

## Business Strategy of Renewable Energy Project to Enhance Revenue in Business Transition

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### ABSTRACT

*This research is motivated by the increasing urgency of the global energy transition to reduce carbon emissions and expand the use of renewable energy sources. Indonesia's energy sector is still heavily dominated by fossil fuels, particularly coal, which contributes more than 60% of the country's electricity generation. This condition highlights the need for business strategies that can support the development of renewable energy while maintaining sustainable corporate revenue during the transition process. Solar energy through Solar Photovoltaic (PV) technology has emerged as a promising alternative due to its rapidly declining technology costs and relatively faster project implementation compared to other renewable energy sources. This study aims to analyze the economic feasibility and business strategies of Solar PV projects in enhancing company revenue during the energy transition, particularly through Engineering, Procurement, and Construction (EPC) and Build-Own-Operate-Transfer (BOOT) project schemes. The research employs a quantitative approach using financial feasibility analysis methods, including Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PBP). The analysis is further supported by sensitivity analysis and the US Index framework to evaluate the most appropriate financing structure. The results show that the Solar PV project in West Java is financially feasible, with an IRR of 20%, which is higher than the Weighted Average Cost of Capital (WACC) of 7.38%, and a payback period of approximately 4–5 years. Furthermore, financing through international bank loans provides the most optimal financial performance, generating the highest NPV and the lowest cost of capital. Therefore, the implementation of the BOOT scheme with long-term contracts and debt-based financing strategies is recommended to ensure sustainable revenue generation while supporting the acceleration of renewable energy development in Indonesia.*

**KEYWORDS** *Renewable Energy, Feasibility Study, Solar PV, Business Strategy, BOOT Scheme*



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### INTRODUCTION

Indonesia's energy sector has been dominated by fossil fuels, particularly coal and natural gas. Coal-fired power plants account for more than 60% of the country's electricity generation (Ministry of Energy and Mineral Resources, 2023). Fossil fuels mainly support economic development and energy access, but they have also produced high carbon emissions and environmental degradation. In order to fulfill the global energy transition, Indonesia has committed to reducing greenhouse gas emissions and increasing the share of renewable energy in national energy mix. The Indonesian government has set a target of achieving 23% renewable energy in the national energy mix by 2025 and reaching net zero emissions by 2060 (MEMR, 2023).

Indonesia holds one of the largest geothermal potentials globally, yet progress in harnessing this abundant resource has been relatively slow due to permitting delays, exploration risk, and high capital intensity (Fauzi & Sutrisno, 2021; Arifin, 2022). Energi Panas Indonesia, a subsidiary of PT Indonesia Power (IP), contributes to the development of geothermal and solar energy projects (Hendrawan & Nur, 2023). However, despite national mandates to accelerate renewable energy adoption, geothermal projects are often delayed due to extensive permitting processes, high upfront capital expenditures, and significant

exploration risks (Habibi, Iskandar, & Darma, 2023). In contrast, solar PV projects, particularly modular systems like rooftop and utility-scale solar farms, have demonstrated faster deployment times and quicker revenue realization, creating a widening performance gap between geothermal ambition and financial sustainability (Prasetyo & Aulia, 2022; Wibowo, 2020; Rahmawati et al., 2021).

Other renewable energy resources could potentially be developed; however, PT Energi Panas Indonesia does not have sufficient internal resources for wind and hydro energy (Aditya et al., 2025; Fahmi, 2025; Halimatussadiyah et al., 2024; Pambudi et al., 2023; Paundra & Nurdin, 2022). Solar power, however, benefits from existing internal resources and is expanding much more rapidly. It demands less capital, can be deployed faster, and poses fewer technical and financial risks. According to IRENA (2023), the price of solar PV modules has fallen by approximately 82 percent over the past ten years, making solar energy one of the most cost-effective renewable options available. Advances in battery storage and off-grid systems have also allowed solar solutions to serve communities that are not connected to the national grid (IEA, 2023).

This creates opportunities for Energi Panas Indonesia to enter new areas and strengthen its revenue streams more quickly. In 2023, the number of solar panel installations in Indonesia increased by 50 percent, driven by deregulation and the growing use of rooftop solar systems (Reuters, 2024). This momentum demonstrates that solar power is not just a temporary fix, but a meaningful growth path that can support financial performance while geothermal development continues over a longer timeline.

