

ABSTRAK

Penelitian ini bertujuan untuk merancang dan mensimulasikan sistem Pembangkit Listrik Tenaga Surya *off-grid* berkapasitas 3 kW menggunakan *software* PVsyst guna memenuhi kebutuhan energi harian sebesar 3000 Wh untuk rumah tangga atau fasilitas kecil di daerah terpencil. Simulasi menunjukkan bahwa sistem memiliki *Performance Ratio* sebesar 73,97%, yang berada dalam rentang layak 70%-90%, menandakan efisiensi yang baik meskipun terdapat kerugian akibat faktor seperti shading, suhu, dan efisiensi komponen. Sistem dirancang dengan konfigurasi optimal, termasuk panel surya monokristalin 200 Wp, baterai VRLA 150 Ah, inverter 1000 W, dan Solar Charge Controller 60A. Analisis ekonomi menunjukkan kelayakan proyek dengan *Net Present Value* positif sebesar Rp15.516.818,48 dan Payback Period selama 5 tahun 6,4 bulan, menunjukkan potensi pengembalian investasi yang cepat dalam masa operasional 20 tahun. Penelitian ini memberikan kontribusi berupa blueprint teknis untuk implementasi PLTS *off-grid* yang efisien dan berkelanjutan, mendukung transisi energi bersih di wilayah tanpa akses jaringan listrik.

Kata Kunci: PLTS *Off-Grid*, PVsyst, Simulasi PLTS

ABSTRACT

This study aims to design and simulate a 3 kW off-grid Solar Power Plant system using PVsyst software to meet the daily energy demand of 3000 Wh for households or small facilities in remote areas. Simulations show that the system has a Performance Ratio of 73.97%, which is within the feasible range of 70%-90%, indicating good efficiency despite losses due to factors such as shading, temperature, and component efficiency. The system was designed with an optimized configuration, including 200 Wp monocrystalline solar panels, 150 Ah VRLA battery, 1000 W inverter, and 60A Solar Charge Controller. The economic analysis shows the feasibility of the project with a positive Net Present Value of Rp15,516,818.48 and a Payback Period of 5 years 6.4 months, indicating the potential for a quick return on investment within the 20-year operational period. This research contributes a technical blueprint for the implementation of efficient and sustainable off-grid solar power plants, supporting clean energy transition in areas without grid access.

Keywords: Off-grid solar power plant, PVsyst, solar power plant simulation