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INVESTMENT AND PROJECT FINANCING ANALYSIS OF NEW AND RENEWABLE ENERGY IN PT PERTAMINA (PERSERO) CASE STUDY: SOLAR PHOTOVOLTAICS (PV) PROJECT

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Abstract

Energy-efficient projects use alternative technologies, fuels and management systems to diminish heat and electricity consumption. New and renewable energy-supply projects produce heat and electricity using sources of energy which are regenerated over short time periods. Their recent rise to prominence in modern society has been driven by their low environmental impact relative to fossil-fueled alternatives. Nevertheless, as they mature, energy-efficient and new and renewable energy technologies must demonstrate not only their environmental benefits, but also their economic competitiveness. This study concentrates on the analysis of investment projects using approaches that take into account the unique economic, environmental and energy characteristics of renewable and energy-efficient technologies. The global demand for energy-supply and efficiency projects has never been greater. These trends are driven by many-mostly inescapable factors: a growing global population, increasing wealth, uncertainty of fossil fuel price, security of supply concerns and enhanced policies to combat greenhouse gas (GHG) emissions and global warming. Indonesia over PERTAMINA has developed NRE technologies like wind power, solar photovoltaic, geothermal, and hydroelectricity. Each of the myriad of energy efficiency and supply projects which will comprise these investments must be identified, shortlisted, modelled and economically assessed before it can be financed and implemented. In this study, we take a short brief overview to propose building a solar PV farm with capacity 50 MW, the purpose of this project investment is to fulfil the government regulation according primary energy mix from NRE approximately 23% on 2025.

Keywords: Investment, Project Financing, Renewable Energy, Solar PV.

1. Introduction and Purpose

The past of assessing the cost and benefits of new and renewable energy projects is most likely providing humans have been harnessing energy for their needs. Hunter-gatherers must have acknowledged that the advantages of cooking, light and warmth from fires outweighed the time and effort involved in collecting the necessary fuel. Nevertheless, it was not until the 18th century that the formal process of investment assessment (capital budgeting) occurred as a discipline, which concentrated on measuring the advantages of long-term capital investments to companies. Assessing the cost-effectiveness of energy investments became much more important as a result of the 1973 oil and 1979 energy crises, which resulted in real oil prices increasing from a long-term historic average of about \$20/barrel (\$/bbl.) to \$60 and then over 100\$/bbl. This indicated a much greater level of interest in energy-efficient and renewable energy-supply technologies as economic alternatives to fossil fuels. With the long-term rise in

fossil fuel prices since the 1970s and predictions for this movement to continue, the investment appraisal of energy projects has continued to become increasingly important.

1.1. Company History

Recently, PT PERTAMINA (Persero) already established for sixty-one years of experience in the energy production. PERTAMINA remains dedicated in constructing the nation-state through energy independence in the field of New and Renewable Energy and Business Diversification. This obligation is revealed by the formation of superior products to run the demands of consumers to get larger products. PERTAMINA needs to strengthen its movement, with the aim of creating sustainable commercial development for the Corporation through investment and industry optimization that remains to grow in accordance with the outlooks of all stakeholders.

1.2. Business Scope Activity

According to the Decree of the Minister of SOE's as a General Meeting of Shareholders dated November 24, 2016 concerning Amendments to the Articles of Association of PT PERTAMINA (Persero) as specified in the Notary Deed No. 27 dated December 19, 2016. The duration of the Company's business activities is business activities in the field of energy operations establishments, such as petroleum, natural gas, and NRE. In addition to additional activities that are suitable or provision commercial accomplishments in the energy sector, as petroleum, natural gas, and NRE, the optimization of assets possessed by the Corporation.

In accordance to Articles of Association, the Corporation can ensure the core business, comprising implementation:

- Petroleum and natural gas exploration;
- Exploitation of petroleum and natural gas;
- Accomplishments in the electrically powered energy area comprising nonetheless not restricted to geothermal exploration and exploitation, geothermal power plants, gas power plants and electricity formed by the Firm;
- Treating accomplishments that yield Petroleum, Special Gasoline, Non-Fuel, Petrochemical, Gas Petrol, LNG, GTL and additional products, either end products or semi-finished products;
- Source of biofuels, treating, transport, storage and profitable accomplishments;
- Accomplishments of shipping of oil, petroleum, gas petrol and / or extra products over terrestrial, marine and / or in-flight containing gas transport over pipelines;
- Storage accomplishments (acceptance, assortment and payments) of apply oil, petroleum, gas petrol and / or additional products to positions beyond and / or underneath the shallow of the terrestrial and / or shallow of the marine;
- Profitable accomplishments (procurement, trade, export, import) of apply oil, petroleum, gas petrol and / or further products, containing viable electricity;
- Improvement, assessment, construction and profitable accomplishments of NRE.

