and take a right decision by undertaking an investment only if the value of the cash flow from investments generates greater than the cost of investing in the first place. The net present value (NPV) is found by subtracting a project's initial investment (CF_0) from the present value of its cash inflows (CF_t) dicounted at a rate equal to the firm's cost of capital (r) by using formula;

$$NPV = Present\ value\ of\ cash\ inflows - Initial\ investment$$

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - CF_0$$

When NPV is used, both inflows and outflows are measured in terms of present dollars. For a project that has cash outflows beyond the initial investment, the net present value of a project would be found by subtracting the present value of outflows from the present value of inflows. There is one important concept of this method which NPV is considered the time value of investor's money, it is a more sophisticated capital budgeting technique than the payback rule (Gitman, 2011). The NPV method discounts the firm's cash flows at the firm's cost of capital. As previously explained, this cost of capital rate is the minimum return that must be earned on a project to satisfy the firm's investors. Projects with lower returns fail to meet investors' expectations, decreasing firm value and projects with higher returns increase firm value. There is specific condition to use NPV for making accept-reject decisions: (Gitman et al, 2011)

- If the NPV is greater than $0, accept the project.
- If the NPV is less than $0, reject the project.

If the NPV is greater than $0, the firm will earn a return greater than its cost of capital. Such action should increase the market value of the firm and the wealth of its shareholders by an amount equal to the NPV.

Internal Rate of Return

The internal rate of return (IRR) is one of the most widely used capital budgeting techniques (Gitman et al, 2011). The internal rate of return (IRR) is the discount rate that equates the NPV of an investment opportunity with $0 because the present value of cash inflows equals the initial investment. It is the rate of return that the firm will earn if it invests in the project and receives the given cash inflows. Mathematically, the IRR is the value of r in formula that causes NPV to equal $0.

$$\$0 = \sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} - CF_0$$

$$\sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} = CF_0$$

There is consideration to put IRR as the financial indicator, by concerning:

- IRR value resulting greater than the WACC, accept the project.
- IRR value resulting less than the WACC, reject the project.

Levelized Cost of Electricity

The LCOE is the most useful method for conceptualizing finances critically to renewable electricity Project (Krupa J, 2018). Below is the Formula that illustrate the LCOE calculation:

$$LCOE = \frac{\Sigma_{t=1}^{n} \frac{I_t + O\&M_t + F_t}{(1+r)^t}}{\Sigma_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

where:

I_t = Investment (*USD/kW in year t*)
$O\&M_t$ = Operations and Maintenance (*USD/kW in year t*)
F_t = Fuel Cost (*USD/kW in year t*)
E_t = Electricity Output (*kWh/kW in year t*)
r = Discount Rate
n = lifespan (*years*) of the project

For the renewable project, investment I_t can be large, especially in the first year of the commercial date. The fossil fuels F_t becomes zero, because the Solar FPV Project depends on Solar Irradiation as the primary resources. The Solar PV Project have an average lifespan of 25 years according to the CERC study (Goswami et al, 2019).

RESULTS

Energy Production

By using the P50 assumption with the 16.68% CF, the energy production for this Solar FPV Project with 145 MWac capacity can be estimated as shown in the **Table 3.**

Table 3. Energy Production in Floating Solar PV Power Plant Project

Floating Solar Photovoltaic Project		
Project Capacity	Mwac	145
Project Capacity	MWp	175
Specific Yield Production **(P50)**	kWh/kWp	1543
Capacity Factor	%	16.68
Peak Sun Hour Nett	PSH/day	3.99
Availability	%	90%
Seasonality	%	90%
Degradation	%	90%
Electricity Generated (6 Months)	MWh	196,848

* Source: Company A Internal Feasibility Study, 2018

As shown in the data above based on internal feasibility study, it can be concluded that this project is really promising that it can deliver such large amount of energy output in one year during operation period.

