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STRATEGIES FOR INCREASING THE USE OF ROOFTOP PV IN INDONESIA

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ABSTRACT

The current high energy consumption can cause scarcity as Indonesia's population growth has increased quite significantly. Alternative energy is needed to anticipate energy problems in the future. Solar energy is one of the options given the most significant potential for energy produced in Indonesia. This research aims to see the strategies that PLN can do to increase the use of Rooftop PV in Indonesia based on the results of the analysis that has been done. The approach to this research is a qualitative approach with the SWOT and FGD methods. Also, the data used are primary data from survey results on Rooftop PV users in Indonesia. The SWOT analysis results show that PLN is in quadrant I, which means it has an extreme market position. PT PLN has the potential to increase the use of Rooftop PV in Indonesia. Two strategic points can be carried out by PLN, namely, carrying out vertical integration and diversifying conglomerates. Also, the researcher has proposed several alternative strategies, namely the upstream (manufacturing) development plan, the downstream (consumer) development plan, and the internal development plan.

Keywords: *Rooftop PV, SWOT, PLN, Business Strategy*
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Introduction

High energy consumption can cause scarcity as Indonesia's population growth has increased quite significantly. It is necessary to use alternative energy sources so that energy availability can meet future generations' needs. The government has conducted various studies related to developing alternative energy as a substitute for non-renewable energy. Some potential powers as a substitute for non-renewable energy include hydropower, geothermal, bio-power plants, biofuel, solar, wind, and marine life. Hydropower has the potential to generate 94.3 GW; geothermal 28.5 GW; PLT bio 32.6 GW; BBN 200 thousand Bph; solar 207.8 GWp; wind 60.6 GW; and marine energy 17.9 GW (Dewan Energi Nasional, 2019).

Based on data from (Dewan Energi Nasional, 2019), solar energy has a great opportunity to replace non-renewable energy because the potential produced is the greatest, namely 207.8 GWp. This potential also cannot be separated from the government's support as the

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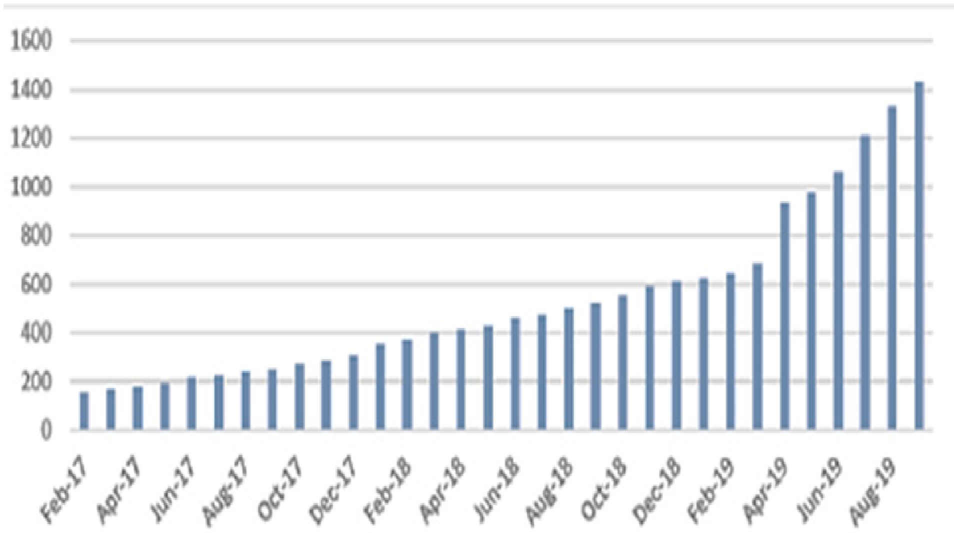
regulator. The government also contributes through the Minister of Energy and Mineral Resources Regulation No. 49 of 2018 to encourage solar energy to be new and renewable.

It should note that the government's role in increasing solar energy use, especially on PV rooftops, has also been done for a long time. Even the PV Rooftop provisions have been regulated since 2013 through the Board of Directors Regulation of PT PLN (Persero), namely No. 733. K / DIR / 2013 concerning Utilization of Electric Energy Photovoltaic by Customers of PT. PLN (Persero). Based on data from the Ministry of Energy and Mineral Resources, PV Rooftop installation continues to increase until 2019. This data is shown in Figure 1, which shows statistics on PV Rooftop users in Indonesia.



Source: ICED (2020)

Figure 1: The development of PV Rooftop in Indonesia in 2017-2019

The current government policy, which continues to be improved, is also a response to the increasing use of rooftop solar panels in Indonesia. Moreover, PLN recorded that the growth of rooftop solar panels in April 2020 reached 17% compared to December 2019 (PT PLN, 2020). Over time, PV Rooftop users' development will affect the amount of investment spent on PV Rooftop, which is currently classified as very high compared to conventional electricity. This cost problem is also homework because not all groups have the same price preference for PV rooftops. This problem allows for opportunities when the parity grid occurs.