1.3. Business Issue

Due to recent circumstances, PERTAMINA recognizes that the resource and consumption of apply oil and natural gas energy stances negative ecofriendly influences that essential diminished. Thus, in the exploration, source and controlling of energy, PERTAMINA started an alteration in placement concerning creating further ecological energy alternatives. The idea mentions to the establishment of energy sources, mutually conservative and NRE, resourcefully accomplished, spotless and real, to run into recent and upcoming energy difficulties, while at the similar period , they are powerful downs the opposing ecological influences to determined level of our measurements toward organize accordingly.

Concisely, PERTAMINA has activated using the expenditure of NRE comprising geothermal. As a result of completion of 2017, through the on stream of the Ulubelu Unit four project, PERTAMINA has effectively elevated the geothermal power plant set up capacity in extra 55 MW. At the moment, PERTAMINA's Geothermal total connected capacity is 587 MW. In addition, geothermal drive stand PERTAMINA's prominence in comparative to the improvement of NRE for the midterm. PERTAMINA is likewise emerging several further methods of NRE comprising Solar PV and Green diesel, beside using those still currently explored such as wind energy, hydropower, and energy storage.

2. Methods

In this study, completely figures has been applied to spread over such principles concepts as PEST analysis, Porter's 5 Forces, Competitor Analysis, VRIO Analysis, VCA, and SWOT Analysis. The outcome of the examination will assist to determine the alternative strategy as facts to answer the issue.

2.1. Conceptual Framework

Determining the accuracy and importance of the conceptual framework in the cluster that is appropriate for the subject being worked on. As a guide, it is usually a conceptual framework that has a section on the internal circumstances of the company, information, profiles and behavior of customers, suppliers, information and communication, and various factors at the macro level such as infrastructure, economic provisions, and political regulations. We can describe as following figure:

