

The Efficiency Estimate of PV Cell under various wind velocities

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Abstract. It is a good chance to harness solar energy for Vietnam to geographic location is near to the equator with the high intense radiation. Photovoltaic (PV) cell is the device to convert directly solar energy into electrical energy. However, its efficiency is strictly impacted by the PV cell surface's temperature which depends on wind velocity, surrounding temperature, radiation and dust. For a long time, computational modelling has been a good choice for engineers to simulate their products. Currently, some softwares like Ansys Fluent, Comsol Multiphysics are chosen to simulate the thermal performance of product. In this paper, authors used Computational Fluid Dynamic (CFD) – Autodesk to estimates the PV cell temperature, then find out its corresponding efficiency. A 3 dimensions model of PV cell with some layers was created by Inventor software, and then simulated under various wind velocities like 0.5m/s, 1.5m/s, 2.5m/s, 3.5m/s, 4.5m/s, 5.5m/s and 6.5m/s to find out the PV cell corresponding temperatures. The solar radiation parameter in Ho Chi Minh city in April was established for simulation. With the same surrounding temperature at 30°C, the result shows that the highest PV cell surface's temperature of 84.8°C with wind velocity of 0.5m/s will drop to 49.81°C with the wind velocity of 3.5 m/s. When the wind velocity is continue increased, the drop of temperature is trivial. The PV cell efficiency at wind velocity of 6.5m/s is only 2.75% higher than that of wind velocity of 3.5m/s. Therefore, when choosing cooling PV cell by air, the air velocity should be chosen at 3.5 m/s to save energy.

Keywords: Solar Energy, PV cell, CFD.

1. Introduction

Viet Nam locates near the equator with the high intense radiation. Therefore, harnessing this free energy is the good way to save energy. Most of applications in solar energy is in the hot water supply. It can be exploited nearly every area of Viet Nam [1]. Besides, PV power is one of the viable energy to replace the traditional fossil fuels which strongly affect the environment. The PV cell is manufactured by following the Standard Test Condition (STC) which indicates that the solar radiation is 1000 W/m², panel temperature is 25°C and light spectrum with an air mass is 1.5. With this condition, the PV cell generates its maximum power named Watt-peak [2]. However, the local weather will affect these parameters and make its efficiency reduced. PV cell temperature is one of the major reasons which reduce PV cell's

