# DESIGN SOLAR WIPER MECHANISM TO INCREASE ELECTRIC GENERATION AND IMPROVE THE PERFORMANCE

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**ABSTRACT**

There were studies that showed that the accumulated dust can reduce the performance of solar panels, but the results were not clearly quantified. The objective of this research was not study the effects of dust accumulation on the performance of solar PV panels.It were found from the study that the accumulated dust on the surface of PV solar panel can reduce the systems efficiency by up to 50% so it is very important to remove dust from the solar cells. With the help of wiper on the basis of object able sensor we can remove dust from solar panels and increase the efficiency of solar cells.

***Key Words: -*** *Solar Energy, Dust, Radiation, Wiper Mechanism, Photovoltaic Module, Efficiency.*

## I. INTRODUCTION

As mentioned previously, dust plays a significant role in decreasing the PV power output in desert areas. Thus, achieving good energy collection efficiencies requires constant cleaning of the PV modules. Normally water is used in the cleaning process and in arid regions the lack of water calls for alternative cleaning processes that can minimize the amount of water required. Sustainable cleaning methods are particularly important in large scale utilization of PVs.There is a variety of methods that can be used to clean the PV modules. Manual cleaning is the most obvious, but it comes at the cost of labors and it is the most time consuming method. Automatic cleaning, using special robots, is also an option that is studied. An alternative that is being extensively investigated relies on the use of self-cleaning coatings that minimize dust accumulation. Studies show that super-hydrophobic surfaces exhibit self-cleaning properties.

## II OBJECTIVE: -

The main objectives of the thesis are as fallow

1. Project Goals: Design a mechanism to detect obstructions on solar panels causing significant loss of power.

2. Design a cleaning mechanism that runs across the length of the panels.

3. Improve overall solar panel efficiency.

## III. METHODOLOGY

The surface characterization included testing of the optical and the morphological properties of the coating, and the water contact angle. In this part of the experiment

the coating was applied on a small glass sample and the coating was then studied.At the same time outdoor testing was performed by comparing the power output between two identical PV modules: a coated and uncoated one.

## IV. TEST PROCEDURES

It is very important to ensure that the PV module surface treatment does not affect the transmittance of the PV glass cover. We tested the optical properties of the coating using two different techniques. The first test[3] employs three identical Licors[4] (pyranometers) were used to compare the values of solar irradiation, solar irradiation through an uncoated glass and solar irradiation through a coated glass.Figure 31 shows the Licor setup, with one extra Licor. Two Licors were covered with glass slides (coated and uncoated)

**Site information**

The effectiveness of clean surfaces its ability to reduce dust accumulation or reduce the amount of water necessary to clean the PV modules. For this reason, we compared the daily energy output of a clean and unclean module at the solar PV test field located at Bhopal City.

| | |
|---|---|
| Site Name | LNCT BHOPAL INDIA |
| Coordinates | 23° 12' 45.29"N, 77° 24' 32.62" E |
| Elevation | 532m |
| Slope inclination | 1° |
| Slope azimuth | 340° north |
| Annual global in plane irradiation | 2067 kWh/m² |
| Annual air temperature at 2m | 24.8° C |

**System description**

| | |
|---|---|
| Installed power | 120.0 kWp |
| Type of modules | c-Si |
| Mounting system | Fixed mounting, free standing |
| Inclination | 180° (south)/23° |
| Inverter euro eff. | 96.0% |
| DC/AC losses | 5.0% / 2.0% |
| Availability | 95.0% |

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**PERFORMANCE CRITERIA**

When the control PV is clean, any difference in energy produced by the two PVs is due to dust accumulation only since the test and control PVs are identical and operate under the same conditions. We used the normalized energy difference as an indication of the dust accumulation.