Project Overview

Solar FPV Power Plant Project will use the equity and long-term debt from the International Financial Institutions or Banks as the funding process. The proportion of those funding sources are 70% senior debt and 30% equity. The Project cost of this Project has been estimated around USD 170 million.

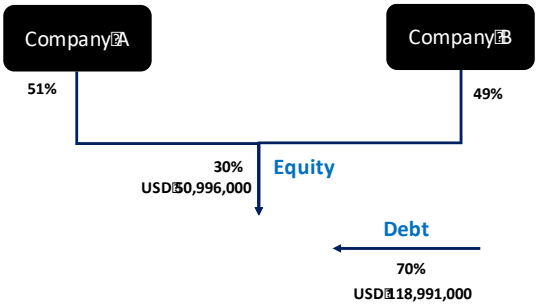

Figure 3. Equity and Debt Allocation of the Project

Based on the project data, the project cost obtained is USD 170,000,000. The cost includes EPC Cost, Development Cost, Initial Working Capital, and Financing Fee, with details as shown in **Table 4.**

Table 4. Assumption of the Project Cost of Solar FPV Project

Cost Description	Amount	
EPC Cost (without VAT)	USD	145,836,328
EPC Cost (VAT, T&D Cost)	USD	163,508,000
Development Cost	USD	2,042,000
Initial Working Capital	USD	105,000
Financing Cost	USD	4,332,000
Project Cost	USD	170,000,000

EPC Cost is the cost imposed on the construction of the plant itself. Costs for the Solar Panel, Module, Generator, and other construction are included in the EPC Cost. Development Cost is the cost imposed on the development of a power plant. It includes the cost of consultants and licensing. Initial Working Capital is the cost used for initial plant operations. Initial Working Capital cost consists of O&M costs and fuel costs. Financing Fee costs resulted from lenders, such as upfront fees, commitment fees, management fees, etc.

The analytical approach taken is to lock in the rates of components A, B, D, and E for each option, so that the three equity funding options have the same component tariffs. The Levelized Cost of Electricity as the component rates to be locked on the three options are shown in **Table 5**.

Table 5. Tariff Component for Solar FPV Plant

Tariff	Amount	
Component A	4.7421	cUSD/kWh
Component B	0.4469	cUSD/kWh
Component D	0.3166	cUSD/kWh
Component E	0.3100	cUSD/kWh
Total Component	5.8156	cUSD/kWh

The indicators used by the authors in this paper are Finansial Profitability such as NPV, IRR Project, IRR Equity, NPV Company A and IRR Company A. Through Company's NPV and IRR, it is expected to see the level of return that will be obtained by the firm based on the equity cash flow issued by Company A and the income received by Company A.

Assumptions of financial statement of the project

Financing the NRE project, especially Solar Power Plant Project, requires assuring the right conditions. If any favorable economic environment complements technology-driven trends related to costs changes, mobilizing the necessary capital-money is not difficult to follow the right conditions (Krupa J, 2018).

However, putting every requisite component from different aspects, such as technical, economic, and legal, a sufficient capital allocated to the renewable energy sector can be quite challenging to overcome. In the current condition, Company A has acknowledged the critical factor from the existing feasibility study. For the study purposes, the author uses the based assumption from Company A internal feasibility study and data collection from an interview with Board of Directors and Senior Leader in Company A to calculate the Solar FPV Project's income statement. **Table 6** shows the general assumption that is being used in this research.

Table 6. General Assumption in Financial Statement

Floating Solar Photovoltaic Project General Assumption		
Project Life	years	25
Repayment Period	years	16
Operation Period	years	25
Construction Period	months	18
Inflation Rate (Average from July 2019 – July 2020)	%	3.6
EPC VAT, Import Duty, WHT	%	11.5
Fix O&M Escalation Rate	%	4.0
Variable O&M Escalation Rate	%	2.0
Target DSCR	x	1.2
Senior Debt Effective Interest Rate	%	4.88
Exchange Rate (USD/IDR)	IDR	14,000
Value Added Tax	%	4.88
Corporate Income Tax	%	25
Tax Holiday	years	7
Electricity Generated	MWh	196,848
Cost of Equity	%	11.67
WACC	%	6.06
Note: *Company A Internal Feasibility Study & Data Collection from Interview, 2020		

