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# Techniques Use for Improvement in Efficiency and Performance in the Solar Module

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## ABSTRACT

***Photovoltaic system is the resend trends in the modern world because this is a renewable energy sources and generate electricity without disturbing the environment. This energy is the ecofriendly energy that not affected to the environment. The solar energy is necessary and important to all countries. The aim of the paper is to improve performance and efficiency of solar module by using different types of methods. Solar tractor is one of the most important methods this methods are continuously tracking the sun light in hole day. That benefitted to get the maximum power and utilized the space with efficiently. The second method is for Dust cleaning, this methods is used for improve the efficiency of the solar panel. In this second methods dust act an obstacle between sunlight and solar panel. The third method is a Cooling method. In this method the solar panel temperature is control because the temperature increases the efficiency of the solar panel is decreases. The fourth method is anti-reflecting coating method, this method is use for improvement in solar panel efficiency This paper deals known and study the different types of methods that's are used to improve the efficiency and performance in solar panel.***

***Keywords: Solar panel, Solar Tracker, Dust Cleaning, Cooling Technique, anti-reflecting coating technique***

## 1. INTRODUCTION

It is the renewable energy sources that convert sunlight energy in to the electrical energy by using the PV cell. The efficiency of solar panel is most important and it is depends on temperature, dust, solar intensity etc.as per the following methods the solar panel efficiency increases that result in to get higher performance of solar panel.

## 2. SOLAR TRACKER

In this systems according to path of way solar tracker change the orientation in complete day for this reasons the panel captured maximum amount of solar rays output that it generate maximum amount of power. In photovoltaic cell the trackers work for minimizing angle of incident between the panel and the incoming light. For this the solar tracker gets maximum power.

### 2.1 Tracker types

- Dual-axis tracker
- Single-axis tracker

Axis of rotation shows the single axis solar trackers. The single axis solar trackers rotate the single axis moving forward and backward in only one direction. The tracker followed the sun horizontally and vertically that's effect to get maximum solar energy generation. The trackers is controlled by controller that control the motor and the gears. The response of the controller is as shown in following figure 1.1 Cadmium Salphide (Cds) receives sunlight to the systems. And the Cds is the most important tracker tim areas.

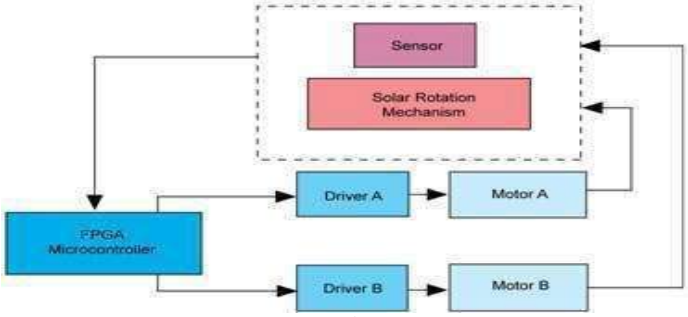


Fig.1.1 Bloch Diagram of Solar Tracker systems.

Boost converter use in the systems for power converter. The function of the converter is to convert output voltage is greater than the input voltage. The circuit is the semiconductor device that storing of energy like inductor, capacitor combination of both is use. Switches are use in systems like IGBT.MOSFET or BJT.Power is supplied by the boost converter by using the DC source. The system input is given to the batteries, solar panel, DC generator or rectifier etc. The boost convertors are use in the system for step up the voltage or regulate the voltage in the solar systems.

### 2.2 Advantages

The solar tracker is very useful to increase electricity production but only forty percent claim around some region to fix angle. The solar efficiency is increases because the solar angle is continuously adjusted by controller as the sun traverses the sky.

### 2.3 Disadvantages

This system is totally automated hence more equipment is added so more maintained and more equipment cost .The moving part is present in the systems so regular maintenance of broken part is required. If the systems is breaks down then the solar panel are in extreme angle and that time production is loss then the efficiency of solar panel is decrease.

## 3. DUST CLEANING

### 3.1 Effect of dust on the performance of solar PV panel

The dust is the more sensitive part in electrical parameter because the due to the dust efficiency of solar panel is decrease .For this purpose the auto cleaning is necessary which remove and clan the dust particle that insure high performance in the photovoltaic cell.

