

***Performance Analysis of a Solar Photovoltaic-Based Rotary Coffee Roaster
Prototype Using an Electric Heater as the Heat Source***

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ABSTRACT

This study aims to analyze the impact of solar panel utilization on the efficiency and operational sustainability of a Rotary Coffee Roaster, evaluate machine performance, and analyze energy consumption during robusta coffee roasting. The system used a solar power plant consisting of solar panels, Solar Charge Controller (SCC), battery, inverter, heater, and DC motor as the main power source. Testing was conducted over four days by observing irradiance, panel power, PLTS component efficiency, energy consumption, roasting temperature, and roasting results. The results showed SCC efficiency of 60%, battery efficiency of 85%, and inverter efficiency of 81.9%. The 600 W heater increased roasting temperature from 55°C to 175°C with an efficiency of 21.73%, while the DC motor operated stably at an average power of 1.18 W with an efficiency of 52.20%. On one testing day, the solar panel generated 1078.2 Wh during 6 hours of charging, with 651 Wh stored in the battery. Energy used during the 1.5-hour roasting process was 411.15 Wh or 63.16% of total battery energy. The best roasting result was achieved at 90 minutes, producing a medium dark roast. Overall, the solar power system successfully supplied the roasting machine energy demand and has strong potential as an environmentally friendly alternative energy source.

Keywords: solar panel, solar power system, coffee roasting, renewable energy.