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Utilization of Solar Panel Energy for electricity in the AT-Taubah Musholla, West Cilebut Village

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Abstract: The AT-Taubah Griya Cilebut Asri 2 Musholla in West Cilebut Village is a place of worship that focuses on its activities in the community to carry out worship, community gatherings, and recitation for children and youth, to increase friendship between West Cilebut village residents, in its activities it needs electricity to support, facilitating residents' activities at the AT-Taubah prayer room, with the application of solar power. making solar panels for use in prayer rooms aims to provide an alternative solution where PLN's electricity facilities are not good or there is no electricity. the results of testing solar panels can be used as an alternative energy where this solar panel utilizes sunlight, namely, to produce electrical energy of 5 volts 125 mA or 0.625 VA.

Keywords: electricity; solar panels; PLN's electricity; sunlight.

1. INTRODUCTION

The development of modern digital technology requires people to be more inclined to adapt to the development process to become a creative, innovative, and independent society that can utilize local technology and resources to produce competitive products. Currently solar energy has become a new alternative energy that is more efficient and very environmentally friendly(Wibowo et al., n.d.).

The AT-Taubah Griya Cilebut Asri (GCA) 2 prayer room is a place of worship located at the Griya Cilebut Asri 2 Housing Complex, West Cilebut Village, Sukaraja District, Bogor Regency, West Java. In general, in terms of the construction of the AT-Taubah prayer room, it has increased, from the beginning of construction around 2020 until now it can function as a place of worship by the community(Azis Pandria & Prasanti, 2021). The construction of this prayer room was carried out independently by the GCA2 public company, so it took a long time for the construction because in terms of the economic capacity of the surrounding community (Zhang et al., 2020), they were still mediocre, in general, the livelihood of the residents was trading, and there were still many residents who had not had the opportunity to work(Sari et al., 2020). Therefore the construction

of the musholla took quite some time, then in terms of the musholla facilities at-taubah, especially related to electricity, the Musholla At-Taubah does not yet have its own meter because the community or the mousque prosperity council of the musholla are still thinking about the cost per month to pay for electricity(Li et al., 2015; Sayen et al., 2009), so so far the Musholla At- Taubah for lighting is still connected to the nearest neighbor, so the use of electricity is still very limited (Sun et al., 2015). Even though the place is often used for community activities such as PKK meetings for women and for recitation for men as well as for teaching children and youth. On the other hand, Perum GCA2, West Cilebut Village, has a large potential for solar energy because the average temperature in the area is around 29 ^{0}C(Kinasti et al., 2019). Opportunity to empower the community as well as the potential for renewable energy, namely the installation of a solar power plant (PLTS) for electricity at the At-taubah prayer room(Maysha & Trisno, 2013).

The use of solar panel technology in the AT-Taubah GCA2 Mosque area is expected to be able to provide electricity to power lights and other electronics, to meet their energy needs. Solar energy is chosen as an alternative energy to produce electrical energy. The tool used here is a solar cell because it can directly convert solar radiation into electrical energy (photovoltaic process) (Kaymak et al., 2020; Othman et al., 2019). So that solar energy can be used at night, during the day the generated electrical energy is stored first in a battery that is controlled by a regulator. The output of the regulator is directly connected to the inverter from DC to AC current. The PLTS system for energy needs at the At-Taubah prayer room uses the Off Grid concept (independent from the PLN network) with batteries as energy storage for power supply at night. However, the inverter used is a Bi-directional inverter type so that electricity from the PLN network can be used as a backup if the energy from the PLTS stored in the battery does not meet the electricity needs of the At-Taubah prayer room (Ismangil et al., 2021).

This can happen when the weather is cloudy for days so that no solar energy is absorbed into the PLTS system (Ismangil et al., n.d.; Mattevi et al., 2011). Thus, of course, it will greatly facilitate the user so that there will be no black out. The objectives of the empowering community partnerships Utilization of Solar Cells as a Renewable Energy Source and Solar Panel Installation are:

a. For Partners:

1. Costs for electricity expenses will save more
2. Increase the understanding of At-Taubah Musholla about renewable sources of electrical energy that are environmentally friendly and efficient (Ismangil & Gendam Prakoso, 2020).
3. If Partners carry out development on a larger scale, the economic impact will be felt more because it can reduce the cost of electricity needs.

b. For Empowering Community Partnerships Team

1. Success in Utilizing Solar Cells as a Renewable Energy Source and Solar Panel Installation can provide enthusiasm and motivation for the Team to develop a Community Partnership Program in a broader aspect.
2. The team can apply their knowledge and abilities as a form of service to the community.

