E-ISSN 2656-8039
INTERNATIONAL JOURNAL OF ENVIRONMENT, ENGINEERING & EDUCATION
www.ijeedu.com
Vol. 1, No. 1, 2019
Review Article

Utilization of Solar Power Plant in Indonesia: A Review

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Received: *November 9, 2019;* ***Accepted:*** *December 15, 2019;* ***Published:*** *December 20, 2019*

Abstract: Energy currently has a crucial role in human life. So far, the primary buffer of energy needs still relies on petroleum. Meanwhile, petroleum is inevitably increasingly scarce and expensive. With the state of the depletion of fossil energy sources, in today's world, there is a shift from the use of non-renewable energy sources to renewable energy sources. Of the many renewable energy sources, the use of energy through solar cells is the most potent alternative to applied in Indonesia. Solar energy is one of the energies currently actively developed by the Indonesian government because as a tropical country, Indonesia has considerable solar energy potential. Solar energy is extraordinary because it is not a pollutant, cannot use up, can trust and does not buy. There are many ways to harness energy from the sun. The electricity we can use today is electricity produced from the process of burning fossil fuels such as coal, oil or natural gas. The combustion results will produce carbon dioxide gas which can damage or adversely affect the environment. Solar electricity can provide electricity continuously because its energy source is a renewable energy source and is also a clean and environmentally friendly energy, to reduce greenhouse gas emissions. Besides, solar electricity can provide electricity quickly and does not require individual costs for maintenance and can provide electricity needs in rural areas, isolated areas, and islands that not electrified by the government.

Keywords: Electrical Energy, New and Renewable Energy (NRE), Photovoltaic, Solar Energy, Solar Home System.

1. Introduction

Economic growth in the business sector, the need for community electronics and industrial changes are the causes of the increasing need for electrical energy [1]. The increasing demand for electrical energy adds great responsibility to the state electricity company [2]. Energy currently has a critical role in human life. Energy is a supporter of national economic activities and used as a tool to achieve social, economic and environmental goals. So far, the primary buffer of energy needs. Still relying on petroleum.

Meanwhile, petroleum is inevitably increasingly scarce and expensive. Reserves of fossil energy sources around the world since 2002 are 40 years for oil, 60 years for natural gas, and 200 years for coal. With the state of the depletion of fossil energy sources, in today's world, there is a shift from the use of non-renewable energy sources to renewable energy sources [3]. The potential of renewable energy, such as biomass, geothermal, solar energy, water energy, wind energy, ocean energy, hydropower until now has not widely used, even though the potential for renewable energy is tremendous, especially in Indonesia. Of the many renewable energy sources such as above the use of energy through solar cells is the most potent alternative to be applied in the territory of Indonesia.

Energy is an essential requirement for humans, especially electricity, electricity continues to increase along with the increasing number of human populations in Indonesia. So far, energy needs still rely on petroleum as the primary buffer of energy needs [4]. Nevertheless, petroleum is increasingly scarce and expensive so that the search for alternative energy to meet the needs of electrical energy continues to develop. Alternative energy is a solution to increase the role of renewable energy to ensure the security of energy supply to meet the ever-increasing national energy needs [5].

Citation this article: Hardianto, "Utilization of Solar Power Plant in Indonesia: A Review," *Int. J. Environ. Eng. Educ.*, vol. 1, no. 3, pp. 1-8, 2019.
DOI: https://doi.org/10.5281/zenodo.3634186

Several types of renewable energy can be used as electricity generation [6], including:

1. Geothermal energy is energy extracted from heat stored in the earth. Geothermal energy used for Geothermal Power Plants. Geothermal Energy is quite economical and environmentally friendly but is limited only to the border area of the tectonic layer.
2. Biofuels or biofuels are fuels either solids, liquids or gases produced from organic materials. Biofuels can be produced directly from plants or indirectly from industrial, commercial, domestic or agricultural waste. There are three ways to make biofuels: burning dried organic waste (such as household waste, industrial waste and agriculture); fermented wet waste (such as animal waste) without oxygen to produce biogas (containing up to 60% methane) or fermenting sugar cane or corn to produce alcohol and esters, and energy from forests (producing wood from fast-growing plants as fuel).
3. Micro-hydro power plants are increasingly popular as an alternative source of energy, especially in remote areas. Micro-hydro power systems can be installed in small streams and do not require large dams, so the impact on the environment is minimal. Micro-hydro power plants can be used directly as engine drives or used to drive electric generators — the power generated between 5 kW to 100 kW.
4. Wind power is alternative energy used in large scale wind farms for national electricity generation and in small individual turbines to provide electricity in isolated locations. Wind power converts the rotation of a turbine blade into an electric current using an electric generator. In wind turbines wind energy is used to rotate mechanical equipment to do physical work, such as grinding "grains" or pumping water.
5. Solar energy is a potential renewable energy source (renewable energy resources). Solar cells are devices that can convert sunlight into electrical energy that can produce power up to 156,486 MW, a more considerable amount compared to other renewable energy sources