The global energy sector is currently undergoing a significant transformation driven by the urgent need to address climate change, reduce carbon emissions, and ensure long-term energy security. According to the International Energy Agency (IEA, 2023), global renewable electricity capacity increased by more than 50% in 2023, marking the fastest expansion in two decades. Solar photovoltaic (PV) technology has emerged as the leading contributor to this growth due to its declining cost and scalability. The International Renewable Energy Agency (IRENA, 2023) reports that the cost of solar PV modules has declined by approximately 82% over the last decade, making it one of the most competitive renewable energy technologies worldwide. This global trend demonstrates that renewable energy investment is no longer driven solely by environmental concerns but also by strong economic incentives.

The increasing adoption of solar energy in Indonesia is also reflected in the growing number of solar installations across the country. According to industry reports, solar panel installations in Indonesia increased by approximately 50% in 2023 following regulatory improvements and the expansion of rooftop solar programs. This growth demonstrates the rising market acceptance of solar energy as a viable alternative to conventional energy sources. Nevertheless, despite the increasing adoption of solar technology, renewable energy developers still face important challenges related to project financing, business models, and long-term revenue sustainability, especially in developing countries where capital availability and investment risks remain major concerns.

Previous studies have extensively examined the economic feasibility and financial performance of renewable energy projects. For example, Aqeeq et al. (2023) analyzed utility-scale solar investments in developing countries and found that solar energy projects can

generate attractive financial returns when supported by appropriate financing mechanisms and regulatory frameworks. Similarly, Habibi et al. (2023) highlighted that renewable energy investments in Indonesia are highly influenced by project financing structures and policy incentives. Other studies, such as those by Bhandari (2009) and Brealey et al. (2019), emphasize the importance of capital budgeting tools including Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period in evaluating the feasibility of long-term infrastructure investments.

Although previous research has contributed significantly to understanding renewable energy investments, several important gaps remain in the literature. Most existing studies focus primarily on the technical feasibility or macro-economic impact of renewable energy development, while relatively few studies analyze the strategic business models that can ensure sustainable revenue for companies during the energy transition process. In addition, limited research has compared different project delivery schemes such as Engineering, Procurement, and Construction (EPC) and Build-Own-Operate-Transfer (BOOT) models within the context of renewable energy investments in Indonesia.

The existence of these research gaps highlights the urgency of conducting a more comprehensive analysis of renewable energy project strategies that integrate financial feasibility evaluation with business model considerations. Companies operating in the renewable energy sector must not only evaluate the technical viability of projects but also develop strategic approaches that enable them to generate stable and sustainable revenue streams. Without an appropriate business strategy, renewable energy investments may face financial risks that could hinder the broader energy transition agenda.

In response to these challenges, this study introduces a novel analytical perspective by integrating financial feasibility analysis, business strategy evaluation, and funding structure assessment within a single framework. Unlike previous studies that focus solely on financial indicators, this research combines capital budgeting analysis with sensitivity analysis and the US Index framework to evaluate optimal financing strategies. This integrated approach provides a more comprehensive understanding of how renewable energy projects can be structured to achieve both economic feasibility and long-term revenue sustainability.

