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IMPLEMENTATION OF THE SCHOOL SOLAR PANEL SYSTEM TO SUPPORT THE AVAILABILITY OF ELECTRICITY SUPPLY AT SDN 4 MESUJI TIMUR

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Abstract
Equitable development is always encouraged by both the central and regional governments. However, in practice it is not easy and goes through a fairly long process. Likewise, the efforts of the government, especially the province of Lampung, are trying to carry out development through equal distribution of electrical energy to areas where the National Cross Border Center (PLBN) is located, such as Mesuji Regency, although it is still unstable and uneven throughout the village. The condition of the lack of electricity supply causes blackouts to occur frequently and in a relatively long period of time. This greatly affects community activities and is no exception in terms of education or at school, especially in the use of technology-based learning media and school administrative matters, such as filling out report cards and so on. Nowadays, filling out report cards must be done through technology-based applications that require electronic equipment such as laptops to use them. The design of the School Solar Panel System (SSPS) is intended in an effort to increase the availability of electricity in supporting teacher professionalism in carrying out learning activities. So that with the design of the School Solar Panel System which will be implemented later, the electricity supply remains available even though there is a power outage.

1.0 INTRODUCTION

Equitable development in Indonesia is currently being promoted by the government, although it has been the focus of the government for the last few decades. This is further strengthened by the relocation of the Indonesian capital to the island of Kalimantan, where physical development will begin in 2024 [1]. In essence, the distribution of population and development has been carried out by the government even since the Dutch East Indies Government was called the colonization, but it was better known as migration by the Indonesian people. Migration itself is the process of moving people from densely populated areas, especially Java, to islands that are the focus of development and in the Japanese military government it was called kokuminggakari, namely the movement of Javanese people to the Lampung area [2]. Lampung is a focus area for migration due to its location which is easily accessible and directly opposite to the island of West Java and Lampung's position as the gateway to the island of Sumatra [3].

However, with an area of 35,376 km2 it is not easy to carry out equitable migration and development in Lampung. Figure 1 shows the road conditions in Mesuji Regency which are still dirt and dusty and very slippery when it rains. The photo was taken directly by the UTI lecturer team during the 2019 service. Apart from the condition of the road, electricity is still far from good because Mesuji Regency has only recently been touched by electricity. Furthermore, this is because in 2017 there were still 40 villages in Mesuji Regency that were still waiting to be electrified due to the incomplete construction of substations (GIs) so that the electricity flow was not stable and still often died in a relatively long period of time, ranging from 4- 5 hours [4]. However, Frequent blackouts become an obstacle to the use of technology-based teaching media in the classroom even though the school has received assistance in the form of 27 units of laptops. The assistance is also in the context of the government which seeks to enable teachers to teach using technology and facilitate other activities. However, with the blackout, other activities related to electricity were disrupted because besides laptops, there were several school facilities that needed electricity. SDN 4 Mesuji Timur has used various facilities that require electricity, including the use of computers which are used as data centers when learning activities are taking place.

The presence of solar radiation produces available solar energy on a very large scale. A study conducted in 2008 showed that the total solar energy that can be utilized on earth is around 1.8 × 1011 Mega Watt (MW) [4]. Therefore, the availability of large amounts of solar energy can be used to generate and supply electricity for years to come. The widespread improvement of photovoltaic technology to harness solar energy has shown a great impact on generating electricity using photovoltaic technology [5]. Photovoltaic power generation was introduced on a large scale in recent years as one of the most potential alternatives to harness energy. The reason for the increasing positive increase to generate power using photovoltaic technology is due to the direct conversion of sunlight to electricity. Application of photovoltaic technology in Energy conversion is one of the most attractive methods of generating energy sources with proven reliability from microwatts to megawatts [6]. Due to their proven reliability output, photovoltaic systems are implemented in a wide range of applications in various areas requiring small to high voltage supplies.