Indonesia is a country located in the equator that gets abundant sunshine throughout the year. So that the use of solar energy as a Solar Power Plant is in high demand and began to develop in all corners of the country by doing a lot of research and testing [7]. One of them is research on hybrid systems between solar cells and Government electricity. Hybrid System is an alternative system that can be applied to high load housing. Hybrid Systems utilize renewable energy as the primary source combined with Government Electricity as a backup (secondary) energy source. In the Hybrid System, renewable energy used can be derived from solar and wind [8]. Combined with Government Electricity so that it becomes a source of voltage that is more efficient, effective and reliable to be able to supply electrical energy needs to the housing.

Increasing energy demand has made the government in cooperation with PLN make a draft of the development of electrical energy that approved through the decision of the minister of energy and mineral resources of the Republic of Indonesia number 1567 k/21/MEM/2018 concerning the ratification of the electricity supply business plan for the State Electricity Company in 2018 to 2027 Based on the security of supply aspect, the risk of electricity consumption growth is smaller than projections, which is quite prominent given that the speed of electricity infrastructure supply faces some of the risks described above, while electricity growth, although projected, is relatively high at 6.90%, but the growth in demand electricity in 2017 is only around 4%). This risk will have an impact on generator oversupply. Nevertheless, on the contrary, there is a risk of growth in electricity demand beyond the projections so that the shortage of power plants can result in blackouts.

The increasing need for household electrical energy requires the latest energy that is more efficient and effective. Sunlight that illuminates regions in Indonesia throughout the year is very suitable for solar power plants utilizing solar cells that can be reached by households. Utilization of solar cells as solar power plants in households can help supply daily electricity needs, and their use can hybridize with electricity [9]. Power plants using solar cells are popularly known as solar home systems (SHS). From the study conducted obtained SHS for households using solar modules 50-100 Wp (watt peak) and generate daily electricity of 150-300 Wh.

Solar home system (SHS) is very appropriate to be used for household electrical energy needs because the installation does not take up too much space and is an affordable price compared to other power plants. Utilizing solar cells, batteries, and battery regulators for solar power plants are possible to install around the house. Based on the regulation of the Minister of Energy and Mineral Resources of the Republic of Indonesia number 28 of 2016 concerning electricity tariffs provided by the State Electricity Company, determining electricity tariffs for household use takes effect from May 1, 2017, with a power limit of 450 VA with a load of Rp. 11,000 and prepaid Rp. 415/kWh, 900 VA, Rp. 20,000 and prepaid Rp. 605/kWh, 1,300 VA with Rp. 20,000 and prepaid Rp. 1,352/kWh. Based on the increasing electrical energy needs, and increasing electricity tariffs, it is necessary to apply a Solar Power Plant using solar cells both as a large generator and household needs or SHS to produce an adequate electricity supply.

2. New and Renewable Energy (NRE)

Indonesia has considerable renewable energy potential (NRE) including 450 MW of mini/micro hydro, 50 GW of Biomass, 4.80 kWh/m2/day of solar energy, 3-6 m/s of wind energy and 3 GW of nuclear energy. At present, the development of EBT refers to Presidential Regulation

No. 5 of 2006 concerning National Energy Policy. In the Presidential Regulation, it is stated that the contribution of EBT in the national primary energy mix in 2025 is 17% with the composition of Biofuel by 5%, Geothermal 5%, Biomasses, Nuclear, Water, Solar, and Wind 5%, and coal liquefied by 2%. For this reason, the steps to be taken by the Government are to increase the installed capacity of the Micro Hydro Power Plant to 2,846 MW in 2025, the installed capacity of 180 MW Biomass in 2020, the installed wind capacity (PLT Bayu) of 0.97 GW in 2025, solar 0.87 GW in 2024 and nuclear 4.2 GW in 2024. The total investment absorbed by the development of NRE until 2025 projected at 13.197 million USD.