Several studies have examined the parity grid. Yan et al. (2019) Stated that solar panel technology achieved grid parity between 2013 and 2020 in some developed countries. The occurrence of grid parity means the time when the kWh electricity costs generated by solar panels are the same as the costs generated from conventional electricity (Bhandari and Stadler, 2009). If this spreads to developing countries, the potential for producing solar panels will be even higher this decade, including in Indonesia.

The potential for developing solar panels in Indonesia can be supported by Indonesia's strategic location, which makes the supply of solar radiation abundant. The possibility of switching from non-renewable energy to renewable energy is also getting more significant. However, that is not the only reason to attract someone to switch from conventional power to environmentally friendly fuel such as PV Rooftop. Previous research digs deeper into consumers' benefits if numerically using PV Rooftop. Duman and Güler (2020) Showed that the average payback period for using PV Rooftops in Turkey is 5 kW of 7.75-14.43 years, with an IRR of 13.68% -6.87% and a PI of 2.2-1.28. Ramírez-Sagner et al. (2017) Analyzed PV Rooftop in Chile and found that almost all districts show the IRR level reaches a maximum value of 11%, which offers excellent potential.

Based on the above background, it should increase the potential for this energy source from solar again to solve the future scarcity problem. With a significant solar energy source, Indonesia should be able to go further to harness solar power. The development of PV Rooftops in Indonesia needs to be considered through the proper steps so that, later on, PV rooftops can help reduce dependence on non-renewable energy. Also, many studies want to know the factors that affect the use of solar panel energy sources, such as in Bach and Calais (2001); Bhandari and Stadler (2009); Chen, et al. (2014), but not many have included strategies that stakeholders should take. This study's results formulate two methods that PT PLN can take as a strategic step to increase PV Rooftop in Indonesia.

This paper has a research question: What strategies can be undertaken to enhance the potential use of PV Rooftop in Indonesia? Therefore this research will discuss strategies that can be taken to increase the potential use of PV Rooftops in Indonesia as a form of anticipation of the scarcity of energy sources in the future. The authors used a qualitative approach in this study, namely the SWOT analysis. Besides, FGDs were conducted with various stakeholders. The data used in this study are primary data taken through a survey of existing PV Rooftop users for both households and industry.

Literature Review

Solar PV systems can be classified based on the application of technology usage. There are two main solar PV systems: grid-tied solar PV systems, better known as on-grid systems, and stand-alone solar PV systems, better known as systems off-grid (Singapore et al., 2009). Meanwhile, if its use is carried out, a combination of a solar power plant (PLTS) with other power plants connected directly to the PLN network is called a hybrid system grid-connected (Arifin Sinaga et al., 2019).

On-grid systems can be divided into two, namely distributed on-grid systems and grid-connected centralized systems. A distributed grid system is typically installed to provide power to customers directly connected to the grid. This system's main characteristic is that the AC load is connected to the electricity distribution network owned by the power plant. So with this system, if the solar panels generate enough electricity, the electricity will flow directly to the existing distribution network. Conversely, if the electricity generated by solar panels is small, it can take from electricity. Meanwhile, a centralized grid-connected system is a centralized power plant, and the power generated is not directly connected to the customer but rather to the electricity grid system. Usually, this system has a considerable enough installed power (Sukmajati and Hafidz, 2015)

Meanwhile, off-grid systems are categorized into two, namely domestic off-grid systems and non-domestic off-grid systems. A domestic off-grid system is a system that provides electricity in a household capacity and is usually installed in remote or rural areas that are not connected by the PLN network. This system only relies on solar energy as the primary energy source to produce electrical energy. Simultaneously, the non-domestic off-grid system is a commercial solar power plant (PLTS) system. This power plant is widely used for various applications, including telecommunications, navigation aids, water pumps, and so on (Sukmajati and Hafidz, 2015).

The hybrid system is a combined or integrated system between several other power plants based on renewable energy. This hybrid technology development aims to obtain optimal power by connecting each other power plant's advantages. This system is also referred to as a combination of off-grid and on-grid systems, with a battery to store energy and can be connected directly to PLN's primary power source. Thus, this system makes customers economical in using electricity and can even sell electricity when the solar panels generate excess electricity (Dinata MMM and Asvial M, 2018). This excess of salable electricity can provide benefits to the consumer side.