$$\eta_{max} = \frac{P_{max}}{E * A_c} \text{ X } 100\ \%$$

**Experimental analysis**

| | |
|---|---|
| Model No. | Jakson 24×315 |
| Max. Power | 315Wp |
| Max. Power voltage | 37.8 V |
| Max. Power current | 8.34 A |
| Short circuit current | 8.85 A |
| Open circuit voltage | 45.6 V |
| Max. System voltage | 1000 V |
| Weight | 22 Kgs |

Efficiency of the single solar panel :-

$$\eta_{max} = \frac{P_{max}}{E * A_c} \text{ X } 100\ \%$$

peak power- 315 W

solar irradiation- 1000W/m²

Area of the panel- 2.4168m²

**Efficiency=315/1000×2.4168 = 0.13033×100 = 13.03%**

From above calculation we got that the solar panel maximum efficiency is 13.03%.

- When we taken the reading of solar panel without dust on 20/02/2018 we observe that efficiency of the single panel is 10.6%.

**Compare the result with the help of graph**

1- On the basis of **Avg. Irradiance w/m²**

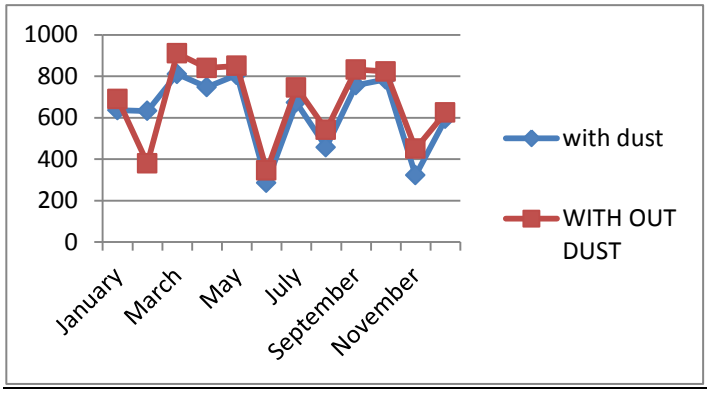
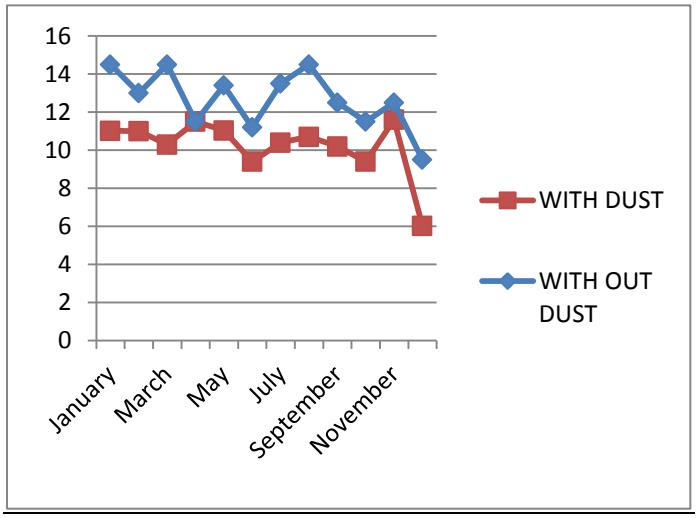



**Figure comparison of power through one year**

**On the basis of Efficiency [%]**




**Figure;- comparison of Efficiency through one year**

**Summary and Conclusion;-**

The objective of this research was to develop a model that describes dust accumulation in order to understand the factors that affect the utilization of PVs in an area with high dust concentrations. We started by developing a simple regression model that describes the power output of a PV, and then using a simple technique we were able to correct for the effect of incident angle without the need for any experimental work (described in chapter 2).Then we moved on to tackle the problem of dust accumulation by trying to relate the rate of dust accumulation to different weather conditions. Our data set limited ourability to statistically verify our model. Therefore, we described ways in which we can improve our experimental setup and the different parameters that need to be studied in order to be able to develop a model that describes dust accumulation

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