

ABSTRACT

THE EFFECT OF SOLAR PANEL CAPACITY AND TILT ANGLE ON THE PERFORMANCE OF THE 12 VOLT OFF GRID PLTS SYSTEM

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The need for electrical energy in Indonesia continues to increase along with population growth and rapid technological developments. One solution being developed to address this challenge is the use of renewable energy, particularly Solar Power Plants (PLTS). This study aims to analyze the effect of solar panel capacity and tilt angle on the performance of a 12-volt off-grid PLTS system, which is reviewed from solar panel efficiency, Maximum Power Point Tracking (MPPT) efficiency, overall system efficiency, and battery capacity in supplying the load. The study was conducted experimentally using monocrystalline solar panels with a capacity of 100–400 Wp, varying tilt angles of 0°–40°, and a fixed load of 400 watts. The test results show that the efficiency of the PLTS system increases significantly with increasing solar panel capacity and optimal tilt angle. A tilt angle of 0° on a 400 Wp panel produces the highest system efficiency of 93.21% and maintains a more stable battery capacity. The highest MPPT efficiency also occurs on a 400 Wp panel at a 0° angle, reaching 98.54%. Thus, the combination of large panel capacity and optimal tilt angle significantly impacts the performance and stability of off-grid solar power systems. This research contributes to the development of efficient and environmentally friendly solar power systems for electricity needs in remote areas.

Keywords: Solar power generation, degree of inclination, solar panels, single battery