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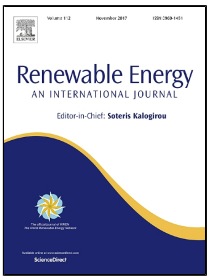

Laboratory based experimental investigation of photovoltaic thermo-control with water and its proposed real-time implementation

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Laboratory based experimental investigation of photovoltaic thermo-control with water and its proposed real-time implementation

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Abstract:

The output of Photovoltaic (PV) panel varies with panel temperature and in order to obtain uniform output from PV panels, water cooling system is recommended by several researchers worldwide. In this study, a laboratory scale experimental setup is developed (irradiance over the PV panel is varied from 87.38 W/m² to 359.17 W/m² and back to initial value in a triangular cyclic shape analogous to daytime radiation variation) for intermittent and continuous water cooling, which is tested for different flow rates. A mathematical analysis of temperature over PV panel with and without water cooling system is also done. For intermittent cooling case, three different flow rates of 3 lit/min, 5.3 lit/min, and 6.2 lit/min are used, which give an increase in total energy produced against no cooling operation of about 18 % for all the three cases. The test results for continuous cooling (wherein a fixed flow rate of 0.6 lit/min was maintained), the total energy produced increases by approximately 29 % against no-cooling operation. The proposed method of cooling the PV panels can be integrated with the water supply system of domestic dwellings. Further, a parametric study is carried out in order to choose the appropriate capacity of pump required for the operation. The proposed approach of integrating cooling of PV panels and water supply minimizes water loss (except evaporation loss) and reuses the cooling water back into the main water supply system of the dwelling. It is observed that the continuous cooling system with a water pump of appropriate capacity improves the performance of PV panels while keeping the consumption of water to minimum.

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