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Improving the performance of solar plate with the solar wiper to increase electric genration

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Abstract

Effective shooting of solar energy is of great importance as phase of discovering a answer for the ever-increasing demand for energy coupled with the depletion of resources of fossil fuels. The area of Bhopal city in the india is related with distinctly high levels of atmospheric dust concentrations. This causes high costs of dirt accumulation on photo voltaic collectors, which decreases the whole energy yields. Therefore, minimizing the quantity of dust that accumulates on pinnacle of the solar collectors is of outstanding importance for photo voltaic electricity utilization in widespread and for the Masdar Initiative and Bhopal City in particular.

The objective of this lookup used to be to advance a mannequin that describes dust accumulation in order to understand the elements that affect the utilization of PVs in an area with high dirt concentrations. Subsequently, we moved on to address the hassle of dirt accumulation through trying to relate the rate of dust accumulation to special climate conditions. Although our facts had a restrained time resolution, we managed to describe qualitatively the dust accumulation dependence on numerous weather parameters. We additionally proposed a new experimental framework that improves the time decision of our experimental setup that approves collecting the one of a kind parameters that want to be studied in order to be able to advance a quantitative model that describes dirt accumulation. A mannequin for dust accumulation mixed with a mannequin that describes the PV strength output willenable us to better predict the energy output and energy yields on one hand, and to optimize the cleansing of PV modules on the other. Also such a mannequin will assist us in developing functionalized coatings that reduce dirt accumulation via figuring out and appreciation the elements that affect dirt accumulation.A cleansing machine for Solar panels consists of a variety of solar cells and a transparent protection pane protecting the Solar cells. The cleaning system consists of a frame, a cleansing device, and an working device. The frame includes a first sidewall and a opposite 2d sidewall facing away from the first sidewall. The cleansing system is affixed on the transparent protection panel. The operating system consists of a motor, a pulley and a belt. The motor is affixed on one cease of the first sidewall. The pulley is affixed on the different stop of the first sidewall. The belt is wrapped around the rotating shaft of the motor and the pulley. The cleaning gadget includes an axle linked to the running device and a washer supplied on the axle. The cleaning gadget is pushed by way of the running gadget to easy the Solar panel.

Keywords

Parabolic trough and Fresnel collectors, Evacuated tubes.

1.Introduction

Effective shooting of photo voltaic strength is of Understanding the factors that have an effect on dust accumulation, namely, weather conditions, is the first step to obtain three necessary targets: 1- creating correct electricity output predictive models through incorporating the drop in power due to dirt when modeling the PV's electricity output, 2- Optimizing the cleansing value of the photo voltaic collectors and 3- Developing coating with self-cleaning homes (summarized in *Figure 1*).:

significant importance, as part of discovering a answer for the ever-increasing demand for electricity that is coupled with the depletion of resources of fossil fuels. The format is to have a hundred percent of the electricity used in Bhopal City generated via renewable resources. *Figure 1* suggests the proportion share of the specific planned sources of strength technology at Bhopal City. Three out of four of these sources count number on photo voltaic energy, namely: evacuated tube collectors, targeted solar energy and photovoltaics, comprising ninety two percent of the whole share. The vicinity of Bhopal City in the India is associated with tremendously excessive levels of atmospheric dust concentrations. This reasons excessive quotes of dirt accumulation on photo voltaic collectors. A quantity of problems are related with dirt accumulation on photo voltaic collectors and can be summarized in the following points.

The location of Bhopal City in the UAE is associated with relatively high levels of atmospheric dust concentrations. This causes high rates of dust accumulation on solar collectors. A number of problems are associated with dust accumulation on solar collectors and can be summarized in the following points:

1. A drop in the total energy yield, which reflects on the energy supply of the city.
2. Difficulty in predicting the power output due to dust accumulation losses.
3. Time and cost associated with cleaning solar collectors.

Therefore, minimizing the amount of dust that accumulates on top of the solar collectors is of great importance for the Bhopal Initiative and in particular for Bhopal City.

In order to be able to resolve the problem of dust accumulation, we first need to understand the dynamics and various factors that affect dust accumulation.