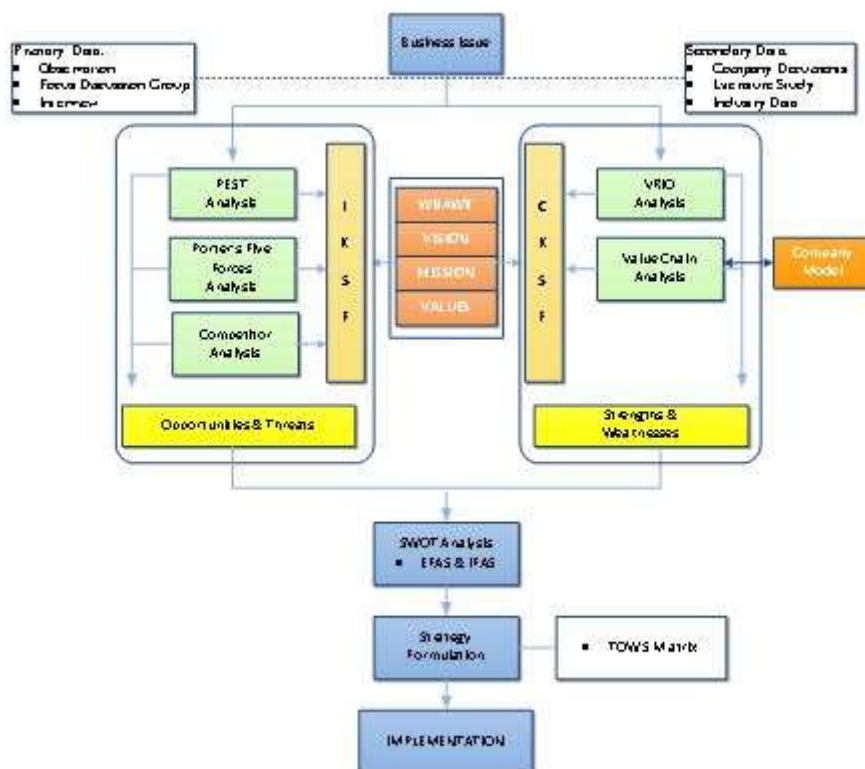


Figure 2.1 Conceptual Framework

2.2.External and Internal Analysis

The overall aim of doing this is to associate the energy efficient areas of the company keen on a dedicated determination to accomplish greater performance. This is regularly completed over several methods. It is essential for PERTAMINA to recognize the situation and the business circumstances that occurs, consequently PERTAMINA has met the recent circumstances and forecast the upcoming opportunity that might occur. Furthermore, PERTAMINA will be competent to proceeds result in business strategy particularly in NRE area to answer the issue.

2.2.1. PEST Analysis Summary

	Political	Economic	Sociocultural	Technological
Fact & Prediction	1. New Political forces in the next elections on April 2019. 2. National Energy Policy state that on 2025 energy mix from NRE approximately 25% 3. NRE Policy according to PP No.79 of 2014 concerning National Energy Policy	1. GDP will grow by 5,3% in 2019 2. Impact of global crude oil prices 3. Economic policy instruments 4. Investment in the energy supply sector 5. Budget overruns of NRE construction can change relatively severely even in diminutive period if the market is unbalanced	1. Impact of Fossil energy extraction 2. Initiatives for further social development 3. Attitude about NRE seems to be identical associated to the community outlooks around climate change	1. New program of wind and water, the heat and the light of the sun, the carbo in plants, and the warmness in the earth 2. Variety method of renewable sources into electricity
	4. Global energy shift determined equally by economics and climate change 5. Policy regarding domestic market obligation (DMO), MEMR regulation No.1395K/30/MEM/2018 on the selling price of Coal for the electrical supply for public interest	6. Inflation, interest and exchange rates have a smaller amount result on NRE Creation 7. The capital cost can be relatively extraordinary for about economies and hence to funding NRE productions each countries have different incentives treatment.	4. Population growth and its effect to the planet 5. The connection concerning population growth and global warming determines that "carbon legacy"	3. The technology of NRE is rapid developing however it still need more support 4. Nowadays NRE are a insignificant percentage of the energy industry around the globe, however that percentage is growing each year.

Impact	<p>1. Changes in the legal, governing or tax systems acquaint with by the government can lead to the deficiency of strong energy policies and a lack of succinct planning.</p>	<p>1. World economy shifting from developed to emerging countries, Indonesia one of the stable GDP growth in the last 4 (four) years to attract investment climate.</p>	<p>1. Fossil fuel extractions causes disturbance and degradation to ecosystems (noise pollution, land subsidence, groundwater contamination)</p>	<p>1. In providing basic energy services, possible losses take place at each stage of extraction, transformation, transportation, transmission and end use</p>
	<p>2 & 3. Will increasingly investment project in NRE to obtain NRE energy mix approximately 25% in 2025</p> <p>4. Higher investment leads to higher GDP</p> <p>5. New regulation of DMO in Coal as supply of electricity will threat the NRE investment</p>	<p>2. Considering energy demand, must find another alternative energy that concern to green environmental</p>	<p>2. Pursuing Clean Development Mechanism (CDM) that also lead to indirect benefits such as employment benefit, local air quality and diminishing GHG emissions.</p>	<p>2. Renewable energy that does not need fuel inputs such as wind, sun, and hydropower, naturally increases efficiency, because no thermal conversion is needed.</p>
		<p>3. The government includes a system for determining taxation rates, government budgets, money supply and interest rates as well as the labor market.</p>	<p>3. The CDM has to contribute to sustainable development in emerging countries.</p>	<p>3. Particularly, RE and energy efficiency methods support each other to facilitate the application of</p>
		<p>4. Since RE are more capital-intensive than conventional generations options, a higher share of RE requires more investment.</p> <p>5. NRE is not bound to volatile raw materials and fuel markets unlike conventional power plants</p> <p>6. Things like the oil crisis and war have a smaller effect on the production of NRE</p> <p>7. From an economic viewpoint, NRE is a inexpensive way out in the long run with a smaller risk of market instabilities.</p>	<p>4 & 5. The commitment uttered at the Conference of Parties (COP) 21 is carried out by encouraging citizen participation in the NRE market, producing and overwhelming its own energy, which results in savings in electricity bills. In some countries, misrepresentation and poor broadcasting of the socio-economic assistances of this sector have affected misunderstanding and refusal by the public economy.</p>	<p>energy that may not be theoretically or economically feasible, the resulting version is greater than the sum of its parts.</p> <p>4. NRE investment permits efficient buildings to become easier power, especially when this renewable energy is not connected to the network.</p>
Summary	<p>An important factor for investing in NRE projects in procedural administrative management and analysis of the results of the policies implemented, which regularly turns out to be inefficient</p>	<p>The accessibility of funds for investment will be justified to expand support for the abundant technological advances of the earth and to overcome institutional and other obstacles to large-scale utilization</p>	<p>Accessibility to energy is an essential circumstance for improvement that not only affects welfare and health factors, but also on environmental sustainability</p>	<p>The energy system have a tendency to concerning a more reorganized and various model.</p>
Industry Key Success Factor	<p>Procedural management administration and analysis of the results of the policies applied The availability of funds for investments Accessibility to energy resources. Energy system decentralized and diversified model Sustainable energy that influences welfare, health and environmental.</p>			