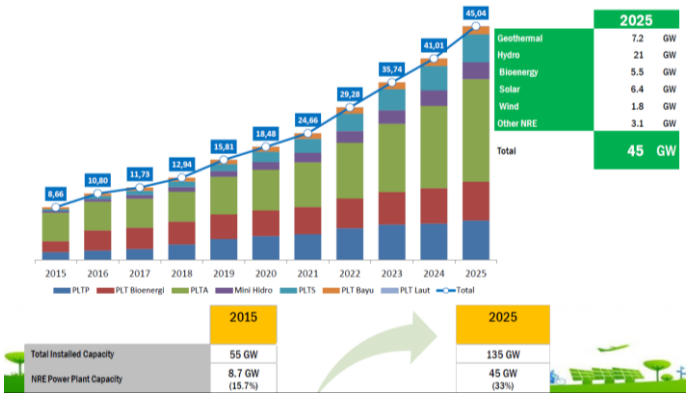

Figure 1. Target New and Renewable Energy (NRE) by 2025.

Efforts made to develop biomass is to encourage the utilization of agricultural and forestry industry waste as an energy source in an integrated manner with the industry, integrating biomass development with community economic activities, encouraging the manufacturing of biomass energy conversion technologies and supporting businesses, and increasing research and development in the use of waste including municipal waste for energy [10]. Efforts to develop wind energy include developing wind energy for electricity and non-electricity (pumping water for irrigation and clean water), developing simple wind energy technology for small scale (10 kW) and medium scale (50-100 kW) and encouraging manufacturers to produce the technology is small and medium scale.

The development of solar energy includes the use of solar power plants in rural and urban areas, encouraging the commercialization of solar power plants by maximizing private involvement, developing the domestic solar power industry, and encouraging the creation of efficient funding systems and patterns by involving the banking world [11]. To develop nuclear energy, the steps taken by the government are to conduct socialization to get public support and cooperate with various countries to increase proficiency in technology [12]. While the steps taken for micro-hydro drilling are integrating development programs for Micro Hydro Power Plants with community economic activities, maximizing the potential of irrigation channels for Micro Hydro Power Plants, encouraging domestic micro-hydro industry, and developing various effective partnership and funding patterns.

To support the NRE efforts and programs, the government has issued a series of policies and regulations that include Presidential Regulation No. 5/2006 concerning National Energy Policy, Law No. 30/2007 concerning Energy, Law No. 15/1985 concerning Electricity, Government Regulation No. 10/1989 as amended by Government Regulation No. 03/2005 Regarding Amendment to Government Regulation No. 10 of 1989 concerning Provision and Utilization of Electric Power and Government Regulation No. 26/2006 concerning Supply & Utilization of Electric Power, Minister of Energy and Mineral Resources Regulation No. 002/2006 concerning the Exploitation of Medium Scale Renewable Energy Electric Power Generators, and Minister of Energy and Mineral Resources Decree No.1122K/30/MEM/2002 concerning Small Scale Power Plants. At present, a New Renewable Energy drafted which contains arrangements for the supply and utilization of new and renewable energy and the provision of facilities and incentives.

3. Potential of Solar Cell Energy

3.1. Potential of Solar Energy

Solar energy is one of the energies currently actively developed by the Indonesian government because as a tropical country, Indonesia has considerable solar energy potential [13]. Based on solar radiation data collected from 18 locations in Indonesia, solar radiation in Indonesia can classify successively as follows: for the western and eastern regions of Indonesia with the distribution of radiation in the Western Region of Indonesia around 4.5 kWh/m2/day with monthly variations around 10%; and in Eastern Indonesia around 5.1 kWh/m2 day with a monthly variation of around 9%.

Thus, Indonesia's average solar irradiance potential is around 4.8 kWh/m2/day with a monthly variation of around 9%. The sun is the primary energy source that emits enormous energy to the earth's surface. In good weather, the surface of the earth receives about 1000 watts of solar energy per square meter. Less than 30% of the energy reflected into space, 47% converted to heat, 23% used for all work circulations above the earth's surface, a small portion of 0.25% accommodated by wind, waves and currents and there is still a tiny portion 0.025% stored through photosynthesis in plants which ultimately used in the formation of coal and petroleum (fossil fuels, photosynthesis processes that take millions of years) which are currently used extensively and exploratively not only for fuel but also for fuel plastic making materials, Formica, other synthetic materials. So, it can say that the source of all energy is solar energy. Solar energy is extraordinary because it is not a pollutant, cannot use up, can trust and does not buy [14].

