Optimization of Efficiency of Solar PV by Cleaning Mechanism: A Review

Utpal Srivastava  
M. Tech Scholar  
Truba Institute of Engineering & Information Technology  
Bhopal, M.P, India  
utpal.srivastava@gmail.com

Dr Rajeev Arya  
Director  
Truba Institute of Engineering & Information Technology  
Bhopal, M.P, India

Shravan Vishwakarma  
Assistant Professor  
Truba Institute of Engineering & Information Technology  
Bhopal, M.P, India

Abstract: Solar photovoltaic systems have long been used to generate power for various applications since the 1990s. The efficiency of the solar photovoltaic model is determined by the available solar radiation and various environmental factors such as humidity, temperature, dust, snow, bird droppings, etc. This environmental factor reduces the performance of the photovoltaic modules. This document discusses the different technologies for cleaning PV modules with their performance in different environments. The problems associated with the different types of cleaning systems are also discussed.

Keywords—Dust, Photovoltaic, Solar Energy, PV cell.

I. INTRODUCTION

Aspects related to energy are increasingly important nowadays. These include, for example, the rational use of resources, the environmental impact of polluting emissions and the consumption of non-renewable resources. For these reasons, there is a growing worldwide interest in sustainable energy production and energy saving. Among the technologies that could play a role in sustainable and widespread energy production, there are interesting solutions such as photovoltaic (PV) cells, wind turbines, biomass systems and fuel cells. Photovoltaic systems, in particular, can be considered as one of the most widespread solutions with significant possibilities for improvement, while guaranteeing energy production with a low environmental impact.

Research and development in the photovoltaic field have generally focused on solar radiation analysis, efficient operational strategies, and the design and sizing of these systems. Past work examined the PV module as far as board demonstrating and I-V attributes. During this work, nonetheless, the basic perspectives and outside conditions that can impact the photovoltaic framework are not mulled over. The proficiency of sun powered cells is a significant information boundary for the plan of photovoltaic items. The space available for solar cell integration is often limited. The efficiency of the cell can even become a feasibility criterion of the main plant.

II. LITERATURE REVIEW

Dayal Singh et al.[1] In this work the electrical shows of the photovoltaic modules on the effect of the saved buildup particles are likely pondered. Test data are used to process the energy viability and execution of photovoltaic structures. It was contemplated that the buildup by and large reduces the capability of photovoltaic daylight based sheets.

F.Mejia et al. [2] This article presented by Soiling discusses the conglomeration of buildup on sun situated sheets, which prompts a decrease in the optical viability of CSP structures. In any case, geographically dispersed data is only open for sun based photovoltaic systems. The movements in viability of a colossal current park (86.4 kWdc) were assessed all through the mid year dry season in 2010 to the extent precipitation
III. SOLAR ENERGY

Photovoltaic cells convert sunlight into electricity through an energy conversion process. In most cases of photovoltaic cells, photons (light energy) fall on the cells, which leads to the excitation of electrons in the atoms of a semiconductor material. Silicon is the main element in the production of photovoltaic systems. [5-7] Excited electrons generate an electric voltage and an electric current. These types of systems provide homeowners with the ability to generate energy reliably, cleanly and quietly, which can lower electricity costs and reduce their dependence on public utilities. The lifespan of photovoltaic cells is very long.

IV. PROPOSED SYSTEM

The autonomous cleaning system for solar modules consists of a solar module, a microcontroller, and a wiper blade, similar to the car windshield wiper. Because the solar panel is placed somewhere in the outdoor environment and constantly collects sunlight, if the glass is not cleaned regularly, it will get dirty. [9-10] This dust on the solar panels can be detected by the solar cell maximum energy efficiency when the solar cell power is low and can detect the microcontroller and start the DC motor to start the solar panel cleaning process.
A DC motor has a place with a class of turning electrical machines that convert direct flow electrical energy into mechanical energy. The most widely recognized sorts depend on the powers produced by attractive fields. Practically a wide range of DC engines have an inward component, electromechanical or electronic, to intermittently alter the course of the current in a piece of the motor.

![Fig. 4 dc motor](image)

**VII. ADVANTAGE**
- Maximum utilization of solar energy.
- Max. Solar energy saving
- It is clean and emission free power production.
- External power supply is not required.
- Increase 40% efficiency of solar power plant.