Table 2.1 PEST Analysis

2.2.2. Porter's 5 Forces

Porter's Five Forces examination is the most important instrument for examining the reasons of the energy industry to measure the effectiveness of method in the recent marketplace. The study will facilitate PERTAMINA to make a deliberate conclusion to answer the issue.



Figure 2.2 Porter's 5 Forces Method

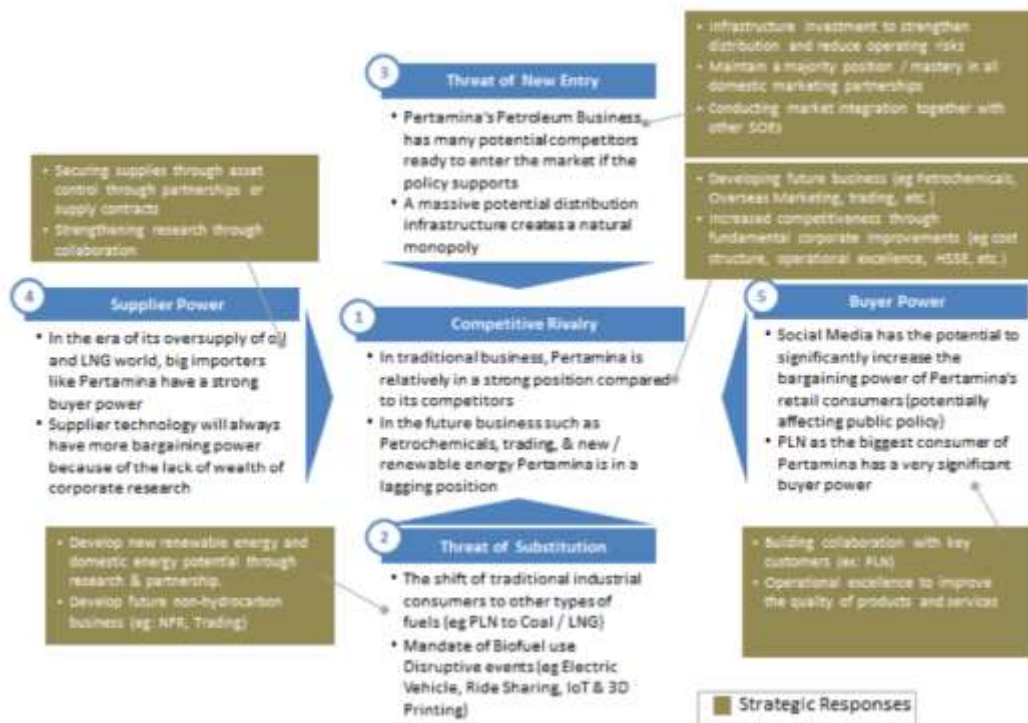


Figure 2.2 Porter's Five Forces Analysis

2.2.3. Competitor Analysis

Competitor analysis takes two major activities, the first one is to attain information approximately significant competitors, and the last one using that information to predict competitor behavior. PERTAMINA is the largest company in Indonesia in terms of revenue and net income, both compared to the other state-owned companies and private enterprises nationwide. Nevertheless, among the major global energy companies, PERTAMINA is one of the smallest in terms of both financial and operational. As an integrated oil and gas company and energy company hence, that it cannot be compared with other companies from different industries.