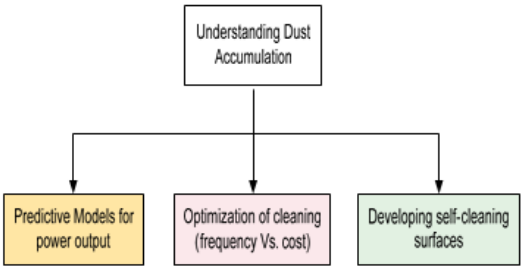

Figure 1 Dust accumulation

Understanding the factors that have an effect on dust accumulation, namely, weather conditions, is the first step to obtain three necessary targets: 1- creating correct electricity output predictive models through incorporating the drop in power due to dirt when modeling the PV's electricity output, 2- Optimizing the cleansing value of the photo voltaic collectors and 3- Developing coating with self-cleaning homes (summarized in *Figure 1*).

2.Effect of dust accumulation on the efficiency of solar collectors

Power output from solar collectors are affected by dust accumulation whether solar thermal collectors (e.g. flat plate, evacuated tubes, parabolic trough and Fresnel collectors), or electric solar collectors (e.g. PVs and concentrated PVs). Deposition of dust on the surface of a solar collector can act in two different ways, the first being in reducing the amount of solar radiation by reducing the transmittance of the glass cover in non-concentrating collectors, see [1], [2], [3] and [4], and the second being in reducing the concentrating ability (e.g. reflectivity or convergence) of the concentrating optical system (e.g. mirrors and lenses) in concentrating solar collectors, see [5], and [6].

Power output from photo voltaic collectors are affected with the aid of dirt accumulation whether photo voltaic thermal collectors (e.g. flat plate, evacuated tubes, parabolic trough and Fresnel collectors), or electric solar collectors (e.g. PVs and focused PVs). Deposition of dirt on the surface of a photo voltaic collector can act in two specific ways, the first being in reducing the amount of photo voltaic radiation by using decreasing the transmittance of the glass cover in non-concentrating collectors, see [1], [2], [3] and [4], and the 2nd being in decreasing the concentrating potential (e.g. reflectivity or convergence) of the concentrating optical machine (e.g. mirrors and lenses) in concentrating solar collectors, see [5], and [6].

The drop in strength due to dirt accumulation varies, and two as argued two by means of El-Shobokshy [5], the impact of dust accumulation on the collectors' performance is difficult to generalize due to the fact it relies upon on elements such as: 1- fabric and size of dust particles, 2- orientation of the floor with admire to the dominant wind direction, 3- wind speed, 4- humidity, 5- distribution of dust on the floor [g/m2] and 6- the tilt of the collector from the horizontal. In addition to the previous, other factors can additionally be argued to make contributions to the problem in generalizing the effect of dust accumulation such as: 1- the geographical position which impacts dirt awareness ranges 2- seasonal effect, see [7] 3- temperature, 4- collector's floor homes (e.g. fabric kind and surface roughness), 5- amount of sand that is already on the surface (accumulation history) and 6- whether the collector is a stationary or a tracking collector.

Background

Previously mentioned, the contemporary lookup addresses three major areas, namely: 1- grasp dirt accumulation and correlating dirt accumulation with weather conditions, 2- creating a regression model that describes the most energy output of a PV module as a characteristic of climate conditions, 3- Testing a functionalized coating and its capability to limit dust accumulation. The following offers a historical past about the modern-day and preceding lookup in these areas.

History

A cleansing device for Solar panels includes a quantity of photo voltaic cells and a obvious protection pane masking the Solar cells. The cleaning gadget includes a frame, a cleansing device, and an operating device. The body includes a first sidewall

and a opposite 2nd sidewall facing away from the first sidewall. The cleaning device is affixed on the transparent safety panel. The working gadget includes a motor, a pulley and a belt. The motor is affixed on one give up of the first sidewall. The pulley is affixed on the different stop of the first sidewall. The belt is wrapped round the rotating shaft of the motor and the pulley. The cleaning machine includes an axle connected to the operating machine and a washer provided on the axle. The cleaning device is driven by means of the operating gadget to clean the Solar panel [8-14].

