INFLUENCE OF TEMPERATURE AND RADIATION ON THE ELECTRICAL CHARACTERISTICS OF A PHOTOVOLTAIC CELL

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The purpose of this article is to explain the differences between different irradiance settings with different tilt angle adjustments. It was shown that the annual cumulative solar radiation energy received with a monthly tilt angle can be approximately 7% higher than that achieved with a yearly tilt angle setting. Furthermore, seasonal and biennial tilt angles have approximately 6% higher annual cumulative radiation absorption than a yearly tilt angle setting. Moreover, considering similar monthly received irradiance, the results show that the received irradiance with a monthly tilt angle setting was 20% higher in the summer months than with an annual tilt angle adjustment.

Keywords: *photovoltaic panel; solar; optimal tilt angle; energy; solar cells, temperature, radiation, efficiency, MATLAB, modeling*.

1. Introduction

Solar panels are devices that convert solar radiation into electrical energy without harming the environment. In order to predict the actual behavior of solar cells, such as changes in maximum power, short-circuit current and open-circuit voltage, by changing temperature and irradiance, can be studied using MATLAB (simulation model). In this paper, a single-diode MATLAB model is used to study the changes in the solar photovoltaic module with changes in temperature (100 ° C, 200 ° C, 300 ° C) and changes in irradiance (400 W/m^2 , 600 W/m^2 , 800 W/m^2) [1-3]. To study the changes in the electrical parameters of the KD 330 GX - LFB and KD 325 GX - LFB solar photovoltaic modules, experimental data are taken, the results of which are discussed in the conclusion. The average annual variation of the extraterrestrial solar radiation level is 1367 W/m^2. On the other hand, the level of solar radiation falling on the Earth is less than the level of extraterrestrial solar radiation and varies depending on the geographical location of countries [7]. Changes in atmospheric conditions, such as the level of solar radiation and temperature during the day, have a great impact on the efficiency of the panel. Therefore, it is very important to know the level of solar radiation and the effect of temperature on the photovoltaic panel. However, in the catalogs, which are carried out in laboratory conditions and are called standard, the panel manufacturers only provide the electrical characteristics of the

photovoltaic panel at a solar radiation level of 1000 W/m^2, a cell temperature of 25 ° C and an air mass flow rate of AM 1.5. As a result, the electrical parameters of the photovoltaic panel, which differ from STC, are unknown. It is necessary to know the electrical parameters of photovoltaic panels under atmospheric conditions. Taking these conditions into account, especially when designing autonomous and grid-tied systems, will give more accurate results [8, 9].

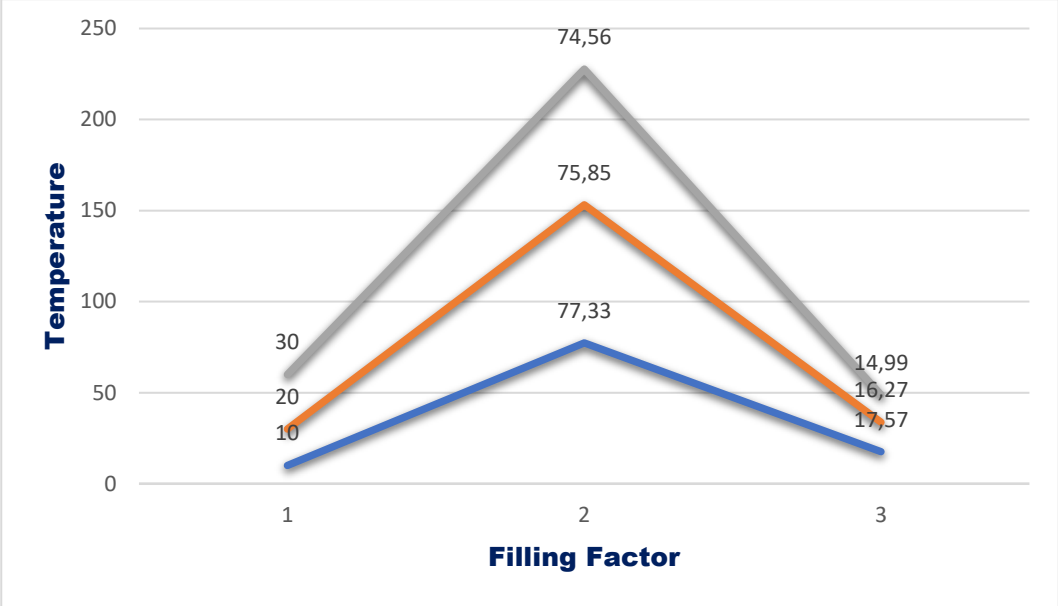


Fig. Change in efficiency depending on temperature:

Changing the KYOCERA Temperature KD 330 GX - LFB may be observed for temperatures of 100 ° C, 200 ° C, 300 ° C, and the changes in P_{max}, V_{mp} , I_{mp}, V_{oc}, I_{sc} are taken from the IV, PV graphs and these values are summarized in Figure. Resistances for the Simulink model KD 330 GX - LFB were determined using the Newton - Raphon method, their values are $R_p = 493.206$ Ohm and $R_s = 0.2500$.

References

1. Stanford, J. M. Solar Electric Systems. - M.: Energy, 2016. - 512 p.
2. Kalogirou, H. Solar Energy Engineering: Processes and Systems. . — 2nd ed. — Oxford: Elsevier, 2014. — 540 p.