Design Of Solar Panel For Improving The Performance And For Reducing Energy Cost


Abstract: Due to the growth in electricity demands the existences of renewable energy resources are keep on increasing. Such increase leads to various technological advancements in the existing techniques. Few such improvements in PV panels are being adopted in this work. PV modules are placed at roof tops for tapping maximum energy. Due to improper tilting angles the efficiency of the panels may be reduced. As well as it may lead to the increased production cost. Panels are normally placed on the rooftops so that sunnrays fall over them and that energy is converted to electrical energy. But during rainy seasons, panels may not be able to produce energy and also its life gets degraded as they are left in the environment for a longer time in the rain. The dust particles already accumulated over the panels may be washed away due to rain. But when heavy rain falls on the panels the efficiency in terms of life would be reduced. To overcome above said problem like tilting angle calculation and protection of panels from rain are being addressed in this paper. For effective calculation of tilt angle of PV panels PVsyst software is used. An improvised modification is done on the design of existing solar panels to protect from rain.

Keywords: PV panel, Tilt angle, Rain drop, rain sensor.

1. INTRODUCTION
Renewable resources are available each year, unlike non-renewable resources, which are eventually depleted. A simple comparison is a coal mine and a forest. While the forest could be depleted, if it is managed it represents a continuous supply of energy, vs. the coal mine, which once has been exhausted is gone. Most of earth's available energy resources are renewable resources. Renewable resources account for more than 93 percent of total U.S. energy reserves. Annual renewable resources were multiplied times thirty years for comparison with non-renewable resources. In other words, if all non-renewable resources were uniformly exhausted in 30 years, they would only account for 7 percent of available resources each year, if all available renewable resources were developed. [1] authors presented a design and then tested for various type of configurations using solid work software. Modelling is done using solidwork software. It will be used for prototyping the model designed. Material, design, and all other parts are simulated using this software. The design results showed the improved performance of the system. Authors in [2] have made an extensive work on the existing technologies for tapping solar energy from sunlight and also an analysis on the future modifications. Various types of panels, its applications and techniques for improving the performance were also discussed. The authors in [3] discussed about available converters and various tracking algorithms. The solar panels configuration can be done for any type of load. The efficiency can be improved for any domestic panels by incorporating proper tracking algorithm. The authors [4] have analyzed the dynamic behavior of the PV model for various operating conditions. Various parameters were monitored in a centralized location so that the control can be made simpler. The performance was verified and it is proved that it has improved efficiency. Optimization of the smart grid is possible with the developed strategy. Authors [5] have derived the expressions for obtaining fast recovery of solar cell parameters from the given data. The error value got reduced by improvement in efficiency. The paper [6] reveals the technical and economical viability for the inclusion of renewable sources which is used as the replacement of conventional sources. Review of reduction in conventional source is done in [7]. Possibilities of new renewable energy sources are discussed and elaborated. Solar cell modules or solar panels convert the solar energy into electricity. These are mounted in such a way that they collect maximum energy from the sun. Most solar panels are rated to a voltage 12V (a half volt PV cells are connected in series, inside of the solar panel to produce the high voltage say12V). The panels are connected in series to form a solar array that produces higher voltage, typically of 24 or 48V in a stand-alone systems, or it can be several hundreds of volts in grid-connected systems. If the panels are connected in parallel, the current delivered to the load will be more and hence the more power while maintaining the same voltage. Irrespective of series or parallel connection, the power rating of the system increases when multiple solar panels are connected together. Availability of solar energy is plenty and tapping it more efficiently is more important. The location of solar panels is mostly roof tops and its tilting position also plays a major role in deciding the amount of energy tapping. The efficiency and the life time of the panels are reduced due to the open environment where panels are placed. Mainly when heavy rainfall occurs the overall efficiency is reduced. This paper mainly concentrates on overcoming above mentioned problems encountered on solar panels.