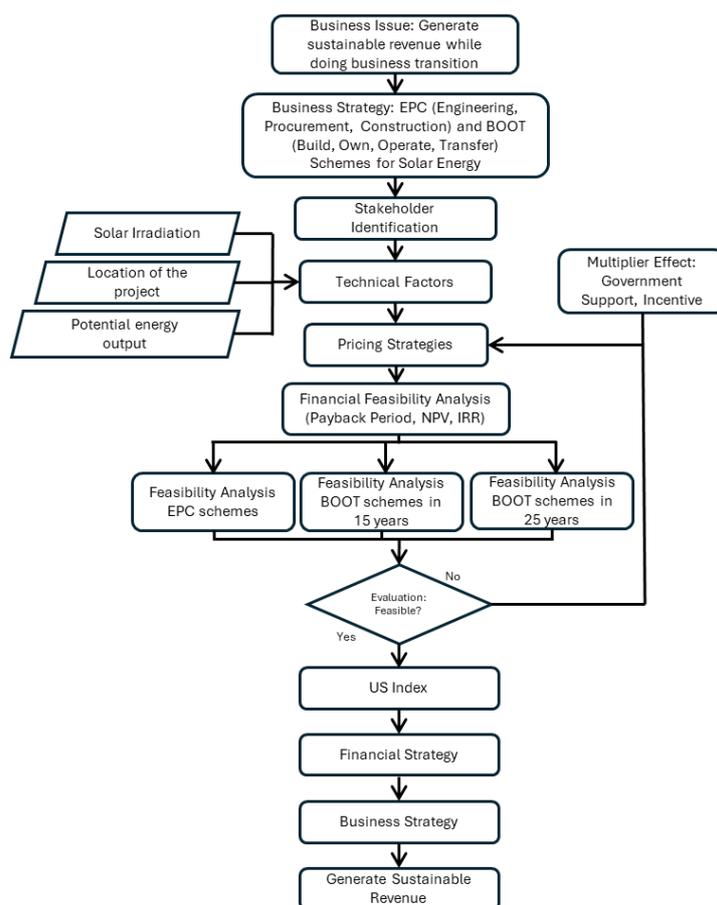
The purpose of this research is to analyze the economic feasibility and strategic business models for solar PV development using different project schemes, particularly Engineering, Procurement, and Construction (EPC) and Build-Own-Operate-Transfer (BOOT). The study specifically examines solar PV project development in West Java, Indonesia, and evaluates the financial performance of BOOT schemes with different operational durations. By comparing multiple project structures, the research aims to identify the most suitable strategy for enhancing long-term revenue generation in renewable energy businesses.

This study contributes to both academic literature and practical decision-making in the renewable energy sector. From an academic perspective, the research enriches the discussion on renewable energy investment strategies by integrating financial modeling with business strategy analysis. From a practical standpoint, the findings provide valuable insights for energy companies, investors, and policymakers in designing renewable energy projects that are financially viable and strategically sustainable.

Ultimately, this research is expected to provide several important benefits. First, it offers a comprehensive framework for evaluating the feasibility of solar PV projects under different business models. Second, it supports corporate strategic decision-making by identifying financing structures that maximize project profitability while minimizing financial risk. Third, it contributes to the broader energy transition agenda by providing evidence-based insights on how renewable energy investments can support sustainable economic development. Through these contributions, the study aims to support the acceleration of renewable energy deployment while ensuring financial sustainability for energy developers and investors.

## METHOD

This study employed a quantitative and comparative financial analysis approach to assess the feasibility of solar photovoltaic (PV) projects using Engineering, Procurement, Construction (EPC) and Build-Own-Operate-Transfer (BOOT) model. The research is designed to provide strategic insights for PT Energi Panas Indonesia (EPI) in addressing its business transition challenges, especially the need for sustainable revenue amid geothermal development, which is relatively slow.



**Figure 1.** Conceptual Framework

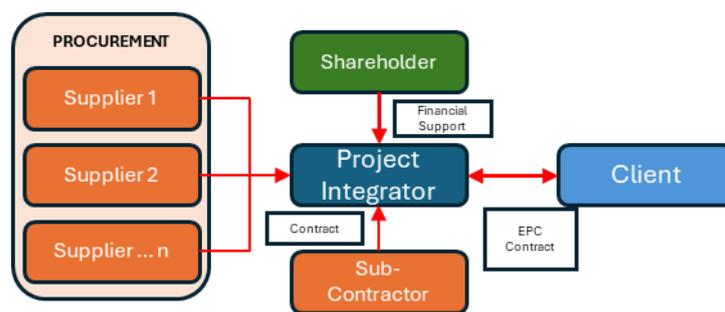
The framework begins with identifying the core business issue, the need to generate sustainable revenue while transitioning toward renewable energy. As a business strategy, EPI

adopts BOOT schemes for solar projects, which minimize upfront investment and allow third-party developers to manage asset ownership and operation for a defined period. From this point, the framework emphasizes the importance of stakeholder identification, technical factors such as solar irradiation, project location, and potential energy output, as critical inputs for the project.