#### 3.1.1 Rugged Robot

Deserts are sunny, so they are ideal for solar power. They are dusty so the efficiency of solar panel is decreases about 0.4-0.8 % per day When we hosing a panel down with water in middle the grid area is problematic so many area the lot of human labor is required where the temperature can go over 122 degrees Celsius Fahrenheit it during the day These are the problems that the **NO**-water **M**echanical **A**utomated **D**usting **D**evice (NOMADD) robot from Saudi Arabia is trying to solve in following fig 2

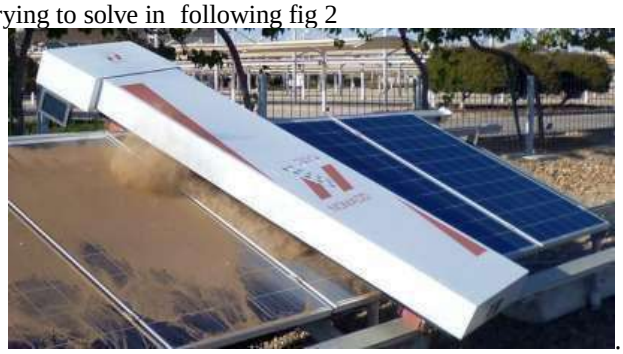

Fig 2 No-water Mechanical Automated Dusting Device

As shown in fig 2 little robots are mounted on tracks along rows of panels, and at least one day they pass over the panels, cleaning them with a brush designed and without any water required. This may show the big difference in manual and robot but the robot is work per week with automatic. Hence the more labor cost is decrease and the efficiency of power output is increase. A single NOMADD can clean row of solar panels about 600 feet long, with plans to upgrade that up to 900 feet. Because each row of panels has its own NOMADD robot, they can work in parallel, and it doesn't take longer to clean a gigantic solar farm.

#### 3.1.2 Self-Cleaning Technique

The technology is important because it involves in the deposition of a transparent, electrically sensitive material on glass or on a transparent plastic sheet that cover the panels. Sensors continuously monitor the level on surface when the dust practical is in critical level then the sensors are work. That is the sensors are continuously monitor the surface of the panel. The electric charge sends a dust-repelling wave cascading over the surface of the material lifting away the dust and transporting it off of the screen's edges. Only two minutes are required to remove the dust in the panel about 90 percent. Coating the surface of solar cells can increase their efficiency and reduce maintenance costs, especially for large-scale installations. Self-cleaning solar panels would be especially effective, in large installations.

The self-cleaning technology was developed by, Boston University professor Malay K. Mazumder and his colleagues, in association with the National Aeronautics and Space Association, and was originally intended for use in rovers and other machines sent to space missions, to the moon and to Mars

The desert environments where many of these installations reside often challenge the panels with dust storms and little rain. Currently, only about 4 % of the world's deserts are used in solar power harvesting Conventional methods of cleaning solar panels usually involve large amounts of water which is costly and scarce in such dry areas.

### 3.3 Robotic Vacuum Cleaner

Robotic Vacuum cleaner has two subsystems, namely a Robotic Vacuum Cleaner and a Docking Station. When the robot are work then it put in two stages that is cleaning and removing dust particles from solar panel The Robot working is totally automated and it operate in accelerometer and ultrasonic sensor. The path of the Robot is predefined. It is designed in this way to work on inclined and slippery surfaces. A control strategy is formulated to navigate, the robot in the required path using an appropriate feedback mechanism systems. The battery voltage of the robot is determined periodically. When the battery voltage is low then the Robot goes return to the station and charge automatically. This power is utilized by solar panel it is robust, commercially viable product, which provides a simple, cost-effective solution to the clean small solar panels.

## 4. COOLING TECHNIQUE

Photovoltaic panels get overheated due to the excessive of solar radiation and high ambient temperatures over heating reduce the efficiency of the panels. The ideal *P–V* characteristics of a solar cell (panel) for a temperature variation between 0 °C and 75 °C are shown in Fig.3.The *P–V* characteristic is the relation between the electrical power output *P* of the solar cell to the output voltage, *V*, while the solar irradiance, *E*, and module temperature, $T_m$, are kept constant. The principle of this technic's is to maximum power output from the solar cells decreases as the cell temperature increases, as seen in Fig.3. This indicates that, heating of the PV panels can affect the output of the panels significantly.