The beneficial solar panel system can increase its potential use in Indonesia. Solar panel systems that use renewable energy, especially solar energy, which has sustainable characteristics, can replace conventional energy systems and are likely to reduce dependence on fossil fuels and greenhouse gas emissions (Nurunnabi et al., 2018). On the other hand, the market for rooftop solar panel users continues to be encouraged through Ministerial Regulation Number 49 of 2018. PT PLN consumers who use Solar Power Plants (PLTS) have increased by 181% since the regulation was enacted (Kementrian ESDM RI, 2019).

Various factors can cause an increase in PV mini-grid users in Indonesia and around the world. Sommerfeld et al. (2017) has examined respondents' motivation in installing solar PV. This study explains respondents' or participants' reasons for installing solar PV from an economic, social, and environmental perspective. From a financial perspective, respondents installed solar PV because of an increase in electricity prices. Respondents decided to install solar PV to save more on their electricity bills. In social terms, the respondent's decision to install solar PV is that they feel they have adequate information regarding solar PV, and there is influence from family or friends. Finally, from an environmental perspective, some respondents stated that their decision to install solar PV believed solar PV was alternative energy and good for the environment, especially in reducing environmental impact and CO2 emissions.

A study reveals how rooftop solar panel users' characteristics meet the public's demand for rooftop solar panels. Research by (Kobayakawa and Kandpal, (2014) looks at the potential demand in Kayalapara Village, India. Their research reveals that household characteristics, such as the number of children attending school, income level, land ownership, etc., significantly impact whether they are willing to connect to the solar micro-grid. The variable that is also an indicator directly influencing the decision to use a micro-network is the income level, which is proxied by wealth and asset ownership. They also concluded that two ways to do this based on customers, namely horizontally and vertically. Horizontally, the network needs to be expanded wisely because consumer segmentation has a high willingness to pay horizontally. Meanwhile, the vertical method is more pro-poor, namely by reducing costs.

Based on research that discusses rooftop PV users' characteristics, it is also necessary to know about rooftop PV players. As for PV rooftop players in Indonesia in terms of customers, as of May 2018, PV rooftop customers reached 414. It is predicted to continue to grow in the business and industrial sectors. Then, in 2019 PV rooftop customers were dominated by the household group by 82%, and export kWh (PEL to PLN) PV rooftop customers were dominated by tariff groups R by 67%, B by 16%, and S by 13%. The number of kWh exported to PLN is dominated by the R tariff group, which has generated more energy (PT PLN, 2020). Meanwhile, PV rooftop players in Indonesia, in terms of producers, also have many PV rooftop service providers, including PT LEN Industri (Persero) in Bandung, PT Adyawinsa Electrical and Power in Bekasi, PT Surya Utama Putra in Bandung, PT Swadaya Prima Utama in Jakarta, PT Azet Surya Lestari in Tangerang, PT Wijaya Karya Industri Energi in Jakarta, PT Sankeindo in South Tangerang, PT Sky Energy Indonesia Bogor, PT Jembo Energindo in Tangerang, and PT Indodaya Cipta Lestari in Jakarta (Asosiasi Pabrikan Modul Surya Indonesia, 2019).

PT PLN in the rooftop PV market requires several reviews that can provide input for the company to take the proper steps. One of the steps that need to be prepared is the marketing strategy for stocking energy products. Research Eagle et al. (2017) discusses social marketing strategies that can be used to deal with the renewable energy transition. The results showed that most consumers desire to invest in battery storage and rooftop solar panels rather than what they currently have. The "future power-saving" indicates a strong belief that rooftop solar panels are the cheapest for electricity. Therefore, the discovery strategy may need to consider incentives or reward schemes to help reverse the "cost-benefit" that might hinder buying behavior. Communicating to reduce energy consumption and costs while maintaining personal comfort may influence homeowners to switch to energy-saving energy. Furthermore, educational programs such as newsletters, the internet, and applications can be a solution for respondents who lack information. Effective marketing communication may provide an opportunity to promote energy-efficient behavior, for example, by using future-oriented slogans such as "I am saving electricity for our children future".

Several studies on strategies for increasing the use of PV rooftops have been carried out. Noguchi (2005) describes the "Cost-Performace" marketing strategy method; that Japanese manufacturers use to market solar photo voltaic homes. This marketing strategy can be considered the core of the Japanese residential manufacturer's success in producing PV solar-powered homes that suit individuals' and communities' wants and needs. The survey results show that home buyers tend to consider housing quality, affecting facilities and life cycle costs, as a top priority, while selling price is less of a consideration. In other words, today's consumers strive to buy innovative products at affordable prices if they believe in superior quality. Bach et al. (2001) use the Balanced Scorecard Method (BSC) as a marketing tool to communicate the benefits of privately owned Grid Connection Photovoltaic (GCPV) systems to potential customers and utilities, and businesses seeking new markets in Western Australia. The Balanced Scorecard method integrates all the main stakeholders' interests, including owners, customers, employees, etc., on the scorecard. Instead of merely measuring the financial impact a new marketing move will create, BSC tries to give a balanced impact report that is holistic and value-based.

