

Modeling of a Concentrating Photovoltaic Module with and without Cooling System

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Abstract : Concentrating photovoltaic systems CPV use optical elements, such as Fresnel lenses, to concentrate solar intensity. The concentrated solar energy is delivered to the solar cell from 20 to 100 W/cm². Some of this energy is converted to electricity, while the rest must be disposed of as a residual heat. Solar cells cooling should be a necessary part of CPV modeling because these systems allowed increasing the power received by the cell. This high power can rise the electrons' potential causing the heating of the cell, which reduces the global module's efficiency. This work consists of modeling a concentrating photovoltaic module with and without a cooling system. We have established a theoretical model based on energy balances carried out on a photovoltaic module using solar radiation concentration cells. Subsequently, we developed a calculation program on Matlab which allowed us to simulate the functioning of this module. The obtained results show that the addition of a cooling system to the module improves greatly the performance of our CPV system.

Keywords : solar energy, photovoltaic, concentration, cooling, performance improvement

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