3.Solar module technologies: mono C-Si

Multi crystalline-silicon (Multi c-Si) PV modules have dominated the world PV market over monocrystalline-silicon (Mono c-Si) due to the value advantage, however, high effectivity Mono c-Si modules have began closing the value gap.

According to Paula Mints, SPV Market Research, in 2016 Multi c-Si had the biggest share at 54 percentage of global module shipments. However, in 2017 Mono c-Si is expected to have a 49 percent share, bypassing Multi c-Si.

Mints stated that in 2016 manufacturers commenced including passivated emitter rear contact (PERC) mono (P-type) capability due to the fact it gives more margin manipulate via slightly higher manufacturing expenses and an capacity to slightly extend prices. New additions of mono PERC capability began coming on-line in 2017. “The style is mono’s taking more market share and it will continue in 2018. PERC has come to be a mature technology and will be put greater in mass production,” stated a spokesperson for JinkoSolar, a vertically built-in solar manufacturer.

LG Solar, some other solar company, echoed the fashion of Mono c-Si, however with N-type. “LG has invested closely on N-type Mono-Si technology and will proceed to do so due to the fact it brings the most fee to customers in terms of value versus efficiency,” stated David Chang, Director of U.S. Sales for LG Electronics’ Solar Business.

Solar Wiper

A cleaning system for Solar panels includes a number of solar cells and a transparent protection pane covering the Solar cells. The cleaning system includes a frame, a cleaning device, and an operating device. The frame includes a first sidewall and a opposite second sidewall facing away from the first sidewall. The cleaning device is affixed on the transparent protection panel. The operating device includes a motor, a pulley and a belt. The motor is affixed on one end of the first sidewall. The pulley is affixed on the other end of the first sidewall. The belt is wrapped around the rotating shaft of the motor and the pulley. The cleaning device includes an axle connected to the operating device and a washer provided on the axle. The cleaning device is driven by the operating device to clean the Solar panel.

An Automatic (Auto) Photovoltaic (PV) Solar Panel Washer comprising a main carrier joined by a connecting member to the main mast. A main hydraulic cylinder system comprising one or more hydraulic cylinders and connector arrangement on the main mast raises the main mast up or pushes it down, activating the connecting member, thereby raising or lowering the main carrier. The positioning hydraulic cylinder determines the angle of the main carrier by pushing one end down or bringing it up. A rotating device assembles rest position over its stationary post. The main carrier comprises a rigid frame with attachments including a cleaning rotates the main Mast and main carrier clockwise or counter-clockwise from assembly consisting of air cylinders with cleaning wiper sys Publication Classification term, tracks for the air cylinder shafts, wash material pipes with spray devices attached, rinse material pipes with spray devices attached, and compressed air drying pipes with air spray devices[15-17].

Figure 2 Solar plates

Experimental setup

As discussed in chapter 1, in order to make the best use of the solar resource available, PV panels (and any other solar collector) needs constant cleaning. We also discussed several ways that can be used to clean the solar collectors. Using passive methods of cleaning such as using the so called self-cleaning surfaces translates into less maintenance, less time consumption and more ease. Any self-cleaning

coating should be suitable for the specific region to be utilized in.

Site information

The effectiveness of clean surface 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.

Table 1 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

Table 2 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%

Table 3 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 :

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

peak power- 315 W
solar irradiation- 1000 W/m²
Area of the panel- 2.4168 m²
Efficiency = 315/1000×2.4168 = 0.13033×100 = 13.03%
From above calculation we got that the solar When we taken the reading of solar panel without dust on 20/02/2018 we obserb that efficiency of the single panel is 10.6%.

Table 4 Efficiency of the single panel

Month	**Date**	**Time**	**Irradiance [w/m²]**	**Power [w]**	**Avg. Irradiance w/m²**	**Avg. Power**	**Efficiency [%]**
February	20/02/2018	12:00	836	213	782,5	201,8	10,6
		14:00	729	190,06			
February	21/02/2018	12:00	709	164,02	676	154,31	9,4
		14:00	643	140,6			

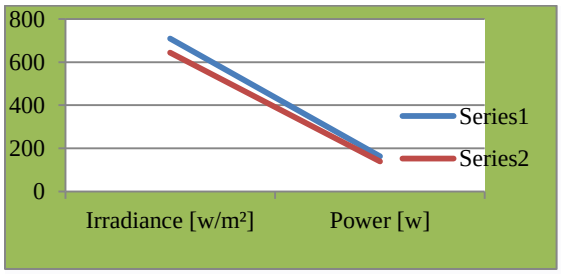

Figure 4 Avg. Irradiance w/m² and Efficiency

We analyse is the solar wiper to clean the panel automatically through which drop in efficiency will reduce. There is a animated solar wiper which we can use it on solar panel.