These technical considerations, alongside pricing strategies, feed into the financial feasibility analysis, using Payback Period, Net Present Value (NPV), and Internal Rate of Return (IRR) as the primary evaluation tools. The analysis compares feasibility across two periods: 15 years and 25 years. Additionally, external factors such as government support and incentive programs are acknowledged as vital enablers that enhance project attractiveness. Based on the financial evaluation, a decision is made regarding project feasibility. If the project is considered feasible, it contributes to achieving the strategic goal of generating sustainable revenue and supporting energy transition objectives.

### **EPC and BOOT project schemes.**

Engineering, Procurement, and Construction (EPC) is a project delivery method commonly used in the construction industry. It refers to three distinct phases: engineering, procurement, and construction. Project performance within these phases is typically measured by the constraints of scope, time, and cost. The success of complex projects is strongly linked to the performance of each of these phases.



**Figure 2.** EPC Schemes Illustration (Source: Internal Documentation Energi Panas Indonesia)

The BOOT scheme is a public-private partnership structure in which a private entity finances, constructs, owns, and operates an energy facility for a defined period. During this concession period, the developer typically sells electricity to a utility or off-taker (such as PLN) under a Power Purchase Agreement (PPA). At the end of the term, ownership of the facility is transferred to the public sector or a designated state-owned enterprise. This model is widely used in utility-scale solar projects, especially where large upfront capital costs and long payback periods exist (ADB, 2020).



Figure 3. BOOT Schemes Illustration (Source: Internal Documentation Energi Panas Indonesia)

### US' INDEX Theory

The US' Index theory is a set of financial parameters that evaluate a company's repayment capability. The purpose is to decide whether a company should maximize the use of debt or equity as it shows the real conditions when a company applies for loans to the Bank (Siahaan, 2019). The US Index is performed to acknowledge a company's repayment capability by comparing the Basic Business Profitability (BBP) to the Loan Interest Rates (I). If the US Index scores greater than 1, the company should go into leverage or debt financing, and if it is lower than 1, the company should go into equity financing; if it is equal to 1, the company is free to choose.

$$US\ Index = \frac{Basic\ Business\ Profitability\ (BBP)}{Loan\ Interest\ Rate\ (I)}$$

$$BBP = \frac{Earning\ Before\ Interest\ \&\ Taxes}{Total\ Asset} \times 100\%$$

### Capital Budgeting

Capital budgeting is the process of evaluating and selecting long-term investments intended to increase the wealth of a company's owners (Gitman and Zutter, 2015). This process involves examining and choosing long-term projects that usually require significant capital and can greatly affect the company's future profits and overall value. There are various approaches to capital budgeting. However, this research will focus on these methods:

#### Payback Period (PBP)

The payback period is the amount of time needed to earn back the initial investment based on the returns or cash flow. This helps to compare various funding alternatives. Generally, a shorter payback period is better because it shows the company can start making a profit sooner.

$$PBP = \frac{Initial\ Investment}{Annual\ Cash\ Flow}$$

#### Net Present Value (NPV)

The net present value (NPV) of a project is calculated by summing the present values of expected cash flows after it is adjusted for the cost of capital and then subtracting the initial investment. A positive NPV helps to increase the wealth of shareholders. Meanwhile, negative NPV shows an unattractive project. The NPV is formulated as below:

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

Where:

$CF_0$  = project's initial investment

$CF_t$  = cash inflows

R = discount rate

T = time or period

### ***Internal Rate of Return (IRR)***

The discount rate that brings an investment's NPV to zero is the IRR (Gitman and Zutter, 2015). This indicates that the initial investment and the cash stream's present value are equal. Simply put, IRR displays the anticipated yearly growth rate of an investment. The same formulas for calculating NPV are also used to calculate IRR, except the NPV is set to zero. When utilizing IRR to make decisions for the project, if IRR is greater than the cost of capital, then accept the project, and if IRR is lower than the cost of capital, then reject the project.

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

### **Sensitivity Analysis**

Sensitivity analysis examines how a change in one input variable can affect the output variables while other input variables remain constant and unchanged. This method is frequently used in capital budgeting to analyze the impact of variations in important factors such as sales, variable costs, fixed costs, cost of capital, and tax rates. These factors can affect the outputs of the project's NPV, IRR, and payback period. Additionally, it helps determine the risks related to a project. Sensitivity analysis is a primary method used to assess assumptions. This method examines how predictions can be affected by changing assumptions. The input variable is considered less important if the assumption modification only slightly affects the prediction. However, it becomes an important variable that needs further investigation and careful consideration if an assumption modification results in a significant change in the expected outcome. Focusing just on the effects of a single variable at a time can be dangerous since it may cause significant assumptions to be missed due to oversimplification.

