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A Predictive Technique Approaches On Optimal Solar Panel Designs

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Abstract

Socio-economical renewable energy power generation is the key challenge to meet the added power demand in present day to day life. This shows more attention on research works on renewable power generation in socio-economic factors.Solar power generation using s PV cells is the key and plays a vital role to meet the desirable power demand. Limitation of availability of light energy makes the major drawback to the solar power generation. This recommends that, the need of vast research work on enhanced solar PV cell efficiency. Application of concept of light reflection may fulfill the enhanced PV cell efficiency in socio-economic factor. In view of this, authors are tried to review the research work done in elsewhere in the world and made new approaches to meet the increased power demand. This paper presents the review of different methodologies of utilization of light source for solar power generation. Also, this paper discussed results presented in existing methodologies and made suggestions for optimal solar panel designs for enhanced solar PV cell efficiency and in order to avoid space occupation problems of solar panels.
Keywords— *Solar tower, solar panel, reflector,light source.*

1. Introduction

Solar power generation is the one of the key renewable energy power generation becomes most popular due to availability of abundant solar power in nature. Consumption of electrical energy is increased due to enlarged population in day to day life. Power generation using the solar energy is the one of the major renewable energy source placed at third place to meet the power demand in the world. Most of the countries are enhanced their research work towards the solar energy due to the limitations of forecasting of hydro and wind energy sources. Also, solar energy is the socio- economic renewable energy source which makes every country to developed country in the world. Solar cells in the solar panels are works by absorbing the light energy and generate the direct current energy and then convert to alternating current energy to different applications [1]. The key operation of the solar cells depends on the absorption of light energy, which suggests the different design techniques of capturing the light energy. This confirms that, extension in the design of solar panel in optimal way is amenable.

The maximum power extraction [2] from solar panel is also one of the key challenges facing the researchers to meet the estimated power demand. In order to extract the maximum power from the solar panels, different algorithms are developed and many are in progress. The concept of algorithms are explains the maximum power extraction is possible during the tracking of light energy throughout the dayonly. This concept dictates that, the maximum power tracking systems facing serious limitation of availability of light energy. Not only the maximum power point tracking, space constraints are also dictates that, size of the solar panel design for expected power demand is also makes key challenge to the electrical designers and researchers elsewhere in the world.

This corroborates need of new developments in design and maximum power extraction constraints of solar panels. Concept of light reflection methodology is well proven and existed methodology in physics, attracted to many authors towards improvement of solar cell efficiency. Many authors [3] [4] [5] [6] are worked on the concept of light reflections elsewhere in the world. It is observed that, many research works concentrated on solar cell efficiency only. It is also proven that space constraints are also one of the major challenge along with the cell efficiency.In view of this, after reviewing the different design and maximum power point extraction concepts elsewhere in the world, authors are trying to design the solar panel in optimal way in order to meet solar panel space constraints and methodology for enhanced solar PV cell efficiency. Therefore, this paper presents the different methodologies to obtain optimal solar panel designs in space and cell efficiency constraints with

expected results by reviewing research works published elsewhere in the world and made suggestions on superior methodology.

2. Methodology

The design of solar panels involves arrangement of light reflectors in inside of the solar panels. As it is well known concept used in many applications such as surveillance, projectors, etcetera, movie screens etc. Also, this concept of light reflection is using in National Astronomy and Ionosphere Center to study the earth Ionosphere [7] and is shown in figure1 below. This confirms that, the concept of light reflection plays a vital role in the design of solar panels.

Figure 1. Arecibo observatory radio telescope

A. Reflection of Light

The reflection of light [8] [9] depends on the nature of interface for different applications. The selection of interfacing surface is depends on the nature of application. Many applications concave lenses and concave shapes for different outputs. The shape of the concave lenses is in parabolic curve shape [10] [11]. The parabolic curvature is depends on angle of reflection, which varies for different applications. The reflection of light reflection [12]for different interface surfaces and concave shape interface is shown in figure 2 and 3.