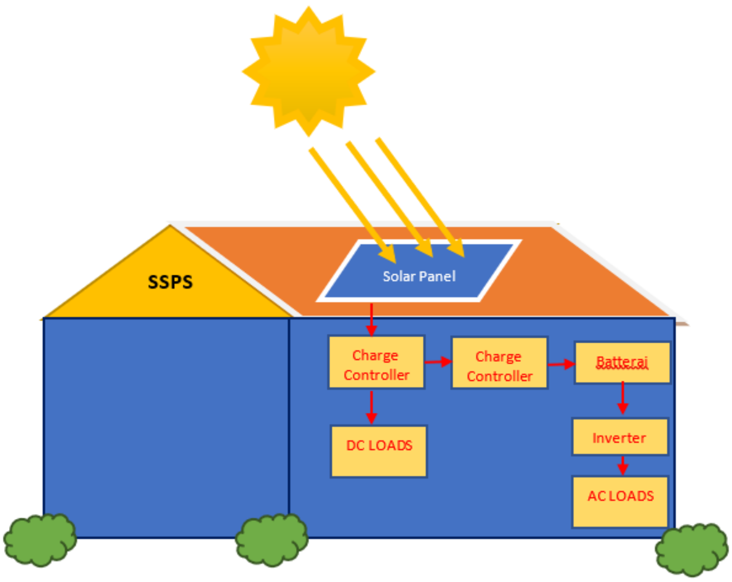

Figure 1 School Solar Panel System (SSPS)

Therefore, a power cut for a relatively long time can hamper activities in schools, especially in the use of learning media which will also be used as teacher scientific papers. Furthermore, the power outage with a relatively long time has also become an obstacle for teachers in filling out the report cards of students who are currently using technology-based applications both in inputting, calculating grades, description of assessments and others. Based on the data and problems above, in general, there are several main problems that occurred in SDN 4 Mesuji Timur, namely a relatively long blackout and disrupting the process of school activities both in terms of teaching and learning and also administrative processes, especially filling out report cards for school students. Thus, the lecturer team from UTI which consists of one lecturer in the Electrical Engineering Study Program and two English Language Education lecturers intend to follow up on the previous service program by trying to solve other problems that arise in the same service scheme, namely the Community Partnership Program (PKM). This is because the problems that arise are still closely related, namely the application of technology to improve teacher professionalism but are constrained by a relatively long blackout. So that the School Solar Panel System (SSPS) can be a solution and as a form of support for equitable development to the government by a team of lecturers by continuing to contribute and serve. This is because the problems that arise are still closely related, namely the application of technology to improve teacher professionalism but are constrained by a relatively long blackout. So that the School Solar Panel System (SSPS) can be a solution and as a form of support for equitable development to the government by a team of lecturers by continuing to contribute and serve. This is because the problems that arise are still closely related, namely the application of technology to improve teacher professionalism but are constrained by a relatively long blackout. So that the School Solar Panel System (SSPS) can be a solution and as a form of support for equitable development to the government by a team of lecturers by continuing to contribute and serve.

2.0 THEORETICAL

2.1. Solar Cell

Solar cell is a device used to absorb and convert sunlight into electrical energy. Sunlight contains energy in the form of photons, where when the photons hit the surface of the solar cell, the electrons will be excited and cause an electric current. This event is referred to as a photovoltaic event or photo electric [7] [8]. Solar cells can be excited because they are made of semiconductor material containing the element silicon. This silicone consists of two types of sensitive layers, namely positive coating (P-type) and negative coating (N-type).

