

ABSTRAK

PENGARUH INTENSITAS CAHAYA DAN BEBAN LISTRIK TERHADAP EFISIENSI PANEL SURYA PADA PLTS *OFF-GRID* 800 WP KOMBINASI PANEL *MONOCRYSTALLIN-POLYCRYSTALLINE*

(Tian Wahyu Hidayat, 2026: 49 Halaman, 14 Tabel, 22 Gambar)

Pembangkit Listrik Tenaga Surya (PLTS) *off-grid* merupakan salah satu alternatif penyediaan energi listrik yang kinerjanya dipengaruhi oleh intensitas cahaya matahari dan beban listrik. Penelitian ini bertujuan untuk menganalisis pengaruh intensitas cahaya dan beban listrik terhadap efisiensi panel surya, persentase kapasitas baterai, dan efisiensi sistem PLTS *off-grid* 800 Wp menggunakan kombinasi panel *monocrystalline-polycrystalline*. Metode yang digunakan adalah metode eksperimen dengan variasi beban 100 W, 200 W, 300 W, 400 W, dan 500 W pada rentang waktu 09.00–13.00 WIB. Parameter yang diamati meliputi intensitas cahaya, efisiensi panel, efisiensi MPPT, persentase kapasitas baterai, efisiensi inverter, dan efisiensi sistem PLTS. Hasil penelitian menunjukkan bahwa peningkatan intensitas cahaya dan beban listrik meningkatkan efisiensi panel serta efisiensi sistem PLTS, sedangkan kapasitas baterai menurun seiring bertambahnya beban. Efisiensi panel tertinggi sebesar 13,16%, efisiensi sistem PLTS sebesar 11,67%, dan kapasitas baterai tertinggi sebesar 98% diperoleh pada intensitas cahaya sekitar 1.030,95 W/m² pada pukul 12.00 WIB. Berdasarkan hasil tersebut, kondisi operasi yang paling efektif terjadi pada beban 500 W sekitar pukul 12.00 WIB, sehingga memberikan kinerja terbaik pada sistem PLTS *off-grid* 800 Wp.

Kata kunci: PLTS *off-grid*, intensitas cahaya, beban listrik, efisiensi panel surya, efisiensi sistem PLTS, kapasitas baterai.

ABSTRACT

EFFECT OF LIGHT INTENSITY AND ELECTRICAL LOAD ON SOLAR PANEL EFFICIENCY IN OFF-GRID SOLAR POWER 800 WP MONOCRYSTALLIN-POLYCRYSTALLINE PANEL COMBINATION

(Tian Wahyu Hidayat, 2026: 49 pages, 14 tables, 22 images)

Off-grid Solar Power Plants (PLTS) are one of the alternatives to providing electrical energy whose performance is affected by the intensity of sunlight and electrical loads. This study aims to analyze the effect of light intensity and electrical load on solar panel efficiency, battery capacity percentage, and 800 Wp off-grid solar system efficiency using a monocrystalline-polycrystalline panel combination. The method used is an experimental method with load variations of 100 W, 200 W, 300 W, 400 W, and 500 W in the time range of 09.00-13.00 WIB. The parameters observed included light intensity, panel efficiency, MPPT efficiency, battery capacity percentage, inverter efficiency, and solar system efficiency. The results showed that the increase in light intensity and electrical load increased the efficiency of the panels and the efficiency of the solar power system, while the battery capacity decreased as the load increased. The highest panel efficiency was 13.16%, the efficiency of the solar power system was 11.67%, and the highest battery capacity was obtained at a light intensity of around 1,030.95 W/m² at 12.00 WIB. Based on these results, the most effective operating conditions occurred at a 500 W load at around 12.00 WIB, thus providing the best performance in the 800 Wp off-grid solar system.

Keywords: *off-grid solar PV, light intensity, electrical load, solar panel efficiency, solar power plant system efficiency, battery capacity.*