Sensitivity Analysis

Sensitivity analysis used in this research aims to measure project financial profitability, such as net present value and the internal rate of return. This analysis will give the perspective for the long run for the project's financial profitability with the variation change from internal and external factors, such as EPC Cost, Effective Interest Rate, DER and LCOE, that can possibly influence the situation. EPC cost is one of the total project cost variables in the Solar FPV power plant, which represents 80% of total capital expenditure. This based assumption for EPC cost is acquired from the awarded EPC contractor bid proposal during the tender process, and became the major variable for Company A to secure the competitive cost to develop the Solar FPV. Referring to the commitment letter from International Bank, Company A acquires several pieces of information regarding the financing fee for the rest funding facility, especially interest rate. However, foreign fund providers' effective interest rate is different compared to many local banks, with the value between 9% up to 14% from 2012 to 2018 (BPS, 2019), which then can be concluded that foreign investment is more competitive than local due to the availability of the USD portions. Beside the EPC Cost, in the financing sector, it is noticed that the risk perception, which has been reduced along with the maturing market, will improve availability and project debt finance pricing as the share debt increase for solar PV, with 70:30 structures and even the 80:20 ratio could be achieved. The tariff has been set for this Solar FPV Power Plant Project, but there is a consideration from the Indonesian Government that the electricity tariff can change based on the influence of political and economic factors. **Table 7** shows the based assumption for conducting the sensitivity analysis.

Table 7. Based Assumption for Sensitivity Analysis

Subject		NPV (k USD)	IRR on Project (%)	IRR on Equity (%)
LCOE (cents kWh)	5.816	32,123.18	8%	13%
EPC Cost (k USD)	145,836.33			
Debt to Equity Ratio	70:30			
Effective Interest Rate (%)	4.88%			

Scenario Descriptions

The authors analyze the three equity funding scheme options with the financial model as an analysis tool based on the project cost. Financial model is a tool to estimate the financial performance of business activity. We can see an overview of financial performance estimated through the financial model, including NPV and IRR.

Alternative A: Equity Loan to Shareholder

In funding alternative A, Company B provides a loan to Company A of 21% equity which is USD 10,709,000, so that Company A can fulfill its obligations in terms of meeting the equity payment of the portion of shares, which is 51% by only providing 30% equity deposit to Project Company. Loan from Company B will be returned by Company A through installments every year in the form of principal installments plus interest at 5% for 7 years as of COD.

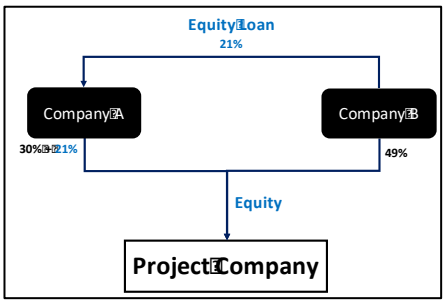

Figure 4. Equity Loan to Company A

Alternative B: Shareholder Loan to Project Company

In funding alternative B, Company B provides a direct loan to the Project Company in the form of a 42% Shareholder Loan which is USD 21,420,000 in amount, that covers 17.40% of 30% of total equity portion, so that both Company A and B can provide minimum Equity deposit to reduce the capital investment risk, which 30% equity deposit from Company A, and 28% equity deposit from Company B. The Shareholder Loan will be returned by the Project Company through annual installments in the form of principal installments plus interest at 5% for 7 years as of the COD.