2.2.4. Value Chain Analysis

Value Chain Analysis is a strategy instrument used to examine the company's internal activities. The aim is to distinguish which activities are furthestmost valued (namely the source of prices or differentiation advantages) for the company and which can be increased to deliver a competitive advantage. Conversely, by considering at internal activities, analysis exposes where the competitive advantage or loss of the company. Companies that compete through differentiation advantages will attempt to do their activities better than competitors. If it strives over cost advantages, it drives to do internal activities at a lower cost than competitors. Once a corporation is able to produce products at a lower budget than marketplace prices or to offer greater goods, it makes an income. Porter presented the broad VC method in 1985. The VC characterizes all internal accomplishments that the company does to produce products and services. Value Chains are designed from the main activities that directly increase value to the end product and funding accomplishments that enhance value ultimately.

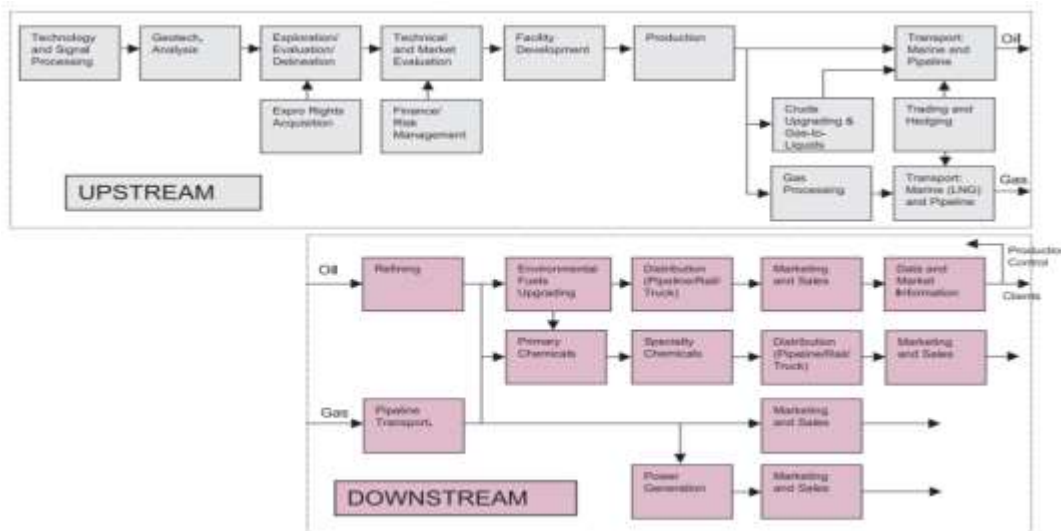


Figure 2.3 PERTAMINA Value Chain Analysis

2.2.5. VRIO Analysis

Capability/Resource	Valuable	Rare	Costly to imitate	Organized to Capture Value	Competitive Advantage
Brand Name	Yes	Yes	Yes	Yes	High
Talent Management	Yes	Yes	Yes	Yes	High
Lean Project Management	Yes	Yes	No	Yes	Medium
Advanced Analytics	Yes	Yes	Yes	Yes	High
Shift toward digital oilfield	Yes	Yes	Yes	Yes	High
Physical Resources	Yes	Yes	Yes	Yes	High

2.2.6. SWOT Analysis

SWOT analysis is a portrait of business situation and providing an input on the making of strategic alternatives. This provides management with a framework of the main issues moving the industry and business and classifies the beginning for emerging strategies. SWOT examination that is well agreed and certainly connected about certain values is an identification of weaknesses and threats. In overcoming it accurately, the business plan will become more reasonable and stronger. This shows that you are not only seeing profits, but are conscious of the challenges opposite your industry.