Lei, et al. (2019) and Chen, at al. (2014) use SWOT analysis to investigate internal strengths and weaknesses, as well as external opportunities and threats in solar PV development. The research results by Lei, et al. (2019) found that in developing PV rooftops in Africa, strong incentive policies are needed and the need to promote hybrid solar power. It is also necessary to proactively respond to solar panel development's potentially adverse environmental impacts and seek opportunities for multilateral cooperation and the Belt and Road Initiative (BRI) framework. Meanwhile, Chen, et al. (2014) analyzed promoting renewable energy as an alternative source to increase energy security in China, Japan, and South Korea. Based on the SWOT analysis, joint development can provide positive results for expanding renewable energy in these three countries. Although the three countries can compete for a larger share of the global renewable market, there are opportunities for increased collaboration.

Data and Research Methods

The data collection technique in this study was through offline surveys. The offline poll was conducted to obtain customer data and potential customers for PV Rooftop. There are 323 existing and potential respondents from households and industries, consisting of 117 existing and 206 potential respondents. The samples were obtained from three provinces: Jakarta, Bali, and East Java, including Surabaya, Malang, Pamekasan, and Sumenep. Details of the number of samples of respondents obtained in table 1.

Supervisors and enumerators in this study carried out the survey. Supervisors supervise, direct, and coordinate the research and conduct data permits. Meanwhile, the enumerator is in charge of conducting interviews directly with respondents.

Enumerators conducted interviews aimed at both existing and potential respondents by asking some basic questions related to identity and characteristics based on the respondent's demographic and socioeconomic conditions. For existing respondents or users of PV Rooftop, the question is more emphasized on the use of PV Rooftop so far, starting from the first year using PV Rooftop, the name of the vendor used when installing, how to purchase PV Rooftop, type of PV Rooftop, and so on. Meanwhile, the question is more directed at how interested the respondents are in using PV Rooftops for potential customers.

Table 1: Details of the Number of Respondent's Samples

District/City	Costumer		
	Existing	Potential	Total
Jakarta	43	143	186
Bali	60	40	100
Surabaya	3	14	17
Malang	5	5	10
Pamekasan	4	4	8
Sumenep	2	0	2
Total	117	206	323

Source: Data processed (2020)

This research uses a qualitative approach using in-depth interviews and Focus Group Discussions (FGD) with related informants or sources. Qualitative research (semi-structured, in-depth interviews) does not generalize the entire population's results. Still, it aims to collect data that supports the phenomenon under study (Djamba and Neuman, 2002).

The analysis technique in this research is SWOT. The SWOT analysis identifies and determines internal and external factors that support and do not achieve goals. As shown in Table 2, Decision makers can evaluate the extent to which there is a strategic match between internal and external characteristics. The SWOT method is used in this study because SWOT research focuses on analyzing organizations for recommended strategic actions. In the business arena, internal and external problem groupings are often the starting point for strategic planning (Helms and Nixon, 2010).

Table 2: Basic Elements of SWOT Analysis

FACTOR	POSITIVE Helpful to achieving the objective	NEGATIVE Harmful to achieving the objective
INTERNAL	STRENGTHS	WEAKNESSES
EXTERNAL	OPPORTUNITIES	THREATS

Source: Lupu et al. (2016)

According to Lupu et al. (2016), the SWOT analysis will focus on categories that provide advantages (strengths) or disadvantages relative to others (weaknesses). Environmental elements can also be used as an advantage (Opportunities) or cause problems (Threats) in achieving goals. All categories can be related to each other, or there is an interaction between internal and external strategies. These strategies are as follows:

1. SO (Strengths-Opportunity) strategy, namely how the strengths can take advantage of current opportunities.

2. ST (Strengths-Threats) strategy is how the strength can deal with existing threats.

3. WO (Weaknesses-Opportunity) strategy is how to overcome weaknesses that prevent profit from existing opportunities.

4. WT (Weaknesses-Threats) strategy is how to overcome weaknesses that can make threats real.

SWOT analysis is conducted to determine the position of PLN so that it will be easier for PLN to make alternative strategy choices. In executing a SWOT analysis, first, PLN needs to formulate internal factors from within the company or an IFAS (Internal Strategic Factor Summary) consisting of strengths and weaknesses. Furthermore, PLN prepares external factors from outside the company or what is termed EFAS (External Strategic Factor Summary), which includes opportunities (opportunities) and threats (threats). The following are the steps PT PLN must take in a SWOT analysis:

