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Efficiency Enhancement of Photovoltaic Panels Using an Optimised Air Cooled Heat Sink

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Abstract : Solar panels that use photovoltaic (PV) cells are popular for converting solar radiation into electricity. One of the major problems impacting the performance of PV panels is the overheating caused by excessive solar radiation and high ambient temperatures, which degrades the efficiency of the PV panels remarkably. To overcome this issue, an aluminum heat sink was used to dissipate unwanted heat from PV cells. The dimensions of the heat sink were determined considering the optimal fin spacing that fulfils hot climatic conditions. In this study, the effects of cooling on the efficiency and power output of a PV panel were studied experimentally. Two PV modules were used: one without and one with a heat sink. The experiments ran for 11 hours from 6:00 a.m. to 5:30 p.m. where temperature readings in the rear and front of both PV modules were recorded at an interval of 15 minutes using sensors and an Arduino microprocessor. Results are recorded for both panels simultaneously for analysis, temperate comparison, and for power and efficiency calculations. A maximum increase in the solar to electrical conversion efficiency of 35% and almost 55% in the power output were achieved with the use of a heat sink, while temperatures at the front and back of the panel were reduced by 9% and 11%, respectively.

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