

Modeling and simulation of a photovoltaic/thermal hybrid system using different back-pipe structures

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Abstract

This paper presents a new approach in modelling a photovoltaic/thermal hybrid system based on Finite Element Method (FEM). Comsol Multiphysics, a commercial simulator based on FEM, and MATLAB simulation tools are used to implement this electro-thermal model. An optimization process takes place for the water back pipes regarding its material, shape and pipe diameter for maximum conversion efficiency and rate of heat transfer. In addition to that current-voltage and power-voltage characteristic curves are plotted and the device electrical parameters (open circuit voltage, short circuit current, fill factor) are calculated for different topologies. The thermal analysis takes place through studying the heat transfer effect and plotting the input/output temperature variation for different configurations. Finally the rate of heat transfer is calculated and plotted showing the leading of one structure over the others.

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