1. Formulate IFAS (Internal Strategic Factor Summary), which is determined based on internal factors in the framework of strength (strength) and weakness (weakness) of at least 5-10 factors for each framework. Analysis of strength is carried out by answering questions about the advantages possessed by PLN. what factors make this rooftop solar PV project feasible to be developed. How is the readiness of human resources in implementing this project, the availability of funds for research development, and what benefits can be felt by PLN when running this project? Meanwhile, an analysis of weakness (weakness) is done by answering the questions about what can be improved by PLN. What should be avoided by PLN.? What factors cause PLN to lose sales, availability of raw materials, and what impacts can be seen or felt as weaknesses in implementing solar PV rooftops.

2. Formulate EFAS (External Strategic Factor Summary), which is determined based on external factors in the opportunity (opportunity) and threat (threat) framework of at least 5-10 factors for each framework. The opportunity analysis is carried out by answering the opportunity questions that PLN can see and what trends align with implementing the rooftop solar PV project. While Threat analysis is carried out by answering the constraints currently being faced, what are the conditions of project implementation, destinations' location, and the risks that PLN might face? Customer relationships and cooperative relationships with third parties (startup companies in the renewable energy sector), what social conditions hinder the project's sustainability? Are there any changes in government regulations that do not support the success of this project?

3. Creating IFAS and EFAS tables containing the formulation of internal and external factors. The table has a column of weight, rating, and weight. Weights are the percentage of management's value to the importance of these factors being considered, with the total weight being 1 or 100% for each table. Rating is the value of each factor in IFAS and EFAS, formulated on a scale of 1-5. Each element will be assessed on its influence on the company. The higher the impact, the higher the ranking, and vice versa. Weighted is the weighted value multiplied by the rating. Furthermore, the weight is calculated to determine the position of PLN in the strategy selection matrix shown by the Cartesian diagram.

4. Determine the position of PLN in the strategy selection matrix based on the Cartesian diagram by determining the X-axis's value and the Y-axis value. The X-axis value is obtained from the weighted number of Opportunities (opportunity) - the weighted number of Threats (threats). The Y-axis value is obtained from the number of weighted Strength- the number of weighted Weaknesses. The strategy selection matrix is shown in the following figure:

Based on the picture above, it can be explained that there are four possible positions for PLN, namely:

1. Quadrant 1

Quadrant 1 is advantageous for the organization because it has strengths and opportunities. In this position, PLN can use its power to make the most of the options. The strategy applied in this condition is aggressive because PLN has an excellent opportunity to become a market leader. PLN can also diversify conglomerates, developing products/services unrelated to old products/services.

2. Quadrant 2

Quadrant 2 is a position where PLN has power and threats. In this position, PLN needs to implement a conservative strategy to use all of its strengths with caution because the threats are significant. PLN can also liquidate all or some of its deemed less profitable assets in this condition.

3. Quadrant 3

Quadrant 3 is a position where PLN has a great opportunity, but this is not balanced with internal strength. PLN should implement a competitive strategy to innovate products/services in this position. Through concentric diversification, the development of products/services that are still related to old products/services adapted to technological developments.

4. Quadrant 4

Quadrant 4 is a very unfavorable position for PLN because it must face various internal threats and weaknesses. The company should implement a defensive or defensive strategy while remaining focused on product concentration, market development, and innovation in this position.