2.2. Charge Controller

Charge Controller is an electronic device that is used to regulate direct current which is charged to the battery and which is taken from the battery to the load [9]. The solar charge controller regulates overcharging (overcharging - because the battery is 'full') and the overvoltage of the solar panels. Overvoltage and charging will reduce battery life. The charge controller applies Pulse width modulation (PWM) technology to regulate the function of charging the battery and releasing current from the battery to the load. 12 Volt solar panels generally have an output voltage of 16 - 21 Volt. So, without a solar charge controller, the battery will be quickly damaged by over charging and voltage instability. Batteries are generally charged at a voltage of 14 - 14.7 volts. Some of the detailed functions of the solar charge controller are adjusting the current for charging to the battery, avoid over charging, and over voltage. The solar charge controller also regulates the current released / taken from the battery so that the battery is not 'full discharge' and overloaded. To buy a solar charge controller that must be considered are: 12 Volt DC / 24 Volt DC voltage, the ability (in the same direction) of the controller, for example 5 Ampere, 6 Ampere, 10 Ampere, and Full charge and lowvoltage cut. In general, there are 6 terminals on an SCC, namely 2 terminals for current from the solar panel, 2 terminals for connecting to the battery, and 2 more terminals for lamp use. For higher efficiency, use DC lamps such as LED lamps. 2016). To buy a solar charge controller, you must pay attention to: 12 Volt DC / 24 Volt DC Voltage, the ability (in the same direction) of the controller, for example 5 Ampere, 6 Ampere, 10 Ampere, and Full charge and lowvoltage cut. In general, there are 6 terminals on an SCC, namely 2 terminals for current from the solar panel, 2 terminals for connecting to the battery, and 2 more terminals for lamp use. For higher efficiency, use DC lamps such as LED lamps. To buy a solar charge controller, you must pay attention to: 12 Volt DC / 24 Volt DC Voltage, the ability (in the same direction) of the controller, for example 5 Ampere, 6 Ampere, 10 Ampere, and Full charge and lowvoltage cut. In general, there are 6 terminals on an SCC, namely 2 terminals for current from the solar panel, 2 terminals for connecting to the battery, and 2 more terminals for lamp use. For higher efficiency, use DC lamps such as LED lamps. and 2 more terminals for lamp use. For higher efficiency, use DC lamps such as LED lamps. and 2 more terminals for lamp use. For higher efficiency, use DC lamps such as LED lamps.

2.3. Battery

Batteries are devices that store electrical power generated by solar panels which are not immediately used by the load. The stored power can be used during periods of low solar radiation or at night. The battery component is sometimes called an accumulator (accumulator). Batteries fulfill two important purposes in photovoltaic systems, namely to provide electrical power to the system when power is not provided by the array solar panels, and to store the excess power generated by the panels whenever that power exceeds the load used. Batteries undergo a cyclic process of storing and discharging depending on the presence or absence of sunlight. During the time there is sun, the solar panels generate electric power. Electrical power that is not used is immediately charged into the battery.

2.3. Inverters

Inverters are electrical devices used to convert direct current (DC) from devices such as batteries, solar panels / solar cells into alternating current (AC). The use of an inverter in a Solar Power Plant (PLTS) system is to provide AC (Alternating Current) currents in devices such as cellphone chargers. The inverter is installed directly on the positive and negative terminals on the battery terminal. Things that need to be considered in choosing an inverter, namely try to choose an inverter whose workload (in Watts) is close to the load we want to use for maximum work efficiency, and has a 12 Volt or 24 Volt DC Input.

3.0 METHODOLOGY

The research was carried out at SD Negeri 4 Mesuji Timur which is located on street Kota Terpadu Mandiri, Margo Mulyo Village, Mesuji Timur District, Mesuji Regency, Lampung. The school was chosen because of the problems faced by the teachers. This problem is the problem of long-term and unpredictable blackouts, which often occur from early morning to late evening. Thus, the impact of the blackout affects the professionalism of teachers in using computers or laptops to fill in student report cards that have been based on technology and use formulas in Ms. Excel. Referring to [10] the methodology used in system development is the System Development Life Cycle (SDLC) as shown in Figure 2.

