

# СЕКЦИЯ 1. ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В НАУКЕ И ПРОИЗВОДСТВЕ

UDC 721.001

## THE INFLUENCE AND EFFECT OF DUST ACCUMULATION ON PHOTOVOLTAIC PANEL EFFICIENCY

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### I. Introduction

Most of the countries nowadays are shifting to move towards the natural resources of the energy developed from renewable energy free resources. The sunshine and irradiance in many countries are mostly available around the year and that drive many nations to be more interested in implementing a sustainable energy production.

As it has been noted, solar panels are considered as one of the sustainable alternatives to fossil sources. However, and as per many research themes they still lack to achieve an excellent efficiency where the maximum can extract power. In a theoretical calculation we may reach up to 29 % efficiency on commercial PV, however those results may reach a maximum of 26 % in an actual study.

The increasingly use of renewable energy sources will help to reduce the dependence on fossil fuels and their adverse impact on the environment. Among the different types of renewable energy sources, the solar PV energy has experienced the fastest growth over the last years due to the cost reduction of PV modules, which has made large-scale PV plants costeffective in several regions worldwide [1].

Many resources are available to accomplish the goals of generating free and clean energy such as solar panels/PV systems, wind generators, biomass plants and fuel cells. However, the most well renowned of these sources of energy production is mainly the PV systems.

According to many conducted researches it was revealed that dust and dust deposits effects the solar panels by dropping the solar power down by 40 % and this is considered to be a waste of the extracted power in a PV system. This waste of power comes from the fact of the accumulated dust deposits that are formed on a solar system due to the humidity/dew. This humidity forms a layer of salty droplets and dust particles that stick on the solar panel surface [2].

This will lead to the following: the solar radiation will get affected by being dispersed and eventually absorbed by the dust deposits which will lead to less power extraction through a PV system. In this research we will analyze and describe how different environmental factors affect the performance of solar PV system.

Multiple factors may affect and being accountable for the efficiency degradation as a whole. Some of those effects may be listed but not limited to; environmental, operational, installation and maintenance parameters, knowing that the biggest challenge is

when we deal with the environmental factor. In this case it affects the PV system generated output power due to the reduction of the solar irradiance when an accumulation of dust particles starts to build up on the solar panels. Other parameters may be considered as well, however are not considered in this paper such as shading, humidity and so forth (fig. 1). Shows how the impact of dust particles accumulate on a solar panel.



Figure 1 – Impact of dust on solar panels

## II. Accumulation of Dust and its affecting factors on PV systems

There are many parameters involved in the accumulation of dust on solar panels that would cause the PV module to lose power. This would depend on a set of various parameters such as: dust properties, wind velocity, ambient temperature and humidity, and solar panels tilt-angle orientation [3]. This is illustrated in fig. 2.

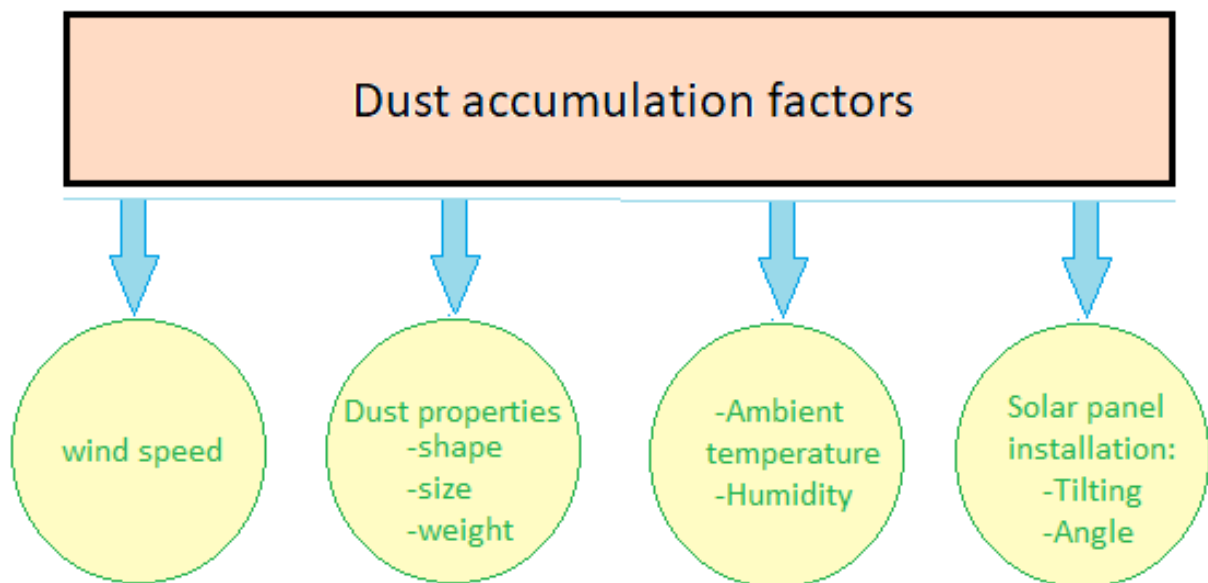


Figure 2 – Dust accumulation factors

### 1. Wind speed and tilting.

This natural factor, the wind may hit the solar panel base and deposition it. This deposition may be set in a location to assist more dust to accumulate on the surface of the solar panel. The amount of accumulation of dust depends on the size of dust and the speed of wind. The tilting position has an influence on decreasing dust particles

from accumulation as the installer select a proper inclination angle shifting from zero and ninety degrees ( $0^{\circ}$ – $90^{\circ}$ ). The closer the tilt angle to  $90^{\circ}$  the more efficient the drop of dust from the surface of solar panels [4].

## 2. Dust property.

When photons number decrease due to dust particles accumulation, the short circuit current ( $I_{sc}$ ) drops and this would lead to a drop in the maximum power generated. This drop depends on the type of dust particles, its size, and the density of dust particles attached to the solar panel surface.

## 3. Factors accounting to environmental parameters.

Some of those factors are related to parameters such as humidity, the influence of dust storms, and the amount of dew which would result in increasing the stick of dust particles on a solar system panel [5].

## References

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