Strengths	Weaknesses
<ol style="list-style-type: none"> 1. Brand name 2. Talent management 3. Lean Project Management 4. Advanced Analytics 5. Shift toward digital oilfield 6. Physical resources 7. Vertically Integrated operations 	<ol style="list-style-type: none"> 1. Skill talent shortage 2. Employee retention 3. Lack of R&D improvement regarding NRE 4. Lack of knowledge between industry and higher education.
Opportunities	Threats
<ol style="list-style-type: none"> 1. Strengthening collaboration 2. Develop NRE through partnership 3. Sustainable energy that influences welfare, health and environmental 4. Accessibility to energy resources 5. Alternative sources give competitive price to customer 	<ol style="list-style-type: none"> 1. Relationship with supplier 2. The availability fund for investments 3. Zero emissions 4. Procedure and analysis result of policies implemented 5. Energy system decentralized and diversified model

From above internal and external analysis, we can summarize the SWOT of PERTAMINA as follow:

3. End result and Argument

Once we examine the recent circumstances challenged by PERTAMINA, there remain rules that the writer can deliver that will be described more in this section.

3.1 Alternate of Business Solution

This practice of TOWS examination is a better form of SWOT analysis that can be accessed in the earlier chapter. The TOWS matrix is an instrument that can be used to define the relationship among internal and external aspects possessed by PERTAMINA. With this TOWS Matrix, it is projected that PERTAMINA can realize in what ways its strengths and weaknesses face opportunities and threats. Conversely, it is possible that PERTAMINA can improve its strength to decide threats and weaken end-to-end weaknesses in the use of opportunities. The TOWS Matrix suggested can be realized as follow:

Table 3.1 TOWS Matrix

IFAS EFAS	Strengths (S)	Weaknesses (W)
	Brand name (S1)	Skill talent shortage (W1)
	Talent Management (S2)	Employee retention (W2)
	Vertically Integration Operation (S3)	Lack of R&D improvement regarding NRE (W3)
	Advanced Analytics (S4)	Lack of relationship between industry and higher education (W4)
	Shift toward digital oilfield (S5)	
	Physical resources (S6)	
Opportunities (O)	The SO Strategies	The WO Strategies
Strengthening collaboration (O1)	Strategic Alliance with competitor (S1, O1, O2, O5)	Internship or In house training with business partner (W1, W4, O1, O2)
Develop NRE through partnership (O2)	Acquire new technologies and skills (S2, O1, O2, O3, O4)	Establish employee engagement (W2, O1, O2)
Sustainable energy that influences welfare, health and environmental (O3)	Added Value Partnership (S3, O1, O2, O3, O4, O5)	Benchmarking to competitor (W3, O1, O2, O3, O4)
Accessibility to energy resources (O4)	Investment in NRE project (S1, S3, S5, S6, O3, O4, O5)	MoU between Industry and Universities (W4, O1, O2, O3)
Alternative sources give competitive price to customer (O5)		
Threats (T)	The ST Strategies	The WT Strategies
Relationship with supplier (T1)	Adapting strategic approach with key suppliers for long-term benefits (S1, T1)	Employee exposure through task force team (W1, W2, T4)
The availability fund for investments project (T2)	Find investor that interest in green energy and climate change (S1, S3, S6, T1)	Training or seconde with Business Partner to learn new technologies (W1, W2, T2, T4, T5)
Zero emissions (T3)	Shifting into NRE technologies (S1, S3, S6, T3)	Benchmark to world class R&D organizations that develop NRE technologies (W3, T2, T4, T5)
Procedure and analysis results of policies implemented (T4)	Integrated Policies and Procedure according Feed in Tariff (S1, S3, T4)	
Energy system decentralized and diversified model (T5)	Diversify electricity portfolios via increases in NRE (S1, S3, S6, T5)	

Considering all the alternatives above, we can conclude that, to pursue government commitment to diminish greenhouse gases (GHG's) emissions, we need to accelerate the energy mix target from renewable energy based on PP 79/2014 approximately 23% on 2025. PERTAMINA as a SOE in Indonesia, has an obligation to establish NRE investments project. Nevertheless, PERTAMINA need to create a scenario to fulfil this solution.

3.1. Analysis of Business Solution

PV technology directly converts solar radiation to electrical energy using the photoelectric effect. Although PV energy output is intermittent, it is largely predictable due to the regular motion of the sun. However, cloud cover and ambient temperature are unpredictable and diminish system output. PV system comprise several component including PV cells (generator), support structures, batteries or electricity grid (storage), power conditioning units, and sometimes, supplementary or backup generator (stand-alone system) to form a hybrid system.