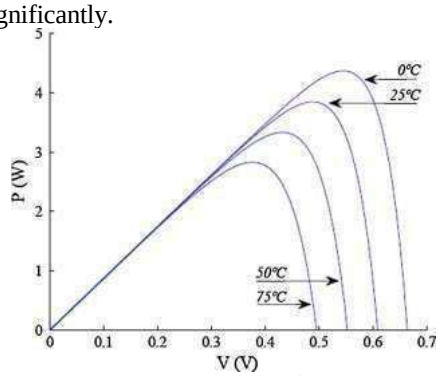


Fig .3 P V characteristics of solar cell

Hybrid Photovoltaic/Thermal (PV/T) solar system is one of the most popular methods for cooling the photovoltaic panels. Nowadays shown in fig4.

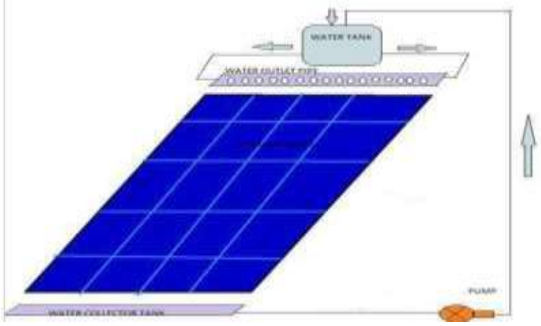

Fig 4 PV hybrid systems

The photovoltaic panel has combined with cooling systems hence it called as Hybrid systems Water is circulated around the PV panels for cooling the solar cells, and the warm water leaving the panels pump back to water tank. Warm water mixed with cool water of tank.

The result of the systems is the cooling systems solve the problem of overheating that result it maintained the efficiency of solar panel increase the water is overheated due to excessive solar radiation.

### 4.1 Antireflective Coating (ARC)

When light strikes the silicon cells, packets of solar energy are absorbed and converted into electrical energy. Because bare silicon plate has a high refractive index, more than 35 % of incident light is reflected away from the panel's surface before it can be converted into usable energy.

### 4.2 Solar Cell Device

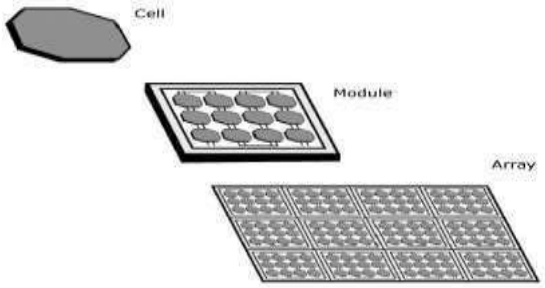


Fig.2.2.1 Basic Structure of solar cell, solar module and solar array

In the solar power plant uses one or more solar panel to convert light energy in to the electrical energy. It consist the different types of components like photovoltaic modules, mechanical and electrical connection and mounting, earthing to regulate the electrical output.

The main component used in photovoltaic system is solar cell. PV cells are made of semiconductor materials such as silicon. For solar cells, a thin semiconductor wafer is specially treated to form an electric field, positive on one side and negative on the other. If electrical conductors are attached to the positive and negative sides, forming an electrical circuit, the electrons can be captured in the form of an electric current that is electricity. PV cells can either in rectangular shape or in circular shape. As the solar cells generates the voltage around 5V, these solar cells can be grouped together to form solar module. The solar modules are generally flat. Also they are available in various ranges of heights and widths. These solar modules can be grouped together to form photovoltaic array. The panels can be connected in series and/or parallel depending on the design of array. Also, separate diodes are required in case of partial and complete load shedding and also in night period. The solar module is rated by the DC output power. This rating is given by standard test conditions. Solar panels are usually used in residential, commercial, institutional applications and light industrial application.

## 5. CONCLUSION

It is most important to maintain the reasonable quality and effective utilization of solar energy which can deal with the global energy crisis at present. The photovoltaic cell converts sunlight energy in to electrical energy without thermal or mechanical link. So the study on improving the efficiency of solar panel is very necessary, I have proposed several methods (using solar tracker, cleaning dust from panel, cooling technique of panel, using anti-reflecting coating etc.)to improve the efficiency of solar panel, Practice has proved that the use of these above methods can effectively improve the efficiency of solar power generation.

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