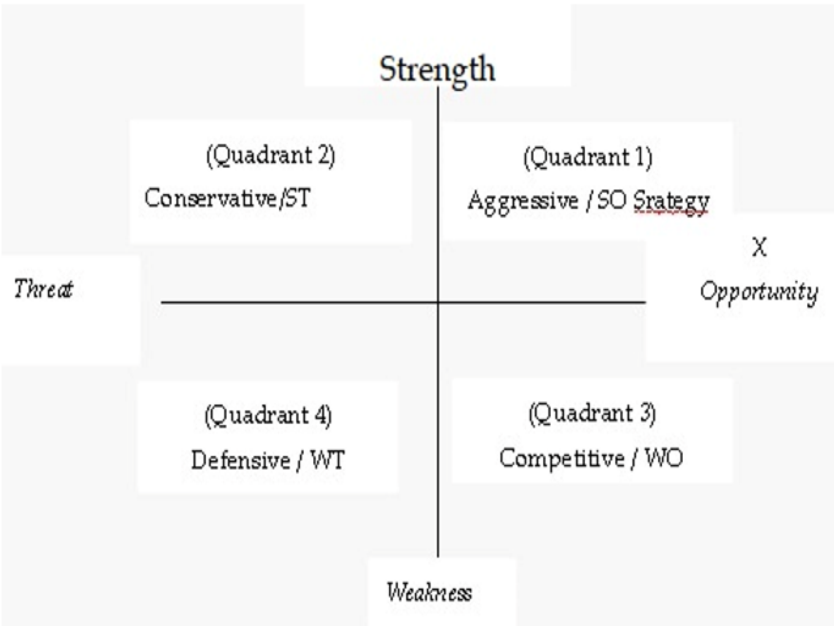


Figure 2: Strategy Selection Matrix

Result and Discussion

This stage begins with conducting FGD (Focus Group Discussion) and distributing questionnaires to analyze each factor in the SWOT analysis indicators, IFAS and EFAS, as mentioned in step 3. First, FGDs are conducted by various groups such as academics, practitioners, companies, rooftop solar PV users, and the general public. Second, the questionnaire was distributed to several sectors, such as (1) households that have utilized solar PV rooftops (RT Existing), (2) households that have the potential to use solar PV rooftops (RT Potential), (3) industries that have been used solar PV rooftop (Industry Existing), and (4) initiatives that have the potential to utilize solar PV rooftop (Industry Potential). Furthermore, participants from the FGD and respondents were then asked to give a rating and weight to each factor in the SWOT analysis indicators, IFAS and EFAS.

Based on the EFAS table, the weighted value for the opportunity is 1.58384, and the weighted number for threats is 1.48571. These two values are then used to calculate the X value on the Cartesian diagram (as in step 4). The value of X is obtained from the difference between the number of weighted opportunities (opportunities) and the weighted number of threats (threats). The result of the value of X is 0.09814.

Next, determine the position of PLN on the Cartesian diagram. Based on the previous step, it was found that the X value was 0.09814, and the Y value was 0.056499. From these results, the position of PLN is in quadrant 1. Quadrant 1 is a very profitable position for PLN. The position of PLN in the Cartesian diagram can be shown in the following figure:

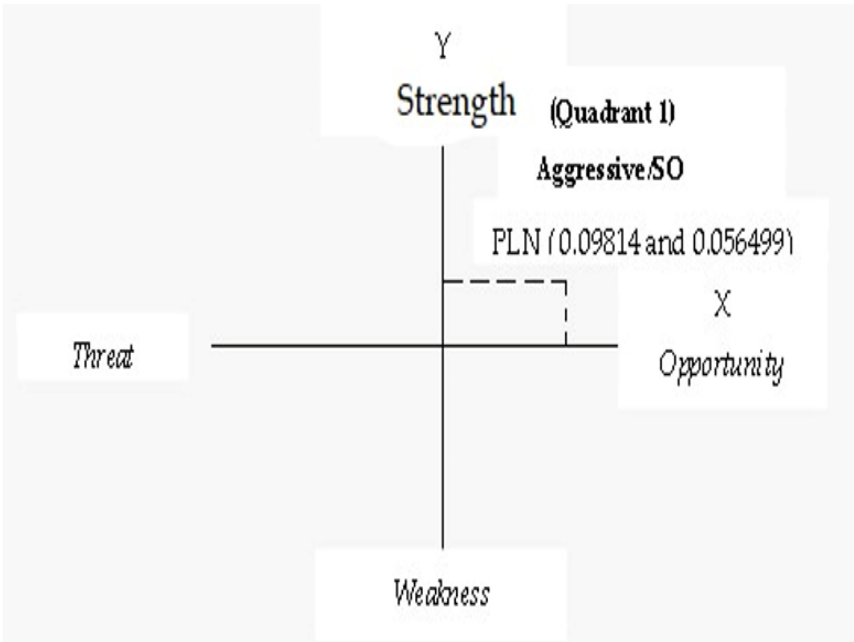


Figure 3: Strategy Selection Matrix

Based on the picture above, in quadrant 1, PLN is in a powerful position. Apart from having excellent strength, PLN has ample opportunities to expand the rooftop solar PV project. The strategy applied in this condition is aggressive because PLN has an excellent opportunity to become a market leader. PLN can carry out an aggressive strategy by carrying out vertical integration and diversifying conglomerates. The following is the explanation:

1. Vertical integration

Vertical integration is an effort to expand a business by mastering all supply chain stages. In practice, vertical integration is divided into upstream vertical integration, downstream vertical integration, and upstream-downstream vertical integration. A company is implementing upstream integration if the company controls the supply of raw materials to support the production process. A company is said to implement downstream integration if the company handles the various distribution and sales networks. Furthermore, the company can enforce upstream-downstream integration if the company can control all the supply chain stages, both the production and distribution, and sales stages.