2. SELECTION OF TILT ANGLE
Prime energy source is the solar energy which should be tapped with more efficient way. Various types of solar panels are available. The arrangement of panels is an important aspect in the process of energy tapping. When panels are rotated in some tilt angle, the energy that is produced would be high and when placed at some other angle, the energy generated could be reduced. It is necessary to find the optimum angle on which the panels have to be placed. This work aims in fixing the proper tilt angle.
angle for the location of panels. The solar data is taken for our institution Kongu Engineering College located in Perundurai, Erode, Tamilnadu. Our institution is equipped with roof top solar panels for reducing the conventional energy usage from the grid. The geographical site parameter in terms of irradiance is obtained for the desired region and it is tabulated in Table 1.

**Table 1: Geographical data for Kongu Engineering College, Perundurai**

Using PVsyst software simulation is performed for various tilt angles and the efficiency and energy cost is calculated. To verify its performance, it is tested for various angles. Figure 1 shows the tilt angle with 22 degrees.

When the tilt angle is varied from 0 to 22 degrees the loss is zero. Figure 2 shows the position of solar panel at 25 degree.

It is observed that the investment cost would be 615 EUR and energy cost would be 0.27 EUR/KWh. Further tilt angle is varied and figure 3 shows one amongst as 42 degree.
It is observed that the investment cost would be 615 EUR and energy cost would be 0.29 EUR/KWh. It is concluded from the results that if the tilt angle is maintained from 0 to 22 degree the loss occurred is maintained as zero with 615 EUR as investment cost. Investment cost remains same but he energy cost keep on varying as the tilt angle is varied. It is better to keep the tilt angle less than 22 degree for the specified location. If there is an unavoidable requirement of increasing the tilt angle it can be increased upto 25 degree, beyond which the cost of energy production would gradually be increased.

3. PANEL DESIGN TO PREVENT RAIN DROPS

Solar panel conversion efficiency of around 20% is reduced by dust, pollen and other rain water droplets that accumulate on the solar panel. To ensure a quality environment for the solar panel to work, increase the efficiency of the solar panel thereby reducing the losses occurred due to environmental effect this project can be used. To impart the sunflower petal shape mechanism is implemented in the conventional solar panel to increase efficiency. The flower goes into a folding position when operated by a command by the rain sensor once it detects rain. This natural mechanism can be imparted to the panels by placing the panels in petal shape as of a sunflower. The efficiency of solar panels are reduced by continuous deposition of rain drops over the surface. The Conventional solar panels gives maximum output only when placed at a higher altitudes which makes maintenance and monitoring tough. In this type of solar panel installation system panels must be installed at very high locations such as top of the buildings, industries, apartments etc., so it is a risk to install and maintain such height. It is required to prepare the rooftops, add racks, screw in and out, wire each panel then connect to an inverter. The solar panel efficiency is very much reduced due to the residues stayed after the rain pours away. This comes to the floor that it must be cleaned once the rain is poured. Panels are arranged is module in rooftop for domestic and commercial use. These modules generate power at day time and they are left in the environment the whole day. The overall life performance of the panels will reduce when the panels are left as such during rainy period. The rain droplets when falls on the panel carry the dust particles which we deposited already and it would stay as a stain forever. When this continues, the life time of the panel will degrade soon. Our project aims at overcoming this difficulty.

3.1 Petal Arrangement

The panel are arranged as such it depicts the arrangement of sun flower. By nature, sunflower the as around the sun and the petals close at night time. Here, the petals will be closed when it comes in contact with the rain and opens when the it drains.

3.2 Petal Protection

A rain sensor is placed and as soon the rain is detected the panel moves in anti clockwise direction. It is designed and that the panels are being protected by a round shield like arrangement.

3.3 Petal operation

The panels will move and will be stopped under the protective shield when the rain is drained, the movement of the panels will be in clockwise direction and comes to the normal position. This arrangement protects the panels from heavy rainfall and improves the overall life time of the same. The hardware is shown in Figure 4 where the panels are to be placed at the projected rods at the four ends. Figure 3.a shows the initial position in which panels will be projected away from the protective shielding during non-rainy period.

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Fig. 5. At final position

REFERENCES


