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Implementation Solar Panel Systems in Households: A Practical Guide to Energy Savings

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ABSTRACT

Recently, the increase in electricity usage has become a reality. In Indonesia, the discovery of renewable energy sources is becoming more frequent. One solution being implemented is utilizing solar energy through Solar Power Plants (PLTS). This journal discusses the implementation of solar panel systems in homes as a practical guide for energy savings. Through case studies of implementation in several homes, this journal presents practical steps in installing and managing solar panel systems. The journal will also discuss the economic benefits obtained through the implementation of this system. The research results indicate that installing solar panels can be an effective step towards achieving energy efficiency and contributing to global efforts to reduce carbon footprints.

Keywords*: Renewable energy, Efficiency, Economic benefits, Solar panels, Household guide*

1. INTRODUCTION

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2. METHOD

Based on the literature search method, several articles were found that meet the discussion criteria. This research provides various discussions and guidelines for implementing solar panel systems in households. The discussion is as follows:

2.1. Solar Panels

Solar panels are electronic devices designed to capture solar energy and convert it into electricity or heat. Solar panels, known as photovoltaics (PV), derive from the word "photo" meaning light, and "voltaic" referring to the conversion of energy into electricity. Solar panels use solar cells, made from semiconductor materials like silicon, to generate electricity when sunlight strikes them. There are two main types of solar panels:

2.1.1. Photovoltaic (PV) Solar Panels:

- Apply the photovoltaic effect to generate electricity. The solar cells in these panels produce electric current when sunlight hits the panel.
- The electricity generated can be used directly to power electronic devices or stored in batteries for use at night or when the sun is not shining.

2.1.2. Thermal Solar Panels:

- Use solar heat to generate steam or fluids that can be used to drive turbines and generate electricity.
- Commonly used for water heating purposes in households or space heating systems.

2.2. Advantages of Solar Panels

Solar panels are one of the alternatives to replace steam-powered electricity generation. Technological developments in making more efficient solar panels, long-lasting batteries, and electronic devices that can use Direct Current (DC) are very promising. The advantages of using solar power are:

1. Renewable energy / Never runs out
2. Reduces dependence on conventional energy sources
3. Clean, environmentally friendly
4. Long lifespan of solar panels and can be a long-term investment
5. Practical and requires minimal maintenance
6. Suitable for tropical areas like Indonesia

2.3. Installation of Solar Panels

The installation of solar panels in households can involve several steps that need to be considered, such as:

- Evaluate energy needs
- Choose the right location

- Select solar panels
- Select an inverter system
- Design and planning
- Install solar panels
- Install the inverter and wiring system
- Connect to the grid or energy storage system
- Test the system

The process of generating solar energy from solar panels is as follows:

1. Solar Panels convert solar energy into electrical energy; solar panels can convert light energy into electrical energy using the photoelectric effect.
2. Solar Charge Controller (SCC) regulates the charging current from the solar panel to the battery to avoid overcharging and overvoltage. The SCC also regulates the current released or taken from the battery to prevent full discharge and overloading. The SCC can also monitor battery temperature.
3. Battery or Accumulator serves as the storage for the current or electrical energy generated by the solar panels. The battery in this solar power system is crucial as it stores the energy or current produced by the solar panels during the day, and the stored energy can be used at night.
4. Inverter is an electrical device used to convert Direct Current (DC) into Alternating Current (AC). This inverter can convert DC current from the battery into AC.

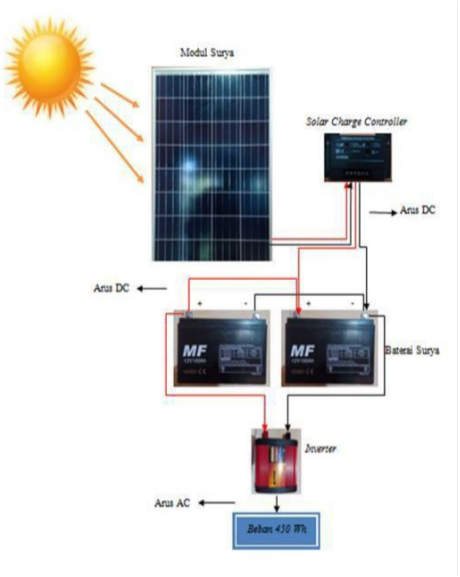

Figure 2.1 Diagram Hardware Solar Panel

2.4. Environment Impact

With the use of solar panels in households, families can contribute to maintaining a healthy environment. Compared to conventional energy sources such as fossil fuel power plants, solar panels can help reduce environmental pollution. The impacts of using solar panels are as follows:

