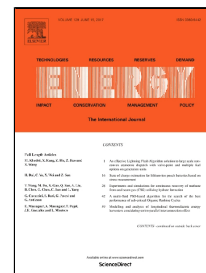


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Performance analysis of tilted photovoltaic system integrated with phase change material under varying operating conditions

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Abstract

In photovoltaic (PV) cells, a large fraction of solar radiation gets converted into heat which raises its temperature and decreases its efficiency. The heat can be extracted by attaching a box containing phase change material (PCM) behind the PV panel. Due to large latent heat of PCM, it can absorb heat without rise in temperature. It will lower down the PV temperature and will increase its efficiency. The available numerical studies analysed the vertical PV-PCM systems. However, PV panels are generally tilted according to latitude of the place. Thus, in the current work, performance analysis of the tilted PV-PCM is carried out. The effects of tilt-angle, wind-direction, wind-velocity, ambient-temperature and melting-temperature of PCM on the rate of heat extraction by PCM, melting process of PCM and temperature of PV-PCM system are also studied. The results show that as tilt-angle increases from 0° to 90°, the PV temperature (in PV-PCM system) decreases from 43.4°C to 34.5°C which leads to increase in PV efficiency from 18.1% to 19%. The comparison of PV-PCM with only-PV is also carried out and it is found that PV temperature can be reduced by 19°C by using PCM and efficiency can be improved from 17.1% to 19%.

Keywords

Phase change material; Photovoltaic; Thermal management

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