2. METHOD

The following is the implementation method used in Community Service activities in Sukadana Village: 1. Survey partner locations, then approach residents through interviews with local villagers to analyze the problems being faced by partners then provide solutions to solve problems faced partners. 2. Conduct questionnaires to residents in partner locations to find out how much knowledge residents have about use of solar power technology. 3. Furthermore, through socialization in advance, providing information to residents about the use of solar technology as a new source of electricity to replace PLN electricity source and how to implement it in everyday life. 4. Installing solar panels on a DC water pump motor as the power source. 5. Explain to residents through a brief educational outreach regarding the operation and maintenance of this solar-powered water pump motor, then proceed with handing over the goods. 6. Make observations in field to find out results that appear during implementation and continue with making reports from observations. 7. Evaluate the results of implementation of Community Service activities by monitoring results after implementation of Community Service and conducting questionnaires on residents regarding the results of Community Service implementation. 8. Make an accountability report on implementation of this Community Service activity.

For more concise can be seen in the following flowchart.

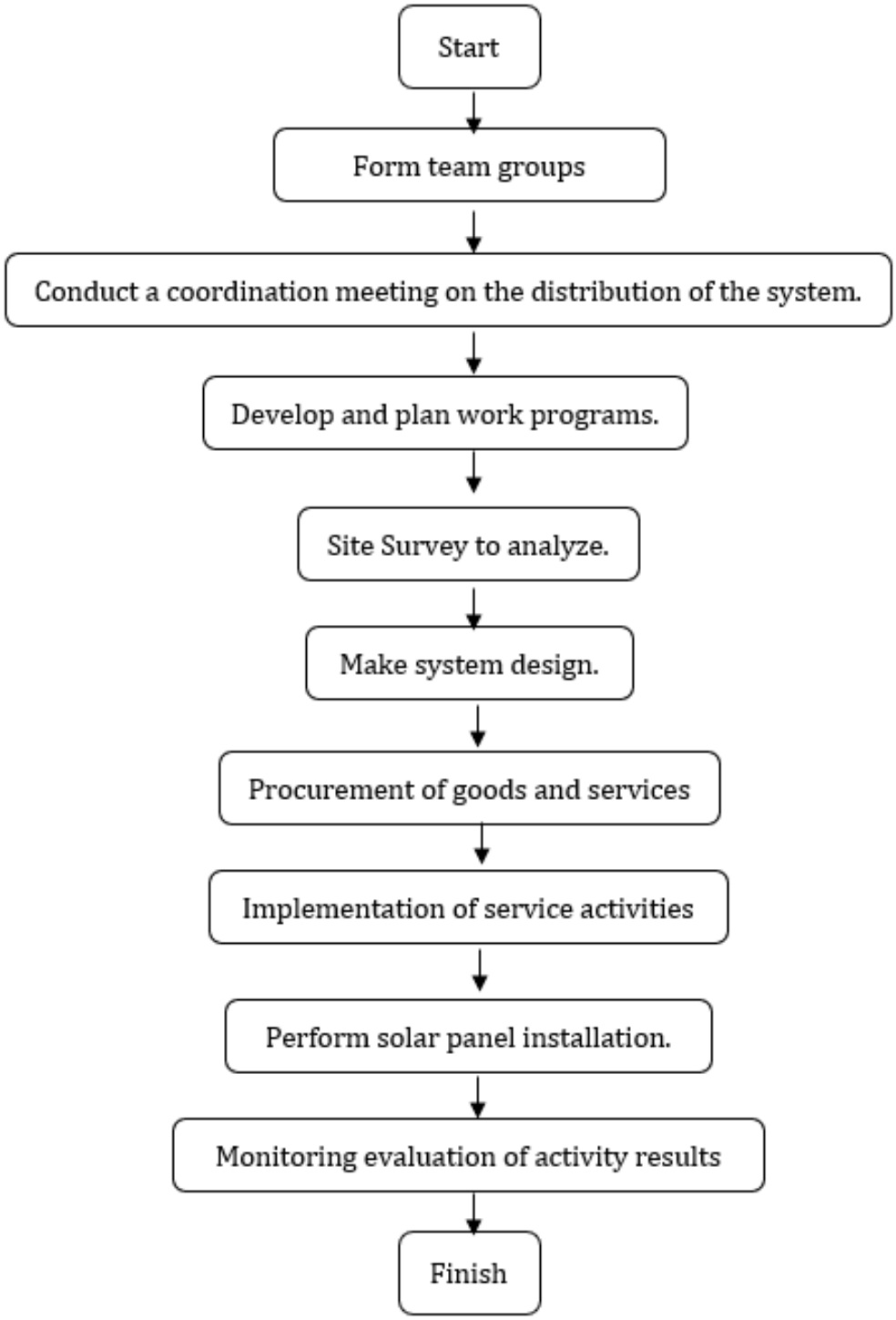

Figure 1. Empowering Community Partnerships Activity Flowchart

In carrying out this Community Service activity, the system design offered to reconfigure the clean water distribution system for residents' ablution at the At-Taubah prayer room is as follows.

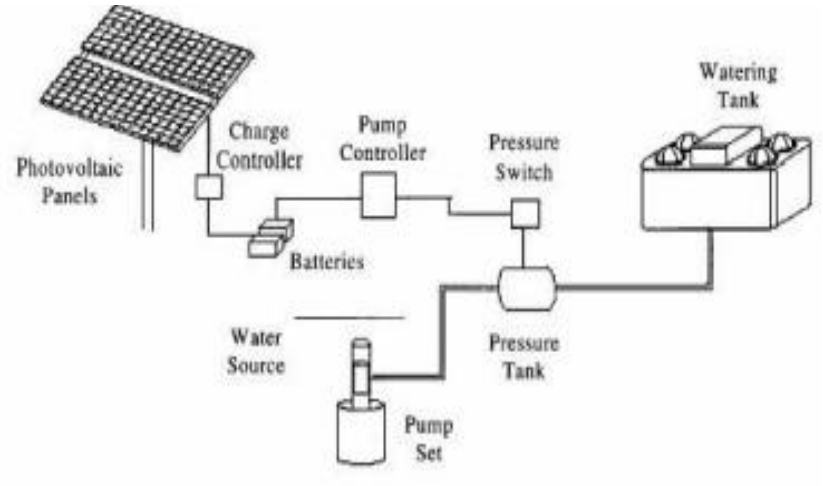

Figure 2. Series of Solar Water Pump Systems(Ngurah et al., 2005)

The solar water pump system built consists of 4-unit solar modules, each with a capacity of 100 Wp, 2-unit DC water pumps, each with a capacity of 180 Watt, 2 sets of solar charge controllers and 2-unit batteries, each with a capacity of 100 Ah. 12V(Ngurah et al., 2005).