The shortcomings of this solar energy are very subtle and not constant. Low solar energy currents result in the use of large surface area systems and collectors to collect and concentrate that energy. This collector system is quite expensive, and there is another problem that systems on earth cannot be expected to receive a continuous supply of solar energy. This means that energy storage or conversion system is needed to store energy at night and in cloudy weather.

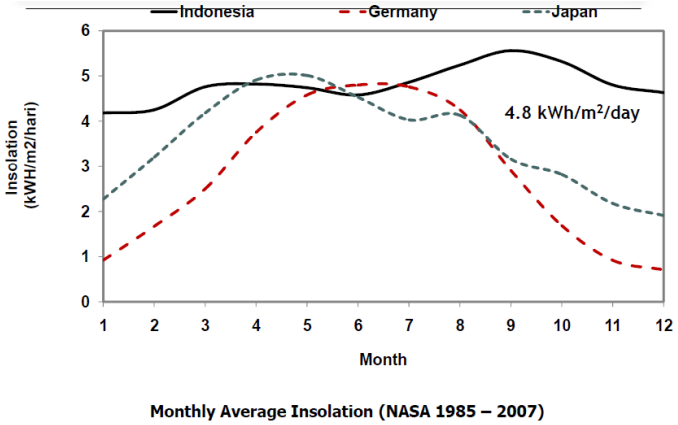

Figure 2. Graph of Irradiation Distribution in Indonesia

Solar or solar energy has utilized in many parts of the world, and if properly exploited, this energy has the potential to be able to provide the world's energy consumption needs for a longer time. The sun can use directly to produce electricity or to heat even to cool. The potential future of solar energy only limited by our desire to seize opportunities [15].

3.2. Photovoltaic Solar Energy Technology

One way to supply alternative electricity that is ready to applied a mass at this time is to use a technology system that introduced as a Solar Energy Photovoltaic System or commonly known as a Solar Photovoltaic Power Plant. The term Solar Energy Photovoltaic System is a term that has standardized by the government which used to identify an energy generating system that utilizes solar energy and uses photovoltaic technology [16]. Compared to conventional electricity in general, photovoltaic solar energy systems seem complicated, expensive and difficult to operate [17]. However, from more than 15 years of operational experience in several regions in Indonesia, the Photovoltaic Solar Energy System is a system that is easy to operate, reliable, and requires low maintenance and operating costs to make the Photovoltaic Solar Energy System able to compete with conventional technology in most conditions Indonesian territory consisting of small islands that are not reached by the Government Electricity Grid and classified as remote areas.

Besides, the Solar Energy System Photovoltaic is a technology that is clean and does not pollute the environment. Some conditions that are suitable for the use of Solar Energy Systems include remote village settlements, transmigration sites, plantations, and fishers, both for home lighting and public facilities. However, following the changing times, at this time in developing countries, the application of Solar Energy Photovoltaic Systems has widely used to supply the electricity in buildings and housing in big cities. In general, photovoltaic modules marketed with a capacity of 50-Watt Peak (Wp) or multiples. Watt-peak units are power units (Watts) that can be generated by photovoltaic modules under standard test conditions (Standard Test Conditions - STC) [18]. The efficiency of electricity generation generated by photovoltaic modules on a commercial scale is currently around 14-15%.