## **RESULT AND DISCUSSION**

The capital expenditure for installing the on-grid solar PV system covers a wide range of components needed to ensure the successful implementation of the project. A total of IDR 14,896,200,000 is allocated for capex. It includes the procurement and installation of key equipment, including solar PV modules, mounting structures, inverters, and monitoring systems. Other costs include zero export equipment, distribution panels, cables, and grounding equipment, which collectively form the foundation for the solar PV system's functionality and integration into the grid. Construction and labor expenses are also substantial, which cover labor costs, safety measures, equipment rental, transportation, and operation and maintenance costs. These ensure smooth installation and operational readiness.

Administrative and regulatory requirements contribute to the overhead, with permit fees amounting to other overhead costs. Additionally, VAT is included, adhering to tax regulations. Furthermore, the projected annual operating expenses come to IDR 365,500,000. The majority of this cost is attributed to the operational and maintenance (O&M) expenses. Considering the initial investment has already taken other expenses into account.

The projected revenue of the solar PV project is based on the energy generated and the electricity price. The projected revenue for solar PV project is calculated based on the system's capacity, annual power generation, and the prevailing electricity price, and is structured around technical factors, pricing strategies, and project revenues.

**Table 1.** Technical Factor PV Project

Technical Factor		
Description	Data	Notes
Project Location	Mobil Manufacture, West Java, Indonesia	Moderate Irradiation
PV Plant Capacity	2435	kWp (Unit)
Potential Power Generated	3,408,812	kWh / year (first year)
Performance Degradation	0.55%	/ year

Technical factor is the key technical specifications of the solar photovoltaic (PV) project. These factors are critical for determining the project's feasibility and expected performance. The factors include project location, PV power plant capacity, potential power generated, and performance degradation.

**Table 2.** Revenue Projection

Revenue Projection				
Schemes	Remarks	Value		notes
<b>EPC</b>	Margin 15%	Rp	17,550,955,000	EPC Contract + OPEX first year
<b>BOOT 15 years</b>	15	Rp	64,477,678,980	excluding performance Degradation
<b>BOOT 25 years</b>	25	Rp	105,247,070,500	excluding performance Degradation

For the EPC scheme, the pricing strategies based on margin that desired by Energi Panas Indonesia. The BOOT (Build, Own, Operate, Transfer) schemes offer long-term contracts of either 15 or 25 years. The strategy is to give a discount of 3% for BOOT 15 years and 5% for BOOT 25 years to the baseline rate.

The EPC revenue is a one-time project value of Rp 17,550,955,000, which includes the EPI's 15% margin. The long-term BOOT models project cumulative revenue over their respective contract periods. For the 15-year scheme, the projected revenue is Rp 64,477,678,980, while the 25-year scheme projects a total of Rp 105,247,070,500. It is important to note that both BOOT revenue figures exclude performance degradation, meaning these are maximum possible revenues and the actual amounts would be slightly lower after accounting for the decreasing efficiency of the solar panels over time.

**Table 3. P&L Statement (EPC Scheme)**

<b>Profit Loss Statement (EPC Scheme)</b>	
<b>Total Revenue</b>	Rp 17,550,955,000
<b>Total Capital Expenses</b>	Rp 14,896,200,000
<b>Total Operation Expenses</b>	Rp 365,500,000
<b>EBITDA</b>	Rp 2,289,255,000
<b>Depreciation (client asset)</b>	Rp -
<b>EBIT</b>	Rp 2,289,255,000
<b>Interest Expenses</b>	Rp -
<b>EBT</b>	Rp 2,289,255,000
<b>Taxes</b>	Rp 503,636,100
<b>Net Income</b>	Rp 1,785,618,900

**Table 4. P&L Statement (BOOT scheme 15 years)**

<b>Profit Loss Statement (BOOT scheme 15 years)</b>	
<b>Total Revenue</b>	Rp 62,053,487,487
<b>Total Operation Expenses</b>	Rp 6,492,459,076
<b>EBITDA</b>	Rp 55,561,028,411
<b>Depreciation (Straight line)</b>	Rp 14,896,200,000
<b>EBIT</b>	Rp 40,664,828,411
<b>Interest Expenses</b>	Rp -
<b>EBT</b>	Rp 40,664,828,411
<b>Taxes</b>	Rp 8,946,262,250
<b>Net Income</b>	Rp 31,718,566,160