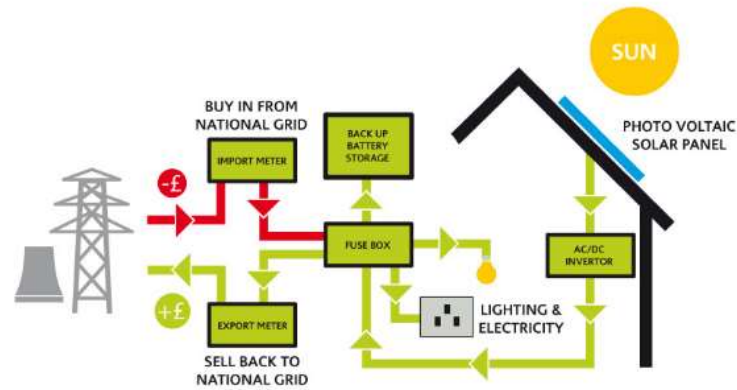


Figure 3.1 Solar PV System

PERTAMINA considering investing in a new solar PV and wishes to evaluate its financial performance. The project is located in Dumai, which has planning permission for solar panel type poly-crystalline and a connection agreement to the electricity grid. The net yield per month A P50 or P90 yield is a measure of the probability that the site will meet or exceed this solar yield. Therefore, for this site, there is a 90% probability that the energy yield will be at least 74,120.35 MWh/year and a 50% chance that it will produce more (or less) than 80,411.79 MWh/year. For the investors, who are exposed equally to upside and downside risks, it is most appropriate to use the P50 metric. Banks, however, usually take a more conservative view as they are more exposed to the downside risks. For instance, if the project goes extremely well they will only get repaid the loan and interest, whereas if it goes badly they are left with a bad debt; they tend to use the P90 figure in their assessments. A P50 figure will be used here since the financial appraisal is being undertaken on behalf of the investors.

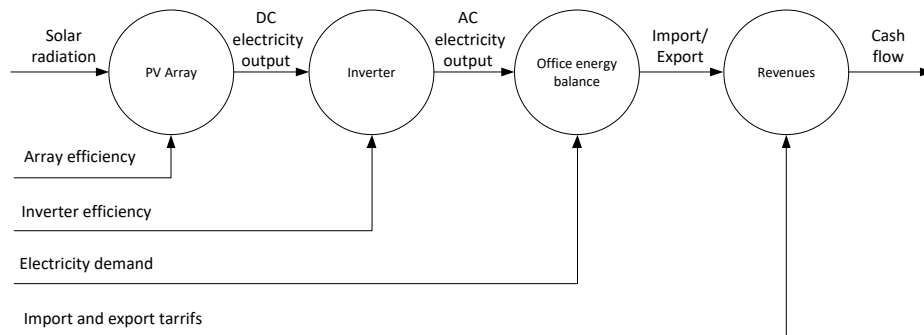


Figure 3.2 Model of Solar PV system

Key Players of this Project

Off Taker (PLN) The entity that receives and uses the electricity generated by the facility and sometimes (particularly in solar and distributed generation projects) provides the site/building on which the facility is located.

Developer/Sponsor (PERTAMINA POWER INDONESIA) The entity sponsoring the project (typically the entity developing the project and who contracted with Power Purchaser– though could inherit this from another entity through, e.g., an acquisition). May or may not itself be a taxable entity, but often does not have a “tax appetite” i.e. the ability to use the tax benefits of owning a facility.

Project Company Special purpose vehicle (“SPV”) established by the Developer to own the facility Limits Developer’s liability in connection with the facility to the Developer’s investment in the SPV Permits the facility to be financed on a “project” basis. Customers sometimes ask for corporate guarantees (or other credit support, such as letters of credit) to backstop the obligations of the SPV / Project Company under the PPA. Except in very specific and limited circumstances, corporate guarantees are not given – they would defeat the purpose of developing and financing the facility on a “project” basis. Project Company (SPV) Customers can draw comfort from (1) requirements that SPE obtain and maintain insurance to protect against insurable risks (and require contractors to have insurance), (2) PV solar systems (and, to a lesser extent, other solar and wind facilities) are, relative to fossil fuel-fired generating facilities, simpler to operate and maintain and environmentally “clean”, not presenting risks of explosions, fire, etc. and (3) Developer (and Investor) making a substantial equity investment in the facility.