Figure 5 Automated cleaning system

On the basis of Avg. Irradiance w/m²

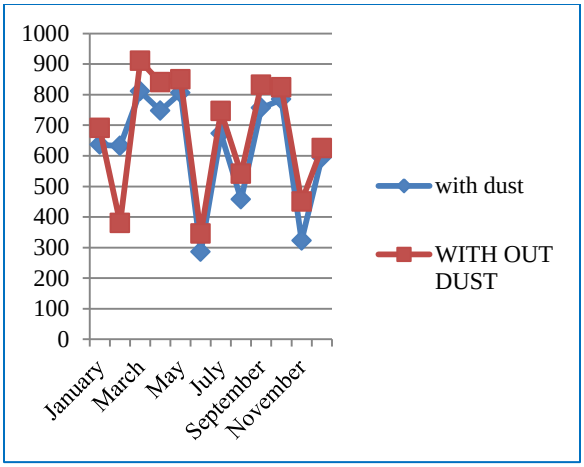

Figure 7 Comparison of power through one On the basis of Efficiency [%]

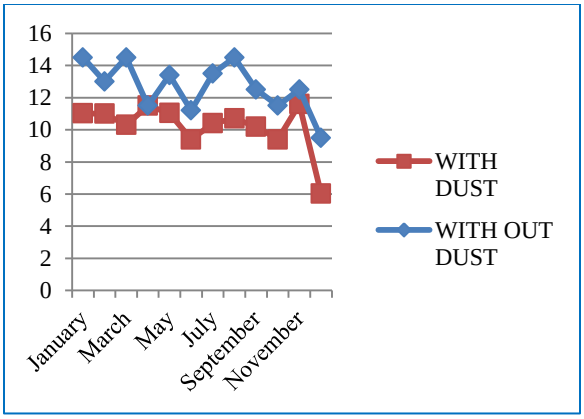

Figure 8 Comparison of efficiency through one year

4.Results and conclusions

It was found from the study that the accumulated dust on the surface of the photo voltaic solar panel can reduce the system efficiency by up to 24.3%.

The solar wiper will increase the efficiency of the panel while cleaning the dust particle to me .
In the Figure 7 and Figure 8 we see the power and Efficiency more compare to the dust solar panel so it is necessary to remove dust from panel to improve efficiency of solar plate.

The fully assembled system was able to detect a shaded cell from debris. Furthermore, it initiated the wiper motion down and up the panel to clear the debris. Also, the system maintained the battery charged when there was no cleaning and sufficient power was available.
More importantly, the project decreased the daily energy lost compared to the case where the PV panel was left shaded for an entire day. In order to determine energy savings, the PV Panel was placed under a solar test bed under identical conditions to test the energy loss from one half shaded g a cell. The losses due to shading alone was determined by taking the difference between the maximum power of the unshaded PV Panel and the maximum power of with one PV cell half shaded. The power losses of the entire Automated Self-Cleaning Solar Panel was also measured. Energy loss was normalized for one day of operation with one cleaning cycle.

5.Future work

Even though our project worked perfectly and was functioning as initially planned, there are still a lot of improvements that can be made to make it more marketable and efficient.

- First of all, we would like to deal with reducing the friction losses in our project. It is something we did not account for since our panel was prepared by the ECE Machine Shop. We could use a better, and more lubricated ball-screw which would significantly reduce our friction losses.
- We would also work on making our project more marketable by designing and ordering a PCB. This would make our circuit look neat, and would also reduce its size considerably.
- We would like to make our DMU more universal. We could make our DMU wireless, which would allow us to relay data back to a central monitoring system.
- Research public opinion and determine whether people would be willing to pay for the long-term savings that our project promises.

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