

INVESTIGATION ON PERFORMANCE OPTIMIZATION FOR SOLAR PANEL BY WATER-BASED COOLING SYSTEM

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Abstract:

The increasing demand for sustainable energy has accelerated the development of renewable energy technologies. Solar photovoltaic (PV) systems have become an important option. However, their performance is affected by high operating temperatures, particularly under tropical conditions. This study investigates the effectiveness of a water-based cooling system for solar panels, where high temperature is the major concern. Reduced power output and heat stress are some consequences of poor cooling effects which can affect PV performance and long-term reliability. This research has developed an experimental model for a water-based cooling system to optimize solar panel performance. The experimental evaluation considered different outdoor solar conditions, including variations in irradiance and ambient temperature. By using a 10 W solar panel with Voc of 22.1V and Isc of 0.61A, the efficiency and output in terms of voltage, current and power are measured. The formation of a thin water film on the PV surface reduced the operating temperature, resulting in improved voltage stability, current output, and conversion efficiency. This experiment recorded an average temperature drop of 16°C and an increase in conversion efficiency of 21%. The findings demonstrate the potential of a simple and low-cost water-based cooling approach for improving PV performance under hot and humid tropical conditions.

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