**Table 5. P&L Statement (BOOT scheme 25 years)**

<b>Profit Loss Statement (BOOT scheme 25 years)</b>	
<b>Total Revenue</b>	Rp 98,585,007,117
<b>Total Operation Expenses</b>	Rp 12,276,582,464
<b>EBITDA</b>	Rp 86,308,424,653
<b>Depreciation (Straight line)</b>	Rp 14,896,200,000
<b>EBIT</b>	Rp 71,412,224,653

<b>Interest Expenses</b>	Rp -
<b>EBT</b>	Rp 71,412,224,653
<b>Taxes</b>	Rp 15,710,689,424
<b>Net Income</b>	Rp 55,701,535,229

The Profit and Loss Statement of the solar PV project is based on EPC scheme, BOOT 15 years scheme and BOOT 25 years scheme. The following tables present the project profit and loss statement for each scheme.

In capital budgeting, long-term investments that aim to increase the owner's—in this case, PT Energi Panas Indonesia's—wealth are evaluated and selected. With a focus on BOOT schemes, three primary indicators were used to assess the economic feasibility of these investments: Internal Rate of Return (IRR), Payback Period (PBP), and Net Present Value (NPV). Assuming no debt and 100% equity financing, the discount rate is calculated from the cost of capital.

**Table 6.** Project Feasibility Indicator BOOT scheme 15 years

<b>Indikator</b>	<b>Nilai</b>	<b>Satuan</b>	<b>Keterangan</b>
IRR	20.00%	-	-
Payback Period	4.60	Tahun	-
Payback Period	4	<i>Tahun</i>	7.2 Bulan
NPV	13,038,727,940	-	-
ROI	10.96%	-	average PV EBIT / investment

**Table 7.** Project Feasibility Indicator BOOT scheme 25 years

<b>Indikator</b>	<b>Nilai</b>	<b>Satuan</b>	<b>Keterangan</b>
IRR	20.00%	-	-
Payback Period	4.83	Tahun	-
Payback Period	4	<i>Tahun</i>	10.0 Bulan
NPV	17,939,038,228	-	-
ROI	8.99%	-	average PV EBIT / investment

Based on the analysis of Tables 6 and 7, the solar PV installation project in Mobil Manufacture, West Java, Indonesia shows positive financial results for both the BOOT scheme 15 years and BOOT scheme 25 years.

For BOOT Scheme 15 years, the project's IRR stands at 20.00% per annum, which is higher than the WACC of 7.38%. This means that the project provides a higher rate of return than the cost of capital, making it profitable to continue. The payback period, which is the time required to recover the initial investment through net cash flows, is 4.60 years. In addition, the project has an NPV of IDR 13,038,727,940 which is the net cash value after

accounting for all project cash flows and initial investment. When the NPV result shows more than zero (positive value), it means the project is acceptable as it generates a net profit.

For BOOT Scheme 25 years, the project's IRR stands at 20.00% per annum, which is higher than the WACC of 7.38%. This means that the project provides a higher rate of return than the cost of capital, making it profitable to continue. The payback period, which is the time required to recover the initial investment through net cash flows, is 4.83 years. In addition, the project has an NPV of IDR 17,939,038,228, which is the net cash value after accounting for all project cash flows and initial investment. When the NPV result shows more than zero (positive value), it means the project is acceptable as it generates a net profit.

Based on the analysis above, the author concludes that the project is feasible for BOOT scheme of 15 years and 25 years. Although it has a good Payback Period, it shows the important impact of the time value of money on the return on investment and back to customer appetite. If the project is not feasible, author suggestion from Conceptual framework is Multiplier effect like government support, incentives, and other scenario that will be analyzed on Sensitivity Analysis.

Although the feasibility analysis previously performed was based on full equity financing, PT EPI may explore the possibility of using debt financing for this project. In the US Index calculation, the average earnings before interest and tax (EBIT), total project assets, the rate of return on equity (BBP) is given on Table 8 for each BOOT scheme. For the US Index analysis, the author uses an interest rate of 8.5% based on an assumption of the domestic bank financing rate in Indonesia (OJK, 2025).