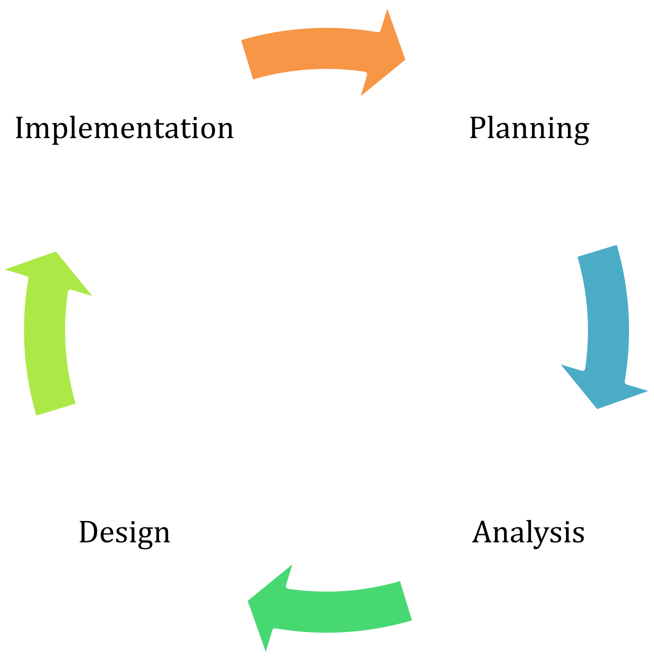

Figure 2 Model of the systems development life cycle

1. Planning
   Make a schedule that will later be used as a guide in the design and development of the school's solar panel system. This step also begins by making details of the tools and materials that will be used and taking measurements of the electricity supply needs.

The schedule with the desired functionality will be sorted along with the estimated time it will take.

2. Analysis
   After analyzing the needs, then a basic design is made regarding the school's solar panel system. This step is the basic idea regarding the existing reality. By designing this functionality, there will be a guide that will be used for the actual design process.
3. Design
   At this stage, the basic design that has been previously made will be made according to the actual needs that have been documented in the analysis stage.
4. Implementation
   This step is the implementation stage of the school's solar panel system. The next process will be tested on the ysolar panel design that has been applied. So that if there are problems that arise, the school solar panel system that has been implemented can be repaired again.

4.0 RESULANTS AND DISCUSSION

Following up and supporting the 2019 implementation year service program that has been implemented that technology can be used as one of the media or teaching facilities in the classroom and can be one of the variables in making Scientific Writing (KTI) to improve teacher professionalism, a School Solar Panel System Design (SSPS) with a design as shown in Figure 3 below.

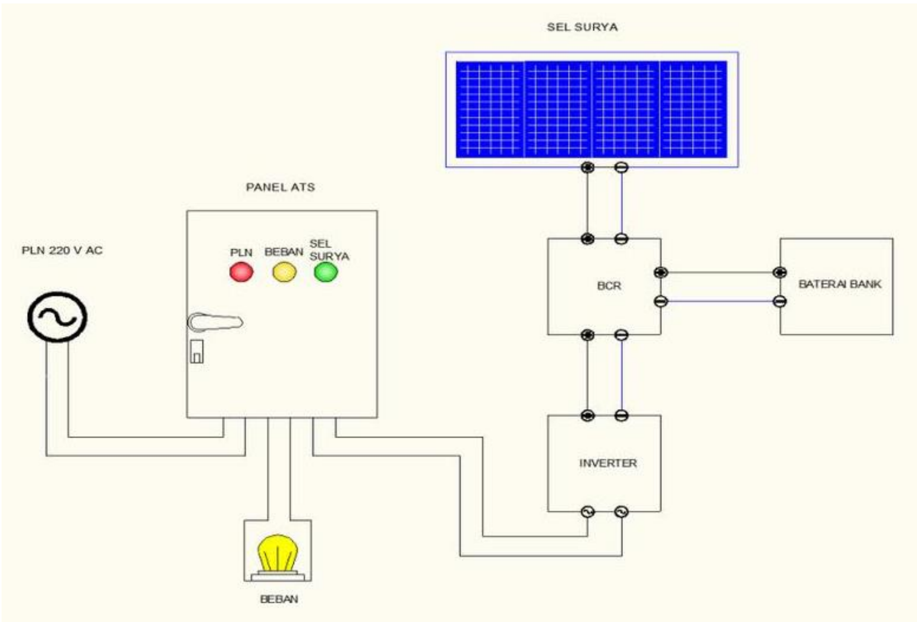

Figure 3 The off-grid system (stand alone)

