

ABSTRACT

This study presents a comparative analysis of various cooling methods applied to solar photovoltaic (PV) panels to enhance their performance and longevity. The investigated cooling techniques include pin fin attachment, phase change material (PCM) heat sink, and heat sink configurations with variant fluid flows and Nano fluids flow such as air, water, MgO, ZnO. The effectiveness of each cooling method is evaluated based on parameters such as temperature, heat dissipation, and energy of the solar PV panels. Pin fin attachment involves the attachment of extended surface fins to the surface of PV panels to increase convective heat transfer. PCM heat sink utilizes phase change materials to absorb and store excess heat during peak solar irradiation periods, thereby stabilizing panel temperature. Heat sink configurations with variant fluid flows utilize different fluids such as air, water, MgO, and ZnO to carry away the panel heat, with the incorporation of nano fluids for enhanced heat conductivity. Experimental setups are designed and conducted to compare the performance of these cooling techniques under various environmental conditions with variant solar irradiance levels. The results reveal the efficacy of each cooling system by reducing PV panel temperature and improving overall Solar- Electrical energy conversion efficiency.