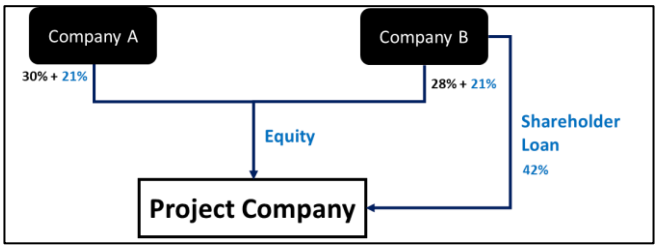

Figure 5. Shareholder Loan to Project Company

Alternative C: Bond Issued by Project Sponsor

In funding alternatives C, a 21% shortage in Company A equity portion is fulfilled through the issuance of bonds by Company A to Company B. Through the issuance of this bond, Company A will receive a fund of 21% equity which will be deposited to the Project Company with total amount of USD 10,709,000. Bond returns are made by Company A to the Company B by paying a coupon of 5% every year until the maturity date and the principal will be paid at the maturity date, which is the 7 year after COD.

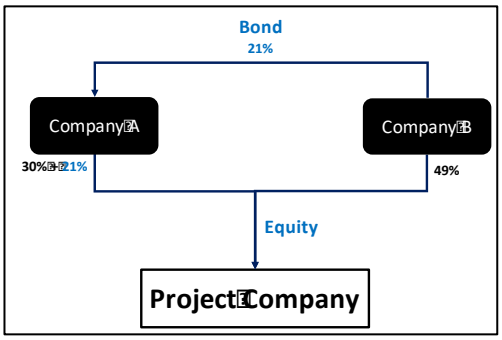

Figure 6. Bond Issued by Project Sponsor

The three options mentioned have the same number of interest/coupon rate and repayment period, which is 5% and 7 years, respectively. The authors believe that the same interest/coupon rate and repayment period between the three options is necessary to assure the fairness of the comparison.

Table 8. Equity Financing General Assumption

Alternatives	Scheme	Interest	Repayment Period
Scenario A	~ Loan from Company B to Company A ~ Company A has the obligation to repay the loan to Company B	5%	7 years
Scenario B	~ Loan from Company A to Project Company (JVC) ~ Project Company has the obligation to repay the loan to Company B	5%	7 years
Scenario C	~ Company A to issue bond to Company B ~ Company A has the obligation to pay back the principal	5%	7 years

DISCUSSION

Summary of Sensitivity Analysis

The sensitivity analysis result for the Net Present Value was conducted using a tornado chart with a range of -20% to +20% respectively, as shown in **Figure 7**. It also shows the significant sensitive factors that change the Project's NPV, which are the Levelized Cost of Electricity, debt to equity ratio, effective interest rate, and EPC cost.