Solar cells have the working principle of the photoelectric effect, namely a material will release electrons if the surface of the material is exposed to light. The energy of the electrons released from the material is very dependent on the energy of the light shining on it while the number of electrons released does not depend on the energy but depends on the intensity of the light shining on the surface of the material. The greater the intensity of the light shining, the greater the number of electrons released from the material, then the number of electrons released determines the amount of current generated and the greater the current generated, the greater the power generated. So, it can be concluded that the greater the Intensity of Solar Radiation, the greater the power The electricity generated by solar panels is also directly proportional. If the intensity of solar radiation is low, the output power of the solar panel is also low, so that the performance of a panel is not maximum. Apart from the effect of the intensity of solar radiation on the output power of a solar panel, on the other hand there is the influence of the ambient temperature on the panel which also affects the output power of the solar panel. Where when the ambient temperature is high, the output power of the solar panel decreases, the solar cell will operate optimally if the cell temperature remains normal (at 25 °C), an increase in temperature higher than normal temperature in the cell will reduce the voltage value (V).

To evaluate the use of solar panels that will be implemented, we will see that after the community has been given an understanding regarding the use of solar panels, we will monitor them periodically, namely every semester, whether the energy absorption of solar panels is going well and the energy utilization is used optimally, so that future sustainability will increase services at the At-taubah prayer room and are useful for the surrounding community.

