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Performance monitoring of a photovoltaic thermal collector system

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Abstract content
   (Max 300 words)

Photovoltaic (PV) modules convert around 15% of incoming solar radiation into electrical energy. This implies that a significant percentage of the remaining radiation is absorbed as heat or being reflected. PV modules are known to operate at temperatures as high as 60℃ when irradiance levels increase above 900 W/m2, which detracts from the STC-rated power of the modules. It is therefore worth investigating how the absorbed heat can be dissipated in a constructive manner. This study thus aims at developing a mechanism to exchange the heat absorbed by PV modules with a coolant such as water, turning the PV modules essentially into a thermal collector in addition to generating electricity. This paper presents the design and performance monitoring of a photovoltaic (PV) module when used as a thermal collector for heating water. The photovoltaic thermal system (PTS) installed at the University of Fort Hare and used for heating water comprised a 80 liter water storage tank, a perspex container at the back of the module with a volume of 14 litres and connecting pipes. The PV module used was a multi-crystalline silicon module, and its conversion efficiency at standard test conditions (STC) was noted to be 11.12%. A similar module was used as a control and preliminary findings indicate that the PV module in the PTS operate at lower temperatures resulting in higher efficiencies. Combining the electrical energy and thermal energy generated by the PTS increased the system's effective efficiency from 15% to 87%. This paper presents the performance monitoring of the PTS as compared to the equivalent PV module.

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