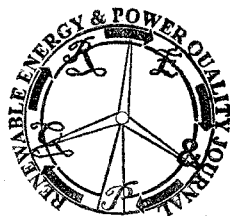


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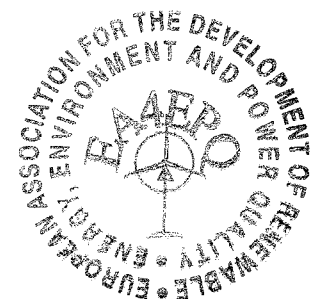
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The effect of surface impurities on photovoltaic panels

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Abstract. This paper deals with the surface impurities that occur onto operating solar cells, a widespread problem. The depositions on the photovoltaic cells, represented by dust and dirt which appear inevitably, lead to deterioration over time or to the decrease of efficiency of the panels that contain the affected cells, and as a result there are losses that appear in the system. Some local depositions create shady areas, causing significant overheating which is experimentally highlighted.

Key words

renewable energy, solar cells efficiency, the effect of the impurities, thermo-vision, model.

1. Introduction

The depositions left by birds, pollution and the dust caused by traffic or from the agricultural activities accumulate rapidly and can reduce the efficiency of the photovoltaic cells by 20% during a dry summer. Other factors such as panel orientation or panel surface material can contribute to the deposition of the impurities. The rules for maintaining the photovoltaic panels are simple, maintaining their surface permanently clean being an important aspect. The deposits left by birds or the fallen leaves should be often removed, because the cells overheat due to the energy of the other covered cells around them, this situation leading to a permanent or long-term failure. The fact that panels should not be shaded is to be taken into account, because the slightest shadow of a panel portion may lead to a decrease in yield by 50%. [1]

To illustrate the statements above, there were made measurements using the thermo-vision camera TI20, Fluke product, and simultaneously simulations using Comsol

Multiphysics software, in order to observe the behavior of the covered cell during the operation.

The main purpose of this paper is outlining the losses that occur in the solar cells due to the depositions and to the shadings, as a result of their heating.

2. The effects of the deposition on the solar cells surface - experimental determination

The experimental determinations were made on polycrystalline panels Schott Solar - AES-275-DG-FT located within the Faculty of Electrical Engineering, Politehnica University of Bucharest.

Using the thermo-vision camera it was noted that any deposit or defect in the structure of the panel leads to a heating of the affected area compared with the rest of the panel (Fig.1). Thus, there have been taken some parts of solar cells for study that contained depositions left by birds, which can cause both temporary defects by their mere presence on the surface of the photosensitive cell and permanent defects on the structure of the affected area. The images below, figures 1 and 2, illustrate the best the temperature difference existing between the covered areas and clean areas. In the image captured with the thermo-vision camera it can be clearly observed that the covered surface has the temperature increase up to 10 °C, namely from the normal temperature of the panel (27.8 °C) with no deposits, to the temperature of 37.5 °C, recorded on the dirty area. The temperature variation on the surface of the panel is presented also by the temperature histogram shown by the camera (Fig. 3). Where it can be easily noticed that the last