Based on the SWOT analysis, PLN has qualified experts (HR) in terms of strength. Experts have produced PLTS components in the solar module producing assembly stage (3rd stage of the three existing stages). In addition, PLN, as a state-owned company, has sufficient funding for research and development purposes for rooftop solar PV. So, it is possible that in the future, with the very rapid development of technology, experts (HR) will be able to produce their solar PV rooftops so that PLN can control the supply chain at the solar PV rooftop production stage (upstream). In addition, PLN, as a company that owns (monopolizes) the electricity market in Indonesia, has a broader share of the solar PV rooftop market so that PLN can control various distribution networks and sales of solar PV rooftops. Thus, PLN can carry out an upstream-downstream vertical integration strategy.

2. Conglomerate diversification

Conglomerate diversification is the development of a business by entering an industry different from the initial sector the company was founded. Conglomerate diversification is a strategy to add new products marketed in new markets unrelated to existing products. In this case, the availability of raw materials such as coal, which PLN has used to produce electricity conventionally, is increasingly scarce. On the other hand, Indonesia has very supportive climatic conditions for developing solar panels. PLN can develop solar panels as an alternative to replace non-renewable energy sources. Thus, PLN can diversify the conglomerate to maintain the company's survival. This product diversification can also be used as an alternative for a product substitution. Besides, the diversification strategy can provide other benefits for PLN, including increasing profitability and competitiveness, investing in various types of products can make the company monopolize the market, and can minimize risk or in other words, if one business unit suffers a loss, then there are still other business units that still survive.

Based on the survey results, it was found that there are already many private PV rooftop service providers or players. The PV rooftop service providers in Indonesia that have been chosen by respondents to install PV Rooftops according to regions include (1) Bali including CV Citra Surya Dewata, Inecosolar, Koperasi Amoghasiddhi, PT Daya Matahari Indonesia, PT Nusa Solar, PT Solar Power Indonesia, PT Solar System, PT Wido Solar, Solar Panel Bali, and Surya Panel Bali; (2) Bogor namely PT Altamaya Teknik Mandiri; (3) Jakarta includes EASR, EIN, ELN, ESDM, PT Contained Energy Indonesia, and PT Sinar Metrindo Perkasa; (4) Probolinggo includes Paiton Energy and IBEKA and PT Integral Sinergi; (5) Semarang, namely PT Sarana Bangunindo Sejahtera; (6) Surabaya includes CV Cahaya Indo Falih and PT Bina Lintas Usaha Ekonomi; (7) Tangerang includes CV Mitra Energi Mandiri, PT Berlin Energi, and PT Enerba Teknologi.

The number of service providers is necessary to know the reasons why respondents use PV Rooftop. Based on the analysis results, four factors are based on the order of the variance value. The reasons for using PV Rooftop include cultural factors, environmental awareness, technological knowledge, and loyalty. The first factor describes the cultural and environmental factors that encourage someone to use PV Rooftop. This follows PV Rooftop's existence, which is easy to find in residential or industrial locations, and the surrounding environment has used PV Rooftop. The PV Rooftop lifestyle that develops in the surrounding environment influences one's behavior in following Rooftop PV. The second factor illustrates the reasons for better environmental awareness and awareness, such as reducing air pollution, saving fossil energy, the spirit of green energy, and sustainable energy. Some of these things become the background for respondents to use PV rooftops. The third factor, which describes the knowledge of technology trends currently developing, is using PV Rooftop. Lastly is loyalty, which means that respondents generally still choose to use PV Rooftop even though the price is still relatively high.

Looking at the various reasons respondents use PV Rooftop, it should also be noted that there are several weaknesses from the customer's point of view. These disadvantages include the too high price, depending on the weather, and the area required for installation being too large. In this case, an analysis is needed to determine the strategy to increase PV Rooftops in Indonesia using a SWOT analysis.

Based on the SWOT analysis that has been carried out, PLN is in a powerful position and has ample opportunities to expand the Rooftop solar PV project. The strategy that can apply in this condition is an aggressive strategy, in which PLN has an excellent opportunity to become a market leader. PLN can carry out an aggressive strategy by carrying out vertical integration and diversifying conglomerates. Apart from the aggressive strategy, strategic alternatives are prepared in detail by considering the strength and opportunities owned by PLN. In addition, the alternative strategy that PLN will implement must also consider the involvement of several parties (from upstream to downstream). Three alternative strategies can be carried out by PLN, namely the upstream development plan (manufacturing), the downstream development plan (consumers), and the internal development plan (PLN / electricity provider).

The upstream development plan deals with controlling the supply chain in the production stage. The program can be carried out using appropriate and targeted government funding to research and development of solar PV rooftops, involving experts from both internal PLN and from parties such as academics and practitioners to participate in research to get better solar panel modules. They involve startup companies engaged in renewable energy to collaborate with PLN to develop solar panel modules and attract local and foreign investors to invest in rooftop solar PV projects.

