

Performance Analysis of Off-Grid Solar Power System for Dragon Fruit Cultivation in Pesanggaran Village, Banyuwangi

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ABSTRACT

Dragon fruit cultivation in Pesanggaran Village, Banyuwangi, requires additional lighting at night to induce off-season flowering, making a reliable and sustainable electricity source necessary. This study analyzes the performance of an off-grid Solar Power System (PLTS) in supporting this lighting requirement, while also examining the effect of solar panel tilt angles (10°, 15°, 20°, and 25°) on system performance, through a six-day field experiment processed based on the IEC 61724 standard using Yield and Performance Ratio (PR) parameters, along with an evaluation of the Solar Charge Controller (SCC) and battery capacity performance. The test results show that the Final Yield increased with the tilt angle, namely 2.635 hours (10°), 2.765 hours (15°), 2.910 hours (20°), up to the highest value of 2.945 hours (25°), with the DC energy (E_{dc}) reaching 0.6253 kWh, while panel efficiency ranged from 9–12%. Conversely, the highest PR was obtained at a 10° tilt angle (80.15%), followed by 15° (72.50%), 20° (71.60%), and the lowest at 25° (63.35%), indicating an inverse relationship between the energy produced and the system's efficiency. Thus, the off-grid PLTS system studied meets the IEC 61724 feasibility standard and is able to supply the additional lighting needs for dragon fruit cultivation in a stable and sustainable manner.

Keywords: *Dragon Fruit, Off-grid PLTS, Panel Tilt Angle, Performance Ratio, Solar Panel Efficiency.*