

FEASIBILITY ANALYSIS OF SOLAR PANEL UTILIZATION FOR IRRIGATION AND LIGHTING SYSTEMS IN GUAVA PLANTATIONS

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ABSTRACT

Plantations play a crucial role in supporting food security and regional economic resilience, including guava plantations that require reliable irrigation and lighting systems. However, limited or unavailable access to electricity from the national grid (PLN) often poses a major obstacle. This study aims to evaluate the technical and economic feasibility of using a Solar Power Generation System (PLTS) as an alternative energy source to support irrigation and lighting in guava plantations. Based on the analysis, an annual energy demand of 1,486.62 kWh can be met with a 2.30 kWp PLTS, comprising four 575 Wp solar panels. The system is capable of generating 3,149.3 kWh of clean energy per year with a performance ratio of 79.9% and can meet the daily peak load of 7,700 Wh using a 48V 200.5Ah battery. Supporting components such as a 2,000 W inverter, 30A MPPT solar charge controller, and a series-parallel panel configuration were designed to ensure optimal system performance. From an economic standpoint, the investment cost of IDR 16,945,000 is considered feasible, with a positive Net Present Value (NPV) of IDR 1,011,835.14, an Internal Rate of Return (IRR) of 10.88%, and a payback period of 8.57 years. These results indicate that the implementation of PLTS is technically and economically viable and presents a sustainable solution for agricultural areas lacking access to PLN electricity.

Keywords: Solar Power System, Irrigation System, Guava Plantation, Technical Feasibility, Economic Feasibility