**Table 8.** US Index for BOOT Scheme 15 years & 25 Years

<i>Keterangan</i>	<i>Nilai</i>
Average PV EBIT	Rp 1,632,751,126
Total Asset	Rp 14,896,200,000
BBP	10.96%
Interest Rate	8.5%
<b>US Index</b>	<b>1.29</b>

<i>Keterangan</i>	<i>Nilai</i>
Average EBIT	Rp 1,339,632,994
Total Asset	Rp 14,896,200,000
BBP	8.99%
Interest Rate	8.5%
<b>US Index</b>	<b>1.06</b>

The calculation results show that the US Index scores are 1.29 and 1.06, which is higher than 1 for both schemes. This shows that leverage can have a positive impact on project profitability with low financial risk. This value also indicates that the project has

sufficient capacity to meet its debt repayment obligations. Furthermore, since the interest rate on the loan is 8.5%, based on the domestic bank interest rate, which is lower than the rate of return on investment (10.96% & 8.99%), the use of debt may be a more financially efficient option than using equity capital entirely. Thus, a debt-based financing strategy may be an effective alternative to help the project continue to be feasible and profitable.

**Table 9.** Summary of Sensitivity Analysis BOOT scheme 15 years

Variables	Impact to IRR (-20%)	Impact to IRR (+20%)	Impact to PBP (-20%)	Impact to PBP (+20%)	Impact to NPV (-20%)	Impact to NPV (+20%)
Capital Expenditures	30%	-21%	-20%	20%	23%	-23%
Operational Expenditures	2%	-2%	-2%	2%	4%	-5%
Electricity Price	-26%	25%	26%	-17%	-45%	44%
Power Generation Efficiency	-26%	25%	26%	-17%	-45%	44%
WACC	0%	0%	0%	0%	19%	-20%

**Table 10.** Summary of Sensitivity Analysis BOOT scheme 25 years

Variables	Impact to IRR (-20%)	Impact to IRR (+20%)	Impact to PBP (-20%)	Impact to PBP (+20%)	Impact to NPV (-20%)	Impact to NPV (+20%)
Capital Expenditures	27%	-18%	-20%	20%	15%	-19%
Operational Expenditures	2%	-2%	-2%	2%	2%	-6%
Electricity Price	-23%	23%	27%	-18%	-41%	37%
Power Generation Efficiency	-23%	23%	27%	-18%	-41%	37%
WACC	0%	0%	0%	0%	23%	-23%

The sensitivity analysis is conducted to know which variables are the most crucial to be controlled. A variety of variables that are believed to influence the economic feasibility of PT EPI solar PV project have been chosen. These variables include the variation of capital expenditures, operational expenditures, electricity prices, power generation efficiency, and WACC. The result shows that electricity price and power generation efficiency are the most sensitive to project feasibility. A 20% decrease in electricity prices leads to a negative NPV up to -45% for BOOT scheme 15 years and -41% for BOOT scheme 25 years. Similarly, a

20% decrease in power generation efficiency resulted in the same negative NPV. Conversely, a 20% increase in electricity prices raises NPV up to 44% increase for BOOT scheme 15 years and 37% for BOOT scheme 25 years. An increase in power generation efficiency by 20% boosts NPV similarly. From this, it shows that electricity price and power generation efficiency are crucial for project sustainability.

**Table 11.** Comparison Source of Funding – BOOT Scheme 15 years

Indicator	Internal Financing	Domestic Bank	International Bank	Leasing
Debt	0%	100%	100%	0%
Equity	100%	0%	0%	100%
WACC	7.38%	6.63%	4.29%	7.38%
IRR	20.00%	20.00%	20.00%	6.35%
NPV	Rp 13,038,727,940	Rp 14,363,961,078	Rp 19,183,538,576	Rp (172,625,372)
PBP	4.60	4.60	4.60	8.13
ROI	10.96%	11.48%	13.35%	3.04%