Based on Figure 3, the SSPS block diagram designed has adjusted the infrastructure conditions in SDN 4 Mesuji Timur. This design is hoped to be able to solve the problem of electricity supply which often goes out when the learning process is taking place for a relatively long time. So that this results in constraints on the use of learning media, filling out report cards, and other learning activities. The working principle of this SSPS is that the sun shines and the radiation generated from this sunlight is then captured by photovoltaic solar panels. This solar panel is a combination of several solar cells that are very small and thin in series, parallel, or mixed (series and parallel), so that it becomes a solar panel that is large enough and can produce large currents and voltages as well. In principle, if sunlight hits the solar panel, the electrons in the solar cell will move from N to P, so that the output terminal of the solar panel will produce electrical energy. The amount of electrical energy produced by solar panels varies depending on the number of solar cells combined in the solar panel. The output of this solar panel is direct current (DC) electricity, the output voltage depends on the number of solar cells installed in the solar panel and the amount of sunlight shining on the solar panel [11]. The output / electrical energy from this solar panel can be used directly to loads that require a DC voltage source with a small current consumption. So that the electric energy produced can also be used in conditions such as at night (conditions when the solar panel is not exposed to sunlight), the output of this solar panel must be connected to a storage medium, in this case the battery. However, this cannot be directly connected from the solar panel to the battery, but must be connected to the Regulator circuit in which there is an Automatic battery charger circuit. In addition, the regulator functions to connect and disconnect the current from the solar panel to the battery automatically and also functions to cut off the flow of current from the load battery in the event of a short circuit or excessive load. The type of regulator designed here is a modified type or a combination of series and parallel. Solar panels can actually be used directly without being given a regulator or battery circuit, but this is not done because it can burden the performance of the panel (due to excessive loads) so that there will be no fatal damage to the solar panel. In addition, this regulator also serves to protect against overloading of solar panels so that the solar panels do not break quickly [12]. The systematics of the process, components, and output descriptions can be seen in Figure 4.

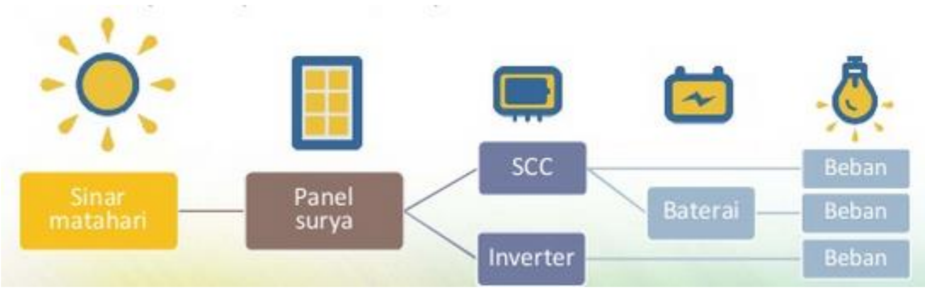

Figure 4 Block diagram of a solar power plant work system

From Figure 3 it can be explained related to the workings of the School Solar Panel System (SSPS) as follows:

1. Solar panels convert sunlight into DC electricity
2. Solar Charge Controller (SSC) regulates DC electricity to be stored in the battery
3. The battery has a certain amount of power capacity to turn on the load when there is a power cut from the PLN source
4. The inverter functions to convert DC electricity into AC electricity
5. Loads can be in the form of electronic devices that support the use of AC electricity or DC electricity

As for the components used in designing the School Solar Panel System (SSPS), it can be seen in Table 1.

Table 1.Components of the School Solar Panel System (SSPS)

No.	Component	Capacity
1	Solar Panel	100WP
2	Solar Cell Controller	20A / 12 volts
3	MC4 socket	4 Install
4	MCB breaker	Unit
5	Socket	Unit
6	Battery charger	Unit
7	Pure Sine Wave Inverter	1000 Watt
8	Solar cell cable	18 meters
9	battery	65Ah - 12 Volt

Figure 4 shows the devices of the School Solar Panel System (SSPS) that have been successfully implemented in schools SDN 4 Mesuji Timur. From the trials conducted School Solar Panel (SSPS) can function properly. By producing electrical energy that can be operated on a number of electronic equipment, such as laptops, fans, cellphones, and other electronic devices. So that with the School Solar Panel System (SSPS), the problem of blackout can be overcome and also this is very supportive of green energy.

Figure 5 School Solar Panel System (SSPS) which has been successfully implemented

5.0 CONCLUSION

The School Solar Panel System (SSPS) has been successfully implemented in schools SDN 4 Mesuji Timur. Evidenced by after the trial, the School Solar Panel System (SSPS) can increase the availability of electricity in supporting teacher professionalism in carrying out learning activities. So that with the School Solar Panel System (SSPS), electricity supply is still available even if there is a blackout from the PLN source.

Thank-you note

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