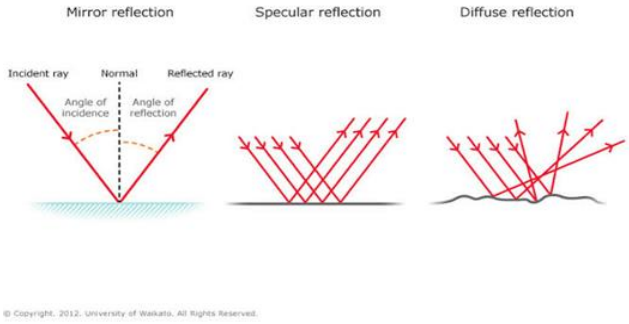


Figure 2. Reflection of light for different interces

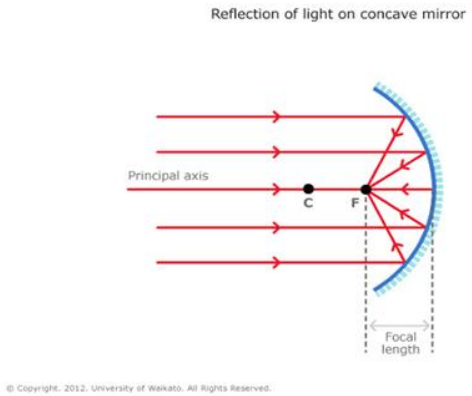


Figure 3. Reflection of light for concave shape design

Different interface surfaces having different reflection coefficients [13] which make a decision on selection of interface surfaces for different applications. Therefore, the reflection coefficients [14] [15] of different materials are shown in figure 4 below

Table 3-1—Total Reflection Coefficients of Various Surfaces

Material	Reflectance
Highly polished silver	0.92
Glass lined mirrors	0.70 to 0.85
White blotting paper	0.82
Emerald green paper	0.18
Black paper	0.05
Dark blue suit	0.03
Dark blue overcoat	0.02
Light grey suit	0.11
Grey suit	0.07
Caucasian (male) face, front	0.30 to 0.50
Negroid (male) face, front	0.10 to 0.30
Roadway (total of specular and diffuse)	
Macadam	0.06 to 0.13
Concrete	0.08 to 0.15
Dirt and gravel	0.03 to 0.07
Black velvet	0.004

Figure 4. Light reflection coefficients of different material

From the above figure it confirms that mirrors are best light reflectors which give nearly same impact of incident light. The light reflection coefficients of silver sheets and quality mirrors are 1 and greater than 1respectively. Hence, it proves that suitable selection of reflecting interfaces may results in single input and multiple output with same and enhanced results. Therefore, authors are interested to design the solar panels with help of this light reflection concept. The following sections describe the possibilities of design of solar panels.

3. Design Models Of Solar Panels

a. Solar Panel Design with Reflector of white sheets

The solar panel design contains reflectors on inside of the solar panel walls and light energy source on the top of the solar panel is shown in figure 5. The reflectors in the walls of the solar panels are act as a light energy reflectors. The light energy reflectors in the solar panels are of silver or white color sheets which are stacked on the every corner of the inside wall of the solar panels. The reflection coefficient of light reflection for white sheets is greater than 1. The solar cells in the panels are arranged so that, the structure of the solar panel looks as a tower [3] [4] structure and is shown in figure 5. The solar cells in the panel arranged as top and bottom with appropriate space between each solar cell. A light energy source is fixed at top of the solar panel and the solar cells are facing on the top of the light energy source. The light reflectors are arranged at wall [5] inside of the solar panel and also back side of the each solar cell. As per design structure of solar panel it is difficult to project the light energy on bottom of the remaining solar cells. In order to overcome this problem, light reflectors are

arranged on inside wall of the solar panel so that, achieve the equal light intensity in inside of the solar panel.

