Modeling and Simulation of Energy Recovery from a Photovoltaic Solar cell

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Abstract.

Photovoltaic (PV) solar cell which converts solar energy directly into electrical energy is one of the feasible alternative sources to fossil fuel. This study aims at predicting the energy recovery from a typical photovoltaic solar cell, BP 3 series 235 W solar panel, by developing a reliable mathematical model of the solar panel which could represent the real systems. The model equation was solved using the 'solve block' tool in MathCAD 14 software and validated by physical data obtained from literature. Using the model developed the effects of temperature and solar irradiance on performance of PV solar panel was investigated using nominal conditions of 298 K and 1000 W/m^2 as basis. Temperature was varied between 273, 298, 323, 348 and 373 K at constant irradiance of 1000 W/m^2. Solar irradiance was also varied using 200, 400, 600, 800 and 1000 W/m^2 while maintaining temperature at 298 K. The energy recovery from the PV model was evaluated using the fill factor concept. From the analysis of results, there is some agreement between the simulation results and the reported experimental performance of the PV solar panel. The performance of the PV system increased with increase in temperature and solar irradiance. In purview of values of solar irradiation (200 – 1000 W/m^2) and temperature (273 - 373 K) that were studied, the energy recovery was maximum at 79.98% which agrees with values of between 75 and 85% obtained in practical solar cells.

Keywords: *Photovoltaic, Mathematical model, Energy recovery, Simulation*

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