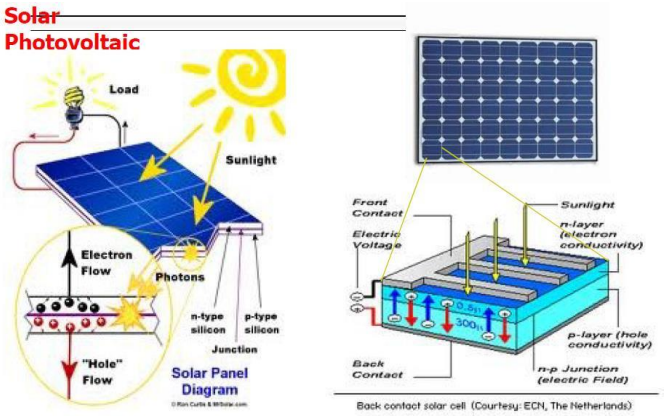

Figure 3. Schematic of Photovoltaic Solar Systems

The main component of a Solar Energy System is a photovoltaic cell that converts solar radiation to electricity directly (direct conversion) [19]. The photovoltaic cell technology that has developed today is generally a type of crystalline technology made with silicon-based raw materials. The final product of the photovoltaic module resembles a sheet of glass with a thickness of about 6-8 millimeters. Then there is the Balance of System (BOS) which includes a controller, inverter, module frame, electrical equipment, such as wires, sockets, and others. There are also energy storage units (batteries) and other supporting equipment such as inverters, centralized systems, hybrid systems, and others [20].

Solar power plants are electricity plants that convert solar energy into electricity. Electricity development can do in two ways, namely directly using photovoltaic and indirectly by concentrating solar energy. Photovoltaic directly converts light energy into electricity using photoelectric effects. The concentration of solar energy using a lens or mirror system combined with a tracking system to focus solar energy to a point to drive the heat engine. Solar or solar energy has utilized in many parts of the world, and if properly exploited, this energy has the potential to be able to supply the world's energy consumption needs for a longer time. The sun can use directly to produce electricity or to heat even to cool. The future potential of solar energy only limited by the desire to seize the opportunity. There are many ways to harness

energy from the sun. Plants convert sunlight into chemical energy by using photosynthesis. Utilize this energy by eating and burning wood. However, the term "solar power" means changing direct sunlight into heat or electrical energy for use. the two basic types of solar energy are "sunlight" and "photovoltaic" (photo = light, voltaic = voltage) [21]. Photovoltaic solar energy involves generating electricity from light. The secret of this process is the use of semiconductor material that can be adjusted to release electrons, negatively charged particles that form the basis of electricity.

The most common semiconductor material used in photovoltaic cells is silicon, an element commonly found in sand. All photovoltaic cells have at least two such semiconductor layers, one positively charged and one negatively charged [22], [23]. When light shines on the semiconductor, electrical fields across the junction between the two layers cause electricity to flow, generating DC. The stronger the light received, the stronger the electricity that obtained. Photovoltaic systems do not need bright sunlight to operate [24]. This system also generates electricity on cloudy days, with outgoing energy comparable to the density of clouds. Based on the reflection of the sun's rays from the clouds, cloudy days can produce higher energy figures than when the blue sky is bright [25].

At present, it is common for small devices, such as calculators, to use microscopic solar cells. Photovoltaics also used to provide electricity in areas where there is no electricity generation network [26]. Researchers have developed a refrigerator, called Solar Chill that can function with solar energy. After tested, these refrigerators will be used by humanitarian organizations to help provide vaccines in areas without electricity, and by anyone who does not want to depend on electricity to cook their food. The use of photovoltaic cells as the main design by architects is increasing [27]. For example, roof tiles or solar slits can replace conventional roofing materials. Flexible film modules can even be integrated into a vaulted roof, while semi-transparent modules provide an exciting mix of shadows with sunlight. Photovoltaic cells can also be used to provide maximum power to the building on hot summer days when the air conditioning system requires a lot of energy, which helps reduce the maximum electrical load [28]. Both large-scale and small-scale photovoltaics can deliver power to the electricity grid or can store in cells.

Ivanpah Solar Plant, located in the Mojave Desert, will be the largest solar power convergence type solar power plant with a power of 377 Megawatts although development supported by US funding for Barack Obama's vision of the 10000 MW renewable energy program, this development is controversial because it threatens the existence of wild animals in the desert [29].

4. Application of Solar Cells

4.1. Solar Power Plants

Solar Power Generation is electricity-generating equipment that converts solar energy into electricity. Solar Power Plants are often also called Solar Cells, or Solar Photovoltaics, or Solar Energy. Solar Power Plants utilize sunlight to produce electricity. DC (direct current), which can be converted into AC electricity (alternating current) if needed. Therefore, even though it is cloudy, if there is still light, the Solar Power Plant can produce electricity. Solar Power Generation is a powerful union (a device that provides power) and can design to supply small to significant electricity needs, both independently, and with Hybrid (combined with other energy sources) [30].

