UNIVERSITAS
GADJAH MADA
Analisis Performa dan Kelayakan Ekonomi Pembangkit Listrik Tenaga Surya Gedung SGLC
Tiara Larasati Noerhasan, Photovoltaic System, Solar Energy, Performance Analysis, Cost Benefit Analysis, Renewa
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Gedung Smart Green Learning Center (SGLC) Fakultas Teknik Universitas Gadjah Mada menerapkan sistem Pembangkit Listrik Tenaga Surya (PLTS) atap berkonfigurasi *on-grid* untuk mendukung kebutuhan listrik gedung. Penelitian ini bertujuan menganalisis performa dan kelayakan ekonomi sistem PLTS. Analisis performa meliputi kontribusi PLTS terhadap kebutuhan listrik gedung, penentuan kondisi operasi optimal melalui simulasi, serta evaluasi kinerja aktual berdasarkan perbandingan dengan hasil simulasi. Hasil penelitian menunjukkan kontribusi PLTS sebesar 8,38% pada hari kerja, 15,18% pada hari libur nasional, 18,86% pada hari Sabtu biasa, 28,66% pada hari Sabtu *long weekend*, dan 30,60% pada hari Minggu. Simulasi tahun ke-3 menghasilkan energi sebesar 81.996 kWh pada sisi *array* dan 78.396 kWh pada sisi *main distribution panel* (MDP), dengan nilai *Performance Ratio* (PR) sebesar 74,3% dan *Capacity Factor* (CF) sebesar 14,34%. Kinerja aktual mencapai 82,36% pada sisi *array* dan 83,19% pada sisi MDP dibandingkan hasil simulasi, serta menunjukkan korelasi kuat dengan curah hujan, di mana peningkatan curah hujan cenderung meningkatkan performa PLTS. Dari aspek ekonomi, sistem memberikan penghematan biaya sebesar Rp172.250.854,16 dengan nilai *Net Present Value* (NPV) sebesar Rp135.021.354,99, *Internal Rate of Return* (IRR) 6%, *Return on Investment* (ROI) nominal 106%, ROI terdiskonto 21,24%, dan *Levelized Cost of Electricity* (LCOE) sebesar Rp716,05/kWh. Investasi mencapai titik impas pada tahun ke-12 tanpa memperhitungkan nilai waktu uang dan tahun ke-20 dengan memperhitungkan nilai waktu uang. Secara keseluruhan, sistem PLTS Gedung SGLC menunjukkan performa yang baik dan layak dioperasikan dari aspek operasional maupun ekonomi.

Kata kunci : Sistem PLTS, Energi Surya, Analisis Performa, Analisis Keuntungan Finansial, Energi Terbarukan

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ABSTRACT

The Smart Green Learning Center (SGLC) Building of the Faculty of Engineering, Universitas Gadjah Mada, utilizes an on-grid rooftop photovoltaic (PV) system to support the building's electricity demand. This study aims to analyze the performance and economic feasibility of the PV system. The performance analysis includes evaluating the PV contribution to the building's electricity demand, determining the optimal operating condition through simulation, and assessing the actual system performance by comparing it with the simulated results. The results show that the PV system contributed 8,38% of the building's electricity demand on weekdays, 15,18% on a public holiday, 18,86% on a regular Saturday, 28,66% on a long-weekend Saturday, and 30,60% on Sundays. The simulation for the third year of operation estimated an annual energy yield of 81.996 kWh at the array side and 78.396 kWh at the main distribution panel (MDP), with a Performance Ratio (PR) of 74,3% and a Capacity Factor (CF) of 14,34%. The actual system achieved 82,36% and 83,19% of the simulated energy yield at the array and MDP sides, respectively. Further analysis revealed a strong correlation between system performance and rainfall, indicating that increased rainfall tends to improve the PV system performance at the SGLC Building. From an economic perspective, the PV system generated total cost savings of Rp172.250.854,16 over the project lifetime. The economic analysis indicates that the system is financially feasible, with a Net Present Value (NPV) of Rp135.021.354,99, an Internal Rate of Return (IRR) of 6%, a nominal Return on Investment (ROI) of 106%, a discounted ROI of 21,24%, and a Levelized Cost of Electricity (LCOE) of Rp716,05/kWh. The investment reaches its break-even point in the 12th year without considering the time value of money and in the 20th year when the time value of money is taken into account. Overall, the PV system at the SGLC Building demonstrates good performance and is feasible for operation from both operational and economic perspectives.

Keywords : Photovoltaic System, Solar Energy, Performance Analysis, Cost Benefit Analysis, Renewable Energy