**VIII. SOLAR PLANT**

Sun based energy is the energy of sun oriented radiation. This energy can be utilized as sun based warm and sun based photovoltaic. The sunlight based force plant utilizes photovoltaic to produce energy. How about we investigate how sunlight based force plants work. The sun based modules produce direct current when first light hits the module straightforwardly. This interior direct current is taken care of into an inverter, which changes it over to exchanging current. This AC power supply is taken care of into the conveyance board by its energy streams to the electrical burden. This is the essential format of a nearby planetary group. In any case, galaxies need a reinforcement source. The reinforcement power source can be a moment network or a battery stockpiling system. Since this is required as a reinforcement, the measure of daylight isn’t consistent, it differs for the duration of the day because of the adjustment of itself. A passing cloud can lessen sun oriented radiation on the sunlight based board and reduction power creation. This deviation can harm the heap under specific conditions. To keep away from this issue, power from one nearby planetary group is joined with power from another source. By utilizing this sun based energy with another source, we can guarantee that the heap gets steady, protected and dependable force, solar force plant can be incorporated with:

1. **GRID TYPE**

   In this grid system, they have no other backup power source. This is called a grid system because it is always synchronized with the grid. This is only recommended for companies with guaranteed nutrition. It is not suitable for frequent power outages.

2. **OFF GRID TYPE**

   This type cannot be integrated into networks, but only into the battery bank and diesel generation. This can be used in places where the network is not connected at all. This can be used for home use.

3. **HYBRID TYPE**

   With this sort, the close planetary system can be coordinated both in the organization and in the creation of batteries and diesel. Suggested for mains fueled frameworks that are inclined to visit blackouts and that require nonstop force during basic burdens. Generally modern and business shoppers in India fall into this class and need this kind of close planetary system.

![Fig. 5 Solar Power Plant](image)

**IX. CLEANING ROBOT**

Cleaning is one of the important activities in the day-by-day life of man, and yet it is viewed as one of the most un-favored exercises. In certain spots, cleaning can even be risky for people. Thus, machines have been developed again and again to assist us with this important evil of cleaning. Mechanical cleaning is the most recent pattern saw as of late. The robot vacuum cleaner is an independent gadget that can move and clean the surface utilizing different methods like scouring, vacuuming or just scouring the surface with a turning brush.

**X. CONCLUSION**

In this work, the study of the performance of a photovoltaic solar module for environmental dust was investigated experimentally. The effect of the dust is determined based on the power reduction and the actual reduction of the photovoltaic module. The electrical parameter of the solar panel is sensitive to the density of the dust. Thusly, it is vital to give a programmed cleaning instrument to eliminate dust particles from the outside of the board to guarantee superior.
REFERENCES

[1] Dayal Singh Rajput, K. Sudhakar “Effect Of Dust On The Performance Of Solar PV Panel” ISSN : 0974-290 Vol.5, No.2, pp 1083-1086, April-June 2013

[2] F.Meija, J.Kleissl “The Effect of Dust on Solar Photovoltaic Systems” Volume 49, 2014, https://doi.org/10.1016/j.egypro.2014.03.251

[3] Athar Hussain ,Ankit Batra “An experimental study on effect of dust on power loss in solar photovoltaic module” December 2017

[4] Surajit Mondal, Amit Kumar Mondal, “An overview of cleaning and prevention processes for enhancing efficiency of solar photovoltaic panels” CURRENT SCIENCE, VOL. 115, NO. 6, 25 SEPTEMBER 2018

[5] He Gaofa, Zhou Chuande, Li Zelun, Review of Self-Cleaning Method for Solar Cell array, Procedia Engineering, Vol. 16, pp 640-645, 2011.

[6] Kawamoto Hinoyuki, Guo Bing, Improvement of an electrostatic cleaning system for removal of dust from solar panels, Journal of Electrostatics, Vol. 91, pp 28-33, 2018.

[7] Mani Monto, Pillai Rohit, Impact of dust on solar photovoltaic (PV) performance: Research status, challenges and recommendations, Renewable and Sustainable Energy Reviews, Vol.14, pp 31243131, 2010.

[8] Arabatzis Ioannis, Todorova Nadia, Fasaki Ioanna, Tsesmeli Chrysovalanti, Peppas Antonis, Li Wen Xin, Zhao Zhiwei, Photocatalytic, self-cleaning, antireflective coating for photovoltaic panels: Characterization and monitoring in real conditions, Solar Energy, Vol. 159, pp 251-259, 2018.

[9] Jiang Yu, LuLin, Lu Hao, A novel model to estimate the cleaning frequency for dirty solar photovoltaic (PV) modules in desert environment, Solar Energy, Vol.140, pp236-240,2016.

[10] Syafiq A, Pandey A. K, Adzman N. N, Rahim Nasrudin Abd, “Advances in approaches and methods for self-cleaning of solar photovoltaic panels”, Solar Energy, Vol. 162, pp 597-619, 2018.