The concept of solar power plants is a simple concept, which converts sunlight into electrical energy. Sunlight is one form of energy from natural resources [31]. The sun's natural resources have widely used to supply the electricity in communications satellites via solar cells. These solar cells can produce unlimited amounts of electrical energy directly taken from the sun, without any rotating parts and do not require fuel [32]. So that solar cell systems often said to be clean and environmentally friendly. Compare with an electric generator, some parts spin and need fuel to be able to produce electricity [33]. The sound is noisy, other than that the gas produced can cause the greenhouse gas (greenhouse gas) effect, which can damage the ecosystem of our planet Earth [34].

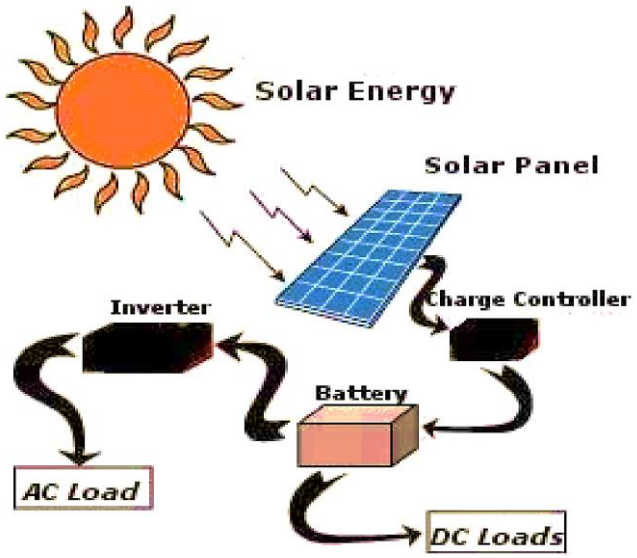

Figure 4. Installation System Using Solar Cells

The solar cell system that can be used on the surface of the earth consists of solar cell panels, a charge controller circuit, and a 12-volt battery with maintenance fees. Solar cell panels are modules that consist of several solar cells connected in series and parallel depending on the size of the required capacity. The battery charging controller circuit in the solar cell system is an electronic circuit that

regulates the battery charging process. This controller can adjust the battery voltage in the 12-volt power supply interval. If the voltage drops to 10.8-volt means the remaining voltage at the 2.2-volt battery, the controller will charge the battery with solar panels as its power source. Of course, the charging process will occur if it takes place when there is sunlight. If the voltage drop occurs at night, the controller will cut off the electricity supply. After the charging process lasts for several hours, the battery voltage will rise if the battery voltage reaches 12 volts, then the controller will stop the battery charging process. The battery charging control circuit is easy to assemble on its own. This controller circuit is available in the market.

The use of solar cells in Indonesia as solar power plants have used in various fields, such as industry, lighting, and households. Indonesia with the sun's potential to illuminate most of the year and several regions crossed by the equator, so that the use of environmentally-friendly electricity by utilizing the sun has great potential because Indonesia which is a tropical region has an enormous solar energy potential with average daily insulation of 4.5 -4.8 KWh /m2/day.

The use of solar cells in Indonesia according to the Indonesian Solar Energy Association quoted from the online news republika.co.id states "until the beginning of 2019 the use of Solar power reached 660 users, in December 2017 there were 400 users, in the middle of 2018 there were 600". Awareness of the use of solar cells as Solar power is increasing based on data from the Indonesian Solar Energy Association, an increase from 2017 to early 2019 reaching +/- 260 users.

Data from the Ministry of Energy and Mineral Resources states that in the Government Electricity Supply Business Plan, the target of using solar energy in Indonesia reaches 1047 Megawatt peaks (MWp) until 2025. Until 2018, the utilization of solar energy through Solar Power Plants is 94.42 MWp. The use of the capacity of Solar Power Plants reaches 94.42 MWp in 2018 and the government's target of up to 1047 MWp in 2025, is an excellent thing because of the government's efforts and targets in the use of more environmentally friendly energy such as Solar Power Plants.

4.2. Electricity Consumption

Government electricity consumption requires a monthly fee that has been determined by the government following the use and installation of electrical power in households. Table 1 shows the costs that must be incurred for household electricity consumption per month according to the power used, and this takes place during the use of electricity from the government, and the costs incurred at any time change according to the rules for applying government electricity tariffs and the use of household electricity. Fulfilment of household electricity can be achieved using alternatives such as solar cells or smaller home systems that can be placed around the house but can meet daily electricity needs.