**Table 12.** Comparison Source of Funding – BOOT Scheme 25 years

Indicator	Internal Financing	Domestic Bank	International Bank	Leasing
Debt	0%	100%	100%	0%
Equity	100%	0%	0%	100%
WACC	7.38%	6.63%	4.29%	7.38%
IRR	20.00%	20.00%	20.00%	#NUM!
NPV	Rp 17,939,038,228	Rp 20,135,262,663	Rp 28,737,113,597	Rp (1,112,174,804)
PBP	4.83	4.83	4.83	52.47
ROI	8.99%	9.59%	11.91%	1.12%

Tables 11 and 12 compare the financial performance indicators of the solar PV project at Mobil Manufacture, West Java under various funding source options. Each option is assessed based on key indicators: WACC, NPV, IRR, and PBP. Among the options, internal financing provides a WACC of 7.38% for both scheme. Then, this option produces the second-lowest NPV of IDR 13,038,727,940 for BOOT scheme 15 years and IDR 17,939,038,228 for BOOT scheme 25 years. Although the IRR matches the project’s return at 20.00%, the PBP is quite short at 4.6 years for BOOT scheme 15 years and 4.83 years BOOT scheme 25 years, making the option favorable compared to the others.

The feasibility of domestic bank loans is improved by a second lowest WACC of 6.63% for both schemes. This results in a greater NPV of IDR 14,363,961,078 for BOOT scheme 15 years and IDR 20,135,262,663 for BOOT scheme 25 years, even though it is lower than international bank loans. While the PBP is quite short, at 4.6 years for BOOT

scheme 15 years and 4.83 years BOOT scheme 25 years, the IRR remains at 20.00%. This option balances cost efficiency and financial viability without compromising control.

International bank loans result as the most favorable option, with the lowest WACC of 4.29% for both schemes, the highest NPV of IDR 19,183,538,576 for BOOT scheme 15 years and IDR 28,737,113,597 for BOOT scheme 25 years. While the PBP is still quite short, at 4.6 years for BOOT scheme 15 years and 4.83 years BOOT scheme 25 years, the IRR remains at 20.00%. This funding strategy provides the best financial returns due to low interest rates and maximizes project profitability.

On the other hand, leasing turns out to be the least feasible option due to its WACC of 7.38% for both schemes, a negative NPV of IDR 172,625,372 for BOOT scheme 15 years and a negative NPV of IDR 1,112,174,804 for BOOT scheme 25 years. The PBP is quite long at 8.13 years for BOOT scheme 15 years and 52.47 years for BOOT scheme 25 years. Significant long-term cost burdens are shown by the IRR of 6.35% for BOOT scheme 15 years and cannot be calculated due to non-convergence for BOOT scheme 25 years, which is also significantly lower than the project's expected return.

Domestic bank loans, however, offer a fair substitute, although one that is less favorable. Meanwhile, internal financing and leasing are less favorable due to lower returns, and longer payback periods specifically for leasing, making them less ideal unless other financing options are unavailable. In conclusion, the option of getting a loan from the International Bank is recommended. Based on the analysis, the option to get a loan from an international bank with a composition of 100% debt and 0% equity is the best option for this project. This option provides the highest NPV, the lowest WACC, and short payback period.

## **CONCLUSION**

The Solar PV project to be developed by PT EPI in West Java, Indonesia, is proven to be economically feasible based on the conducted analysis, which shows that all project indicators remain viable, with an NPV greater than zero, an IRR higher than the WACC, and a relatively short payback period of around five years. The optimal financing strategy for this project is acquiring a loan from an international bank with a 100% debt and 0% equity composition, as this option yields the highest NPV and the shortest payback period. The study recommends that PT EPI prioritize a long-term business strategy by implementing Build-Own-Operate-Transfer (BOOT) schemes with at least a 25-year contract to ensure sustainable profitability, while short-term EPC projects can still be used to improve cash flow in support of long-term goals. Additionally, PT EPI is advised to adopt a debt-based financing model by leveraging international bank loans, which offer lower interest rates and greater capital access compared to leasing or full-equity financing. The company should also utilize Solar PV projects as a revenue stabilizer to balance the high capital expenditure and risk associated with geothermal developments, ensuring both energy transition progress and financial stability. Furthermore, maintaining operational efficiency through the adoption of advanced technology and monitoring systems is essential to minimize performance degradation and maintain consistent electricity output throughout the project's lifespan. Future research is encouraged to explore alternative funding sources and financing strategies for similar large-scale renewable energy projects.

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