

Performance Analysis of a 1.1 kWp Hybrid Solar Power System at Tito Garage

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ABSTRACT

The utilization of solar energy as a renewable energy source continues to be developed to support sustainable energy needs. One of its implementations is the use of a hybrid Solar Power Plant (Photovoltaic System) in small-scale businesses, such as Tito Garage Workshop in Jember Regency. This study aims to analyze the technical performance of a 1.1 kWp hybrid photovoltaic system based on component efficiency parameters and Performance Ratio (PR). The research method includes literature review, direct data collection, and performance analysis of each system component, namely solar panels, Solar Charge Controller (SCC), batteries, and inverter. The results show that the efficiency of the solar panels is 18.79%, SCC is 72.97%, batteries are 93.3%, and inverter is 97.2%, resulting in an overall system efficiency of 12.43%. This value is still within the general efficiency range of photovoltaic systems. The Performance Ratio (PR) is 85%, which is categorized as good since it falls within the standard range of 70%–90%. Based on the analysis, the 1.1 kWp hybrid photovoltaic system at Tito Garage is considered feasible to be implemented and capable of operating effectively.

Keywords: hybrid photovoltaic system, performance ratio, PV performance, solar energy, system efficiency