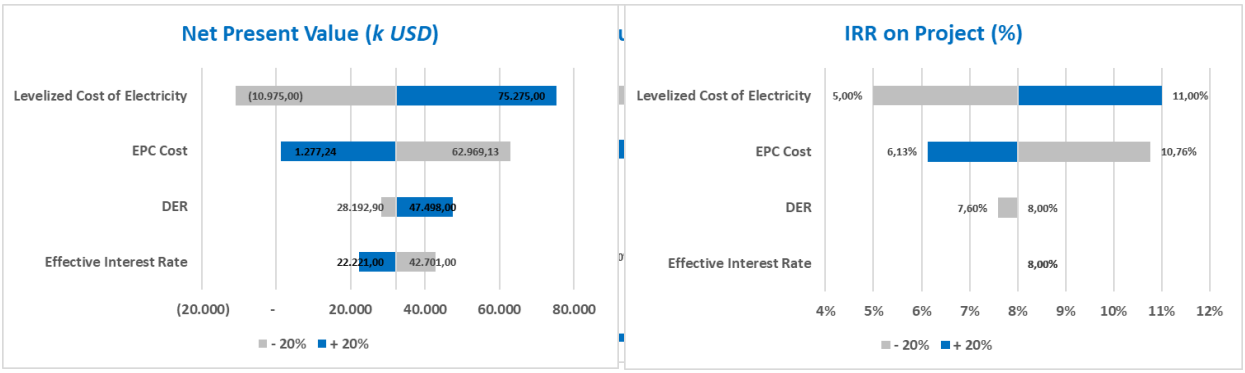

Figure 7. Sensitivity Results

It is seen above that the most sensitive factors that create the potential effect on Project's Financial Profitability is Levelized Cost of Electricity with the highest IRR value and the extreme movement in any decrease of LCOE value, lower than the based assumption, which concludes that reducing the electricity tariff to 20% or more will create this Solar FPV Project to be not feasible. This is important for Company A to acknowledge that the political and economic factor proved to influence tariff reduction. By getting IRR return lower than WACC (6.06%), the Company will not get high margin for the long run. It is believed that there is a correlation between any necessary government's action with the electricity tariff. However, this based assumption for the LCOE has been set and complies with the MEMR Regulation No 50 the year 2019 with the value of 5.816 cents USD/kWh. The second sensitive factor is EPC Cost, and this has become critical when certain and latest technology applied to this Project. However, this Project is still inline in positive trends if there is any change in EPC Cost.

Equity Financing Results

Analyzes is done by comparing the results of each of the three options. Looking at the results of the analysis, the NPV value for the three options is greater than 0, indicating that by applying the scheme and tariff set out above, the project is worth investing.

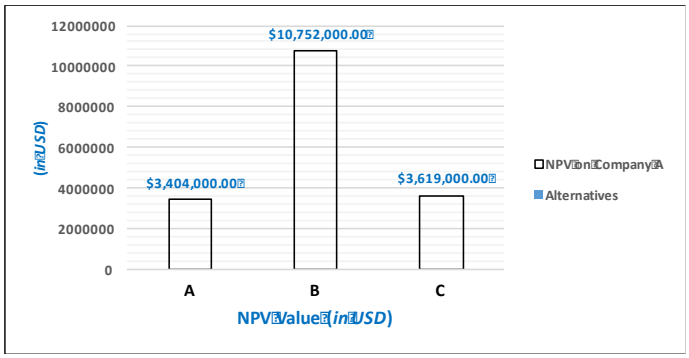

Figure 8. NPV Comparison on Company A

Based on the calculation of the Company A NPV for each alternative, it can be seen that alternative B using Shareholder Loan provides the greatest NPV value for Company A, which is 10,752,000 USD. If alternative C is implemented, namely the bond issuance, the NPV obtained by the Company A is 3,619,000 USD. Through the application of alternative A which is Equity Loan, Company A received the smallest NPV value, which is USD 3,404,000.

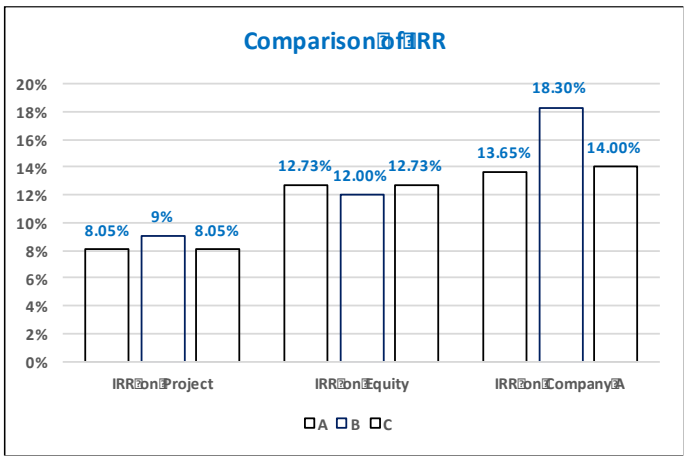

Figure 9. Comparison of IRR

If you see the IRR comparison above, alternative A and C have similar IRR Project and IRR Equity values. This is because the cash flow of the two options are the same. No repayment of loan is made at the project level at alternative A and C. Lending at alternative A and C from Company B is carried out by Company A as shareholders, so that the difference in cash flow in alternative A and C occurs only at Company A cash flow.