1. Reduction of Greenhouse Gas Emissions: Solar panels can generate energy without needing fossil fuels, which are the primary sources of greenhouse gases like CO2.
2. Reduction of Air and Water Pollution: By switching to solar energy, households can help reduce air and water pollution that harms human health and ecosystems.
3. Protection of Natural Habitats: The construction of infrastructure for conventional power plants can cause damage to natural habitats. Solar panels tend to have a smaller environmental impact on natural habitats because they utilize already-built areas like rooftops.
4. No Toxic Waste Production: Solar panels are power generators that do not produce toxic and hazardous waste like some conventional power plants. Solar panels have a relatively clean lifecycle.
5. Improvement of Local Air Quality: By using solar panels, households can help improve the air quality in their surroundings and reduce health risks.

3. RESULT AND DISCUSSION

To determine the capacity of the solar modules to be used, we need to calculate the power requirement, divided by the duration of solar radiation absorption.
Solar Module (Wp) = Power Requirement (Wh). The absorption duration (hours) is determined based on the peak solar energy, which occurs between 10:00 AM and 2:00 PM. This calculation will allow us to determine the number of solar modules required.

Table 3.1 Total Power Requirement

Item	Duration (Hour/Day)	Power Consumption
AC	8	430 W
TV	8	100 W
Lamp (15 Units)	8	60 W
Refrigerator	24	50 W
Iron	1	300 W
Washing Machine	2	300 W
Water Pump	3	650 W
Blender	½	130 W
Rice Cooker	8	465 W
Water Dispenser	24	250 W

The total daily power requirement for the household load is 3575 Watts. This is divided by the duration of solar energy absorption to determine the total number of solar modules to be used.

$$Power = \frac{Power\ Requirement\ (Wh)}{Absorption\ Duration\ (Hours)}$$

$$Power = \frac{3575\ Wh}{4\ H}$$

$$Power = 893.75\ Watt\ Peak$$

Thus, it can be concluded that 9 solar panels of 100 WP (Watt Peak) are needed.

Table 3.2 Cost Budget Plan (RAB) Calculation for Solar Panel Installation

Item	Unit	Price
Solar Panel 12 V (100 Watt Peak)	9	Rp. 700.000 per sheet
Sollar Charge Controller (POWMR) 30 A	1	Rp. 1.300.000
Baterai 12 V 100Ah	2	Rp. 2.500.000
Inverter 12V 1000W	1	Rp. 3.000.000
ATS (Automatic Transfer Switch)	1	Rp. 480.000
MCB (Miniature Circuit Breaker)	3 (2 DC dan 1 AC)	Rp. 100.000
Kontaktor (SN12) 220V	2	Rp. 200.000
Relay LY2N	2 (AC 220V & DC 12V)	Rp. 75.000
Voltage Protection Modul	1	Rp. 150,000
Timer Ewik	1	Rp. 200.000
Panel Box	1	Rp. 285.000
Cable, skun kabel, etc	As Needed	Rp. 1.500.000

The total budget required is Rp. 19,065,000. If we take an example of a household spending Rp. 1,500,000 per month on electricity costs, then in a year, that household could spend Rp. 18,000,000 on electricity. What if this continues for 20 years? With an investment in solar panels, the household can save money on electricity with proper and good maintenance, as solar panel systems can last a long time. Therefore, installing solar panels in a household can be a suitable long-term alternative for families looking to save on energy costs.

4. CONCLUSION

Based on the findings of this journal, it can be concluded that:

1. Solar panels, as the primary choice for alternative electricity generation, stand out as the best solution to replace conventional energy resources. Their advantages not only include efficiency in generating electricity but also have a wide range of positive impacts in various aspects, as discussed earlier.
2. The implementation of solar panels in households opens the door to significant electricity cost savings. Families who use this technology can experience a noticeable reduction in their monthly electricity bills. This not only provides direct economic benefits but also promotes awareness of energy efficiency among the community.
3. By choosing solar panels, we are not only investing in energy independence but also supporting environmental balance. Solar panels have a positive impact on the ecosystem, reducing greenhouse gas emissions, and minimizing carbon footprints. In this way, households using solar panels contribute to environmental preservation.

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