Table 1. Electricity Tariff for Household Purposes

Tariff Group	Power Limit	Charges (Rp. /kVA /Month)	Usage Fee (Rp. /kVA)	Prepaid (Rp. /kWh)
S-1/TR	220 VA	-	Subscriptions per month (Rp):14.800	-
S-2/TR	450 VA	10.000	Block I: 0 - 30 kWh: 123	325
			Block II: >30 - 60 kWh: 265	325
			Block III: >60 kWh: 360	325
S-2/TR	900 VA	15.000	Block I: 0 - 20 kWh: 200	455
			Block II: >20 - 60 kWh: 295	455
			Block III: >60 kWh: 360	455
S-2/TR	1.300 VA	*)	708	708
S-2/TR	2.200 VA	*)	760	760
S-2/TR	3.500 VA - 200 kVA	*)	900	900
S-2/TR	>200 kVA	**)	-	-

Source: Regulation of the Minister of Energy and Mineral Resources of the Republic of Indonesia No 28 of 2016

The burden of Government Electricity Supply to meet the needs of customers is increasingly increasing, the needs of industry, households and the public are very dependent on the ability of Government to supply electricity. PLN, which is the leading supplier in Indonesia, sometimes overwhelmed to meet customer needs, so it needs alternative electricity generation to meet electricity needs, especially households. The use of Government electricity which must pay electricity tariffs per month by using solar cell Solar power, electrical energy can be used without having to make payments every month, only once spending an affordable cost. Solar power that is environmentally friendly and can reach is a very potential alternative in Indonesia, especially for meeting household electricity.

Solar power generation using solar cells is one of the solutions to meet national electricity needs because Indonesia is a country that is almost sunny for most of the year [25]. Solar power plants that are possible to used in tropical regions such as Indonesia make solar power plants

need to be developed and used throughout Indonesia to meet the electricity needs of each region [35]. The spread of the use of solar power plants throughout Indonesia is increasing which initially 400 users reached 600 by the end of 2018 based on data from the Indonesian Solar Energy Association, the Ministry of Energy and Mineral Resources itself has a bigger target, reaching 1047 MWp in 2025 although at the end of the year in 2018 it will still reach 94.42 MWp. The use of solar power plants in regions throughout Indonesia is increasing as in the NTT (Nusa Tenggara Timur) region, which reached an increase of 62% from the previous year. Data from various sources such as the Indonesian Solar Energy Association, the Ministry of Energy and Mineral Resources and the UIW of NTT showed an increase in the use of solar power plants in all regions of Indonesia. Photovoltaic cells or solar electricity assemblers much glimpsed by the community considering this technology can be used in various locations that have a lot of sunlight potential. Most use of solar cells placed on the roof of a house or places that exposed to direct sunlight [36].

The development of solar energy in Indonesia is relatively slower, compared to other Asian countries. This is a challenge for the government to develop solar energy in Indonesia [37]. Noted, until the end of 2018, the total installed capacity of solar power plants has only reached 95 Mega Watt (MW), whereas in the 2019-2028 Government Electricity Supply Business Plan only targets the construction of a 2-GigaWatt Solar Power Plant (GW) until 2028. The slow development of Solar electricity power in Indonesia is not in line with global trends, where solar electricity has become the highest renewable energy growth rate in recent years.

The capacity of solar power plants in Indonesia has reached 60 Mega Watt peak (MWp) is targeted to increase to 85 MW, while Singapore has reached 150 MWp will increase to 250 MWp. Compared to Vietnam, which is just developing solar, Indonesia is far behind. Indonesia has considerable electricity potential from solar energy, can meet future electricity needs in the form of above-ground solar power plants and rooftop solar power plants. There is a vast market potential for solar electricity users in households, commercial buildings, government buildings and industries.

5. Conclusions

The use of solar cells throughout Indonesia is increasing every year, as the government target by the Ministry of Energy and Mineral Resources in 2025 reaches 1047 MW throughout Indonesia. The use of solar power plants utilizes solar cells at an affordable cost and does not use too many places, has the potential to become an alternative power plant for households, compared to government electricity that must be paid monthly, government electricity using solar cells only incurs an initial fee and no longer incur costs tariffs such as electricity usage from the Government.

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