Debt Provider/Lender provides (**MANDIRI**) construction financing and term financing (and may also provide for working capital and/or letter of credit facilities to support the Project) Receives fixed return based on fees, interests and principal. Receives Cash Grant proceeds in certain eligible projects to the extent that the debt facility is financed with the expectation to have such proceeds to repay a portion of the facility or a particular tranche (e.g., cash grant bridge tranche). Receives a first lien on all real and personal property of the Project Company, including rights to Cash Grants, obligations of members and prospective members to make capital contributions, and a lien on the membership interests of the Project Company.

EPC Contractor (BECHTEL, US) was hired by Project Company to construct the Facility, usually on a turnkey basis. Must be sufficiently creditworthy to backstop performance obligations and/or provide letter of credit or surety bond. Required to provide delay and performance liquidated damages to ensure timely construction and facilitate the ability to meet PPA delivery obligations.

Operator & Maintenance (PERTAMINA RU II DUMAI) was employed by Project Company to operate and maintain Facility ideally on a fixed price basis or fee subject only to growth, should be experienced party. Need to insure that an agreement is structured with incentives to perform well and to reduce costs.

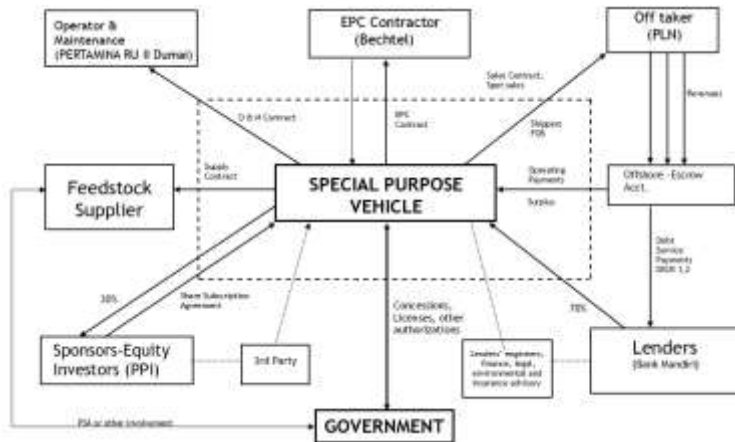


Figure 3.3 PERTAMINA Project Financing Scheme

Sources and Uses	USD 000's	Percent	USD/kWp	IRR's	Nominal	Real
Uses of Funds						
Capital Expenditures	83.333,33	91,93%		Project Pre-tax	18,79%	
Development Cost	1.500,00	1,65%		Project After-tax	14,89%	
Owner's Cost	2.000,00	2,21%		Debt IRR Pre-tax		
Initial Working Capital	841,65	0,93%		Debt IRR After-tax		
Development Fees	0,00	0,00%		Equity IRR	26,40%	
Banking Fees	946,78	1,04%		DSCR	1,37	
Interest During Construction	2.023,65	2,23%		LLCR		
Debt Service Reserve Account	0,00	0,00%		PLCR		
Total	90.645,41	100,00%				
Sources of Funds						
Senior Debt Funded with Cash	63.450,00	70,00%				
Senior Debt Capitalised Interest	0,00	0,00%				
Total Senior Debt	63.450,00	70,00%				
Equity Funding	27.195,41	30,00%				
Total	90.645,41	100,00%				

Table 3.2 Project Financing Summary

Conclusion

According to this analysis and calculation we can accept this project if:

- Free Cash Flow to Project:
- NPV to Project > 0 (discount rate WACC), or;
- IRR to Project > WACC
- Free Cash Flow to Equity:
- Equity NPV > 0 (discount rate K_e), or;
- IRR Equity > K_e

Thus, we can conclude from above formulation, that IRR Equity > K_e equal with $26.4\% > 20.3\%$ and the aggressive DSCR for NRE industry particularly in power system minimum 1.2 times, from above calculations the result of DSCR for this project financing 1.37 times. Therefore, we accepted this project investment to establish.

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