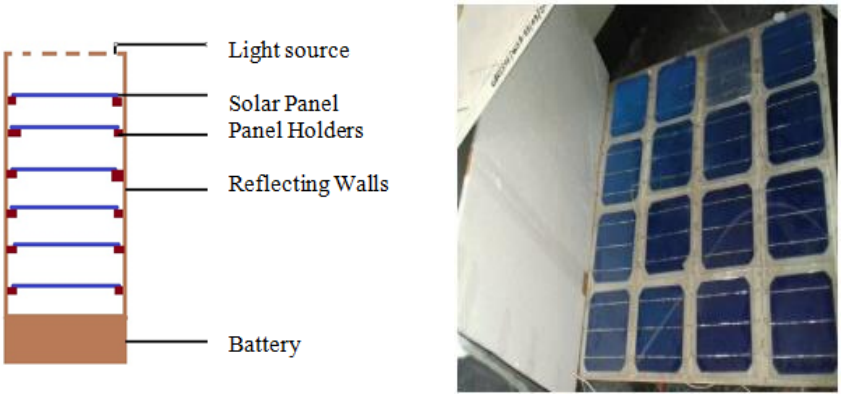
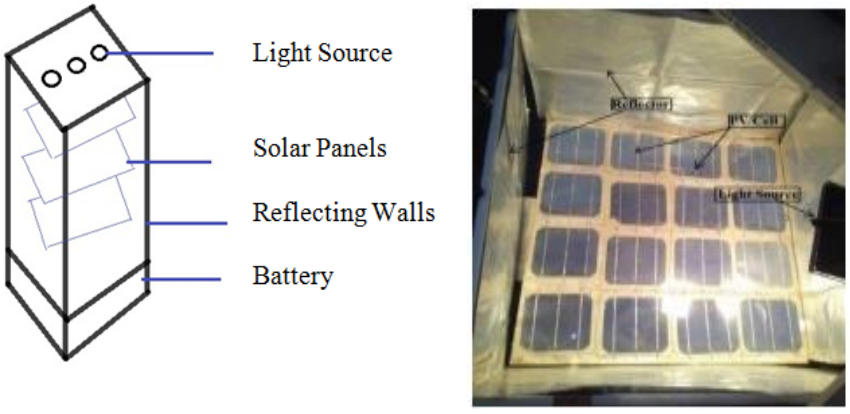


Figure 5. a) Solar tower 2-dimentional view b) Practical view

The design of solar panel in solar tower structure type confirms that, the panel design meets the space constraints. Not only have the space constraints, the tower type design with light reflectors also met the continuous extraction of maximum power.

b. Solar panels with reflectors of mirrorsors

In this type of designs mirrors can used as reflectors in place of the white sheets which are used in above design. Mirrors are the one of the good reflectors which may give acceptable efficiency of in the solar panel designs. The design structures of this type of solar panels are also similar to above designs. Mirrors are arranged on wall of the inside of the solar panels, the weight of the solar tower increased as compared to above design and the structure of solar tower in three dimensional view is in figure 6 below



(A) (B)

Figure 6. A) Solar tower 3-dimentional view B) Practical view

c. Solar panel design with instanteneous light energy

The efficiency of the solar cells increases by continuous instantaneous light energy reflections on the solar cell. As it is a well known concept that, an instantaneous light reflection on any object results in enhanced reflection intensity which have huge amount of energy compared continuous emerging light intensity. It is observed that the light reflection coefficients of instantaneous lights are 0.8 to 1.15 and up to 143 % for proper arrangement. The instantaneous light reflection [5] varies with different frequency bands and which is observe from the figure 7 below.

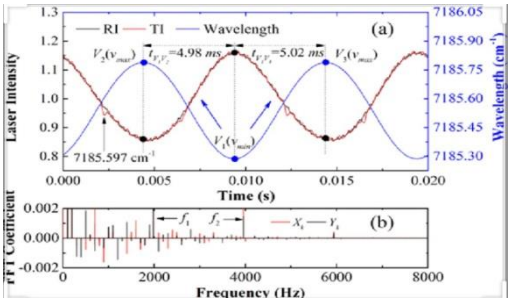


Figure 7. Frequency of different light reflections

The instantaneous lights have enough kinetic energy as compared to continuous incident light energy. As compared to above two panel design considerations, this instantaneous light reflection panel designs improved solar panel out puts. This type of design may have an additional arrangement to obtain the movement of tilt of light reflectors with small angle. The frequency of instantaneous light reflections may arrange so that, the possibility of 143 % of reflection coefficient [16] can be achieved.As compared to above two methods of designs this type solar panel designs results in increased solar cell efficiency.

CONCLUSION

A serious drawback of existing solar panels is its availability of light energy for power generation using solar cells. This authenticates that the existing solar panels are limited to generate the electricity over a particular time period only. Hence, there is a need of new design modification in solar panel design in order to overcome the continuous solar power generation problem. Therefore, solar tower type of panel designs may overcome the uneven solar power generation problems and may give same and enhanced output power with less space occupation. Specifically, solar tower type panel design with instantaneous light reflection arrangement results in enhanced solar panel efficiency.

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