In view of the fact that there is a repayment loan made by the project company in alternative B, the interest expense to be paid by project company is greater compared to the other two alternatives resulted from the bank interest payment and partner interest payment, causing less pre-taxable income for the project company, thereby resulting in even fewer taxes to be imposed. Because the taxes are less than alternative A and C, revenue for the project company is the greatest.

IRR Equity in alternative B has the smallest value than the other two alternatives, namely 12.00%. This occurred because in alternative B, the project company repays the loan before the money is available for the shareholders. Whereas for alternative A and C, loan repayments are made by Company A, not by the project company, so the money available to shareholders is greater than alternative B. This causes the IRR Equity on alternative A and C to be greater than alternative B, namely 12.73%.

If alternative A is implemented, the IRR obtained by Company A is 13.65%, while alternative C offers Company A an IRR of 14.00%. The difference in Company A IRR value in alternative A and C relates to the loan repayment method mentioned above. Company A IRR and Equity IRR in alternative B have the same value because in alternative B there is no partner loan repayment activity carried out by Company A.

Looking at the calculation of Company A NPV and Company A IRR above, it can be seen that the funding alternative B, specifically by using the Shareholder Loan scheme, offers the highest NPV and IRR values for Company A, amounting to 10,752,000 USD and 18.30%. From this calculation, by implementing equity funding alternative through shareholder loan, Company A gets substantially greater return than alternative A and C.

CONCLUSIONS

The feasible indicator that is being used in this research was financial profitability, resulting in USD 32,123,180 NPV higher than 0. Moreover, this project also gives certain commitment by generating 8% IRR on Project, 13% IRR on Equity, which indicates higher than the current Project Cost of Capital (6.06%). The Solar FPV Power Plant Project is feasible to execute proven by the results of the sensitivity analysis.The parameter used is common in Company A's business practices that can give a certain effect to the JVC cash flow and return for the long-run. The parameters are the levelized cost of electricity, debt-equity ratio, effective interest rate, and EPC Cost. This analysis resulting that Levelized cost of electricity is the most sensitive factor among the others. However, the EPC Cost is quite similar, which can potentially affect the financial profitability of the firm. The changes for DER, EPC Cost, and Effective Interest Rate are still financially feasible to conduct with the escalation +20% and -20%, respectively, except the Levelized Cost of Electricity. In this event the developer should be aware and strategical to face several changes from Government provisions that can fluently affect the electricity price in the future.

Furthermore, the author is keen to resolve the financial issue in Company A, which comes to several alternative solutions using Equity Financing to answer the third research question. Based on the discussion explicated above, it can be concluded that the calculation of NPV, IRR Project, IRR Equity, NPV Company A, and IRR Company A from the three equity funding options can be shown in **Table 9**.

Table 9. The Comparison for Each Alternative

Alternatives	NPV on Project	IRR on Project	IRR on Equity	NPV on Company A	IRR on Company A
A	USD 32,148,000	8.05 %	12.73 %	USD 3,404,000	13.65 %
B	USD 55,523,000	9.43 %	12.00 %	USD 10,752,000	18.30 %
C	USD 32,148,000	8.05 %	12.73 %	USD 3,619,000	14.00 %

As seen above, it can be concluded that Alternative A is considerably not the best option to implement because alternative B and C offer a significantly higher return for Company A. From those three alternatives, alternative B has the highest Company A's NPV and IRR values. From the financial aspect, the best equity funding scheme to be implemented by Company A in the IPP assignment project is alternative B, namely by using a *Shareholder Loan* because the option offers a higher return value for Company A compared to the other two options discussed above.

LIMITATIONS

The research scope is limited, only covers the financial analysis of the Solar Photovoltaic Power Plant Project and not another aspect besides financial aspects. This research uses the integration of internal information from project documents such as feasibility study, PPA, and interview as the data assumption for the Solar Photovoltaic Power Plant Project. The primary and secondary data provided might be modified due to the confidentiality of the information from respondents, companies, and institutions related to the subject. Some of the company names and institutions might be altered.

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