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| Title | Numerical and Experimental Investigation on the Performance of a Photovoltaic Thermal Collector with Parallel Plate Flow Channel under Different Operating Conditions in Malaysia | | |
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| Published Journal Name | Solar Energy | | |
| Type of Publication | Journal | | |
| Volume | 144 | Issue |  |
| Publisher |  | | |
| Publication Date | January 2017 | | |
| ISSN | 0038-092X | | |
| DOI |  | | |
| URL |  | | |
| Other Related Info. |  | | |
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| Abstract |  |
| Solar energy is universally accepted as the most potential alternative power source due to its inexhaustible availability, diverse conversion technology and environmental friendly nature. Hybrid photovoltaic-thermal (PV/T) system is an optimized solar energy system that produces electricity and thermal energy simultaneously from the same physical profile. The basic problem of the hybrid collector is the removal and transfer of heat in an efficient way. In this article, PV/T system with a novel design of thermal collector excluding the absorber plate has been introduced to resolve the above mentioned problem. A parallel plate thermal collector without absorber plate has been attached directly to the PV module backside by means of thermal paste only and the performance of the PV/T is evaluated numerically and validated by experimental data for different operating conditions. A 3D numerical analysis of the PV/T system has been performed using finite element method (FEM) based software COMSOL Multiphysics\_. The outdoor experimental investigation has been done under the typical climatic condition of Malaysia. Elevation head of water has been employed to ensure passive cooling of PV module. The numerical simulation results are found in well agreement with those of experimental measurements. Thermal performance of PV/T without absorber plate is found almost as good as that with absorber plate. The numerical and experimental values for maximum overall efficiency of the PV/T system was found 84.4% and 80%, respectively under the irradiation level at 1000 W/m2 with both inlet and ambient temperatures being 34 \_C. The developed simulation model can be extended for other designs of thermal collector using different materials. | |