Meanwhile, the downstream development plan is related to controlling the distribution and sales chains. Some alternative downstream development plans that PLN can do are encouraging the participation of consumers in the household and business / industrial sectors to take advantage of rooftop solar PV either on-grid or off-grid, providing appropriate and targeted subsidies to underprivileged consumers who are in remote areas, increase the quality and quantity of promotions to increase the brand image of solar PV rooftop to expand market reach, involve the community who are campaigning for the green energy movement to cooperate with PLN in socializing solar PV rooftop and involve the community in developing solar PV rooftop in the local area so that people have a sense of belonging. Thus, the organization will participate in maintaining the durability or durability of the solar PV rooftop.

Third, the internal development plan is related to the internal readiness of PLN in bridging the upstream development plan and the downstream development plan. Several alternatives for internal development, namely recruiting professional workers in the field of solar PV rooftops, increasing understanding and mastery of technology for employees to provide better services, supportive regulations (related to prices, fiscal incentives, business, etc.) to improve involvement of partner companies, investors, and the public in the development of solar PV rooftops, and PLN is performing its functions well as a company monopolizing the market. In this case, PLN regulates electricity policies so that the whole community can enjoy its use.

In addition, based on the results of the FGD, one of the most important strategies to increase the potential use of PV Rooftops in Indonesia is a marketing strategy. Two marketing concepts are often used to get consumers, namely, Strategic Marketing and Tactical Marketing. Strategic marketing consists of (1) Segmentation, which is based more on demographics, psychographics, and geography. If you take a glimpse of last year's PV Rooftop study results, the existing segmentation in the PV Rooftop market is based on demographics and psychography. Based on demographics, the results show trends based on age, income, and the younger generation that can be used as market segmentation. Meanwhile, psychography is said because PV Rooftop users are mostly people who love and are aware of the environment entering their lifestyle. (2) Targeting, namely clusters that fit the group. (3) Positioning, namely how the company makes efforts so that the products offered to get a different place in consumers' hearts or, in other words, have a good impression on consumers. One way can be supported by product differentiation.

Tactical marketing is usually referred to as the marketing mix. The marketing mix for PV Rooftop consists of four points: Product, Price, Place, and Production. First, the product, namely all performance components, creates value for customers, including brands, logos, symbols, guarantees, etc. Second, price, namely how consumers make payments, several strategies to determine costs. Third, place determines products reach consumers on time without waiting long. This place will discuss how PV Rooftop does warehousing, logistics, and transportation. Lastly, promotion is synonymous with marketing communication to customers. Apart from these four points, market size is also an important factor in marketing strategies, attracting investors to invest domestically (Meidayati, 2017).

The existence of legality also supports these various strategies. The legitimacy of using PV Rooftop is based on several regulations the Indonesian government has made. Law Number 30 of 2009 concerning Electricity has covered community participation in energy supply. In addition, there is the Minister of Energy and Mineral Resources Regulation Number 49 of 2018 concerning the Use of Rooftop Solar Power Plants by Consumers of PT Perusahaan Listrik Negara (Persero). With that, it is hoped that the potential use of PV Rooftop in Indonesia will increase with the strategies suggested from the results of the analysis that has been carried out.

Conclusion and Suggestion

Limited non-renewable energy sources are currently encouraging greater use of alternative energy. One energy source that can overcome the problem of energy scarcity in Indonesia is energy from the sun. Indonesia's potential for solar energy is the largest at 207.8 GW, so PV Rooftops in Indonesia need to be increased. This study aims to describe PT PLN in expanding the use of PV Rooftops in Indonesia. This study uses a qualitative approach, which imposes a SWOT analysis and FGD analysis in elaborating the primary data obtained from the survey.

This study indicates that PT PLN occupies quadrant I, which means that the position held by PT PLN has enormous strength. The strategy that PT PLN can carry out is aggressive. Strategies or steps that can be taken are vertical integration and conglomerate diversification. Also, several alternative techniques have been proposed by the researcher, namely the upstream (manufacturing) development plan, the downstream (consumer) development plan, and the internal development plan (PLN / Electricity Provider).

The limitation of this research is analyzing the aspects of users and potential users.

In determining future strategic steps, analysis can be carried out from the service provider's perspective. Another element that service providers can consider is how far the market competition is and how feasible it is to enter the Rooftop PV market.

For its policy implication, PLN needs to make a business model to increase the potential for energy sources from solar to solve the future scarcity problem. With a significant solar energy source, Indonesia should be able to go further to harness solar power. The development of PV Rooftop in Indonesia needs to be considered through the proper steps so that, later on, PV rooftops can help reduce dependence on non-renewable energy

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