3. RESULT AND DISCUSSION

Solar cells work using the p-n junction principle, namely the junction between p-type and n-type semiconductors. This semiconductor consists of atomic bonds in which there are electrons as a basic constituent. The n-type semiconductor has an excess of electrons (negative charge) while the p-type semiconductor has an excess of holes (positive charge) in its atomic structure. This condition of excess electrons and holes can occur by doping the material with dopant atoms. For example, to get p-type silicon material, silicon is doped by boron atoms, whereas to get n-type silicon material, silicon is doped by phosphorus atoms. The illustration below depicts p-type and typen semiconductor junctions. The role of the p-n junction is to form an electric field so that electrons can be extracted by the contact material to generate electricity. When the p-type and n-type semiconductors are in contact, the excess electrons will move from the n-type semiconductor to the p-type to form a positive pole in the n-type semiconductor, and vice versa a negative pole in the p-type semiconductor. As a result of this flow of electrons and holes, an electric field is formed which when sunlight hits this p-n junction arrangement it will push electrons to move from the semiconductor to the negative contact, which is then used as electricity, and vice versa the hole moves towards the positive contact waiting for the electrons to come, as illustrated in Figure 3.

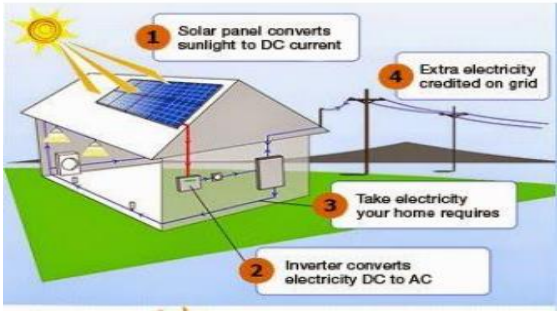

Figure 3. Series of Solar Water Pump Systems(Karim et al., n.d.)

The solar panels used are not from factory assembly, but solar cells are self-assembled to become a solar panel. Each solar cell is arranged in series to get the maximum voltage output. 1 solar panel requires approximately 36 solar cells arranged in series. In its application, several solar panels are required to produce enough power as shown in Figure 6. Several solar panels are connected in series (1 row of panels is connected in series) and the output of each line is arranged in parallel. The output of the solar panel unit is direct current (DC) which will later be converted into alternating current (AC) for the purposes of electric devices. Assembling a solar panel for use requires the following additional devices: charge controller, battery or accumulator, DC/AC inverter Some of the above devices are arranged as shown in Figure 4.

Figure 4. Solar Power Systems

DC current from the solar panel will flow to the charge controller. On the charge controller the current or charge can be controlled to flow to the battery (battery charging) or directly menun the DC/AC inverter for direct use. The battery used is a secondary cell such as a lithium battery or accumulator. Multiple batteries are needed to charge more. The batteries used are arranged in series. The electrical energy stored in the battery is then channeled to the DC/AC inverter. In a DC/AC inverter, the DC current generated by the battery will be converted into AC current so that it can be used for electrical devices such as lamps, refrigerators, chargers for electronic devices, and so on. The use of batteries as a source of DC current in inverters is usually used at night. Inverters can also receive DC current directly from the panel, produces electrical energy of 6 volts 109 mA (Kinasti et al., 2019). TEC produces more electrical energy when compared to the solar cells shown in Table 1

Tabel 1. Electrical energy generated by solar panels is converted into AC 220V

Temperature (oC)	Voltage (Volt)	Current (mA)
30	5,59	86,3
30	5,85	98
34	6,24	104
37	6,5	112
39	6,53	125

One piece of monocrystalline solar cell with a size of 118 x 63 mm produces electrical energy of 6,53 volts 125 mA or 0.625 VA. Electrical energy generated by solar panels This is stored in a 6-volt battery, 1300 mA then converted to AC 220 V with using a DC to AC inverter so it can power the load.

4. CONCLUSION

From the results of testing the solar panels that were made, the results obtained were that the solar panels could be used as an alternative energy that utilizes sunlight it was found that solar panels can produce electrical energy of 5 volts 125 mA which can be utilized at the At-Taubah GCA2 mosque.

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