SOLAR SHIELD: SOLAR BASED POWER GENERATION TECHNIQUE

New technique for enhancing solar panel performance.

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Abstract - This paper implements an efficient way to power generation system, using solar power panel. Solar energy system is used to collect maximum power from sun. This proposal is to use the solar panels implemented in this project more efficiently and to carry out a realistic experimental approach to enhance the solar output power up to a significant level with new kind of structure for solar panel. We design a perfect shield for protect this panel with UV light, temperature, dust and many more thing. This design does not only protect but increase the performance of this Solar panel. It consumes less space compare to general Solar panel. Even we do not need for track sun for better power output. So, Cost would be cut down for sun synchronous circuit. This paper implements an efficient way to electrify or generate electricity with combining concept of light pipe and solar panel for power generation.

Index Terms - Photovoltaic (PV), Solar Panel, Techniques of enhancement, Shield, Tubular Skylight, energy consumption, light pipe system, sustainable energy resources, renewable resources.

I. INTRODUCTION

Now a days, with increasing concern of global warming and the depletion of fossil fuel reserves, many are looking at sustainable energy solutions to preserve the earth for the future generations. Solar energy is the viable source of renewable energy over the last two-three decades. It is now used in variety of fields such as industries, domestic purpose. Solar energy system is designed to collect maximum power from sun and to convert into electrical power. [1] When photons of sunlight strike the cell, electrons are knocked free from silicon atoms and are drawn off by a grid of metal conductors, yielding a flow of direct current. Solar cells, they have no moving parts and are consequently quiet, extremely reliable, and easy to operate. [2]

Let's talk about the light pipe, a light pipe refers to an overhead opening, which allows daylight to pass through a pipe (often mistakenly called skylight). It is innovative device able to transport and distribute natural light without heat transfer in dark rooms, different from traditional openings, and minimize the loss of light. This system is made of a dome placed on the roof, a highly reflective tube walls (greater than 99%), and a diffuser. The dome should be shockproof and UV resistant. It protects the tube from dust and rain. The device can be coupled with an optical device to capture and redirect the sky radiation inside the tube. SOLATUBE® in Australia patented this concept in 1986.

II. PHOTOVALATIC (PV)

Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. [3] Solar energy is unsurpassed by any other form of energy. Solar energy was originally coming from sun. Solar cells convert this solar radiation into useful electrical energy and store them in storage such as batteries, but in these cases, it will directly converted to be used for competition. Solar radiation strikes the earth surface and creates the paramount source of alternative energy. Solar panels help to harvest this energy and convert it into usable energy. Solar is an intermittent power source that functions only when the sun is shining. Solar cells or photovoltaic cells are arranged in a grid like pattern on the surface of the solar panel.

- **TYPES OF SOLAR PANEL**
  1. Mono crystalline silicon panels
  2. Polycrystalline silicon panels
  3. Amorphous silicon panels

These are the types of solar panel that can be used for project according to their usages. Solar panels are typically constructed with crystalline silicon, and the more expensive gallium and Yrsenide, which is produced exclusively for use in photovoltaic cells. The process of producing solar energy is a process of converting light (photons) into electrical propulsion known as the photovoltaic effect (PV). Contained within photon of light contains the number or rate of energy varies depending on the wavelength and spectrum of solar generated. When the photon is in violation or in contact with the solar panel, solar panels will absorb photons in some degree. Not all photons are absorbed by the solar panels because it depends on the type of semiconductor materials used to produce the solar panels. Photon energy at certain levels is able to dissolve the bonding electrons from atoms to produce electricity. Quantity of the energy produce is difference between materials with other material in the production of solar cells. This energy level is known as band-gap energy which is measured in units of electron-volts. A material with band-gap energy between 1eV and 1.8 eV are the best material and has a high efficiency of energy production.

III. LOSSES IN SOLAR CELLS

Solar cells manufactured through industrial process have efficiencies of the order 12 -15% this shows about 88 - 85% losses occur in solar cells. If these losses are overcome, efficiency improvement could be obtained. It becomes necessary to study different losses that occur in the solar cells and the methods which can be implemented to reduce them. Some practices which are followed to reduce the losses are, better material selection, proper manufacturing techniques or changing design procedure of the cell.

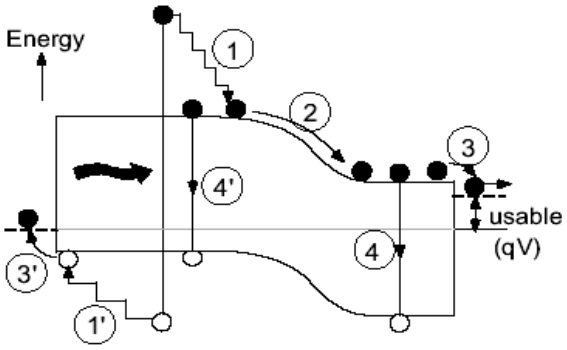

Figure 1 Efficiency losses in Solar cell

As concert about solar cell so many losses produce which actually reduce the efficiency of solar cells. Mainly three fundamental losses over there,

1. Thermalization loss (1 and 1')
2. Junction and contact voltage loss (2 and 3)
3. Recombination loss (3',3 and 4')

In bracket consider the specific loss at specific stage. Efficiency is defined as the ratio of energy output from the solar cell to input energy from the sun. In addition to reflecting the performance of the solar cell itself, the efficiency depends on the spectrum and intensity of the incident sunlight and the temperature of the solar cell. Therefore, conditions under which efficiency is measured must be carefully controlled in order to compare the performance of one device to another. Like all other semiconductor devices, solar cells are sensitive to temperature. Increases in temperature reduce the band gap of a semiconductor, thereby effecting most of the semiconductor material parameters. The decrease in the band gap of a semiconductor with increasing temperature can be viewed as increasing the energy of the electrons in the material. Lower energy is therefore needed to break the bond. In the bond model of a semiconductor band gap, reduction in the bond energy also reduces the band gap. Therefore increasing the temperature reduces the band gap.

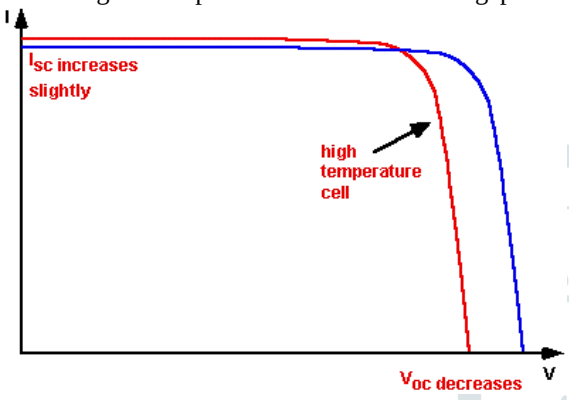

Figure 2 IV characteristics of a solar cell.

In a solar cell, the parameter most affected by an increase in temperature is the open-circuit voltage. The impact of increasing temperature is shown in this figure. The open-circuit voltage decreases with temperature because of the temperature dependence of I_0. The equation for I_0 from one side of a p-n junction is given by;

$$I_0 = qA \frac{Dn_i^2}{LN_D}$$

Here: q is the electronic charge given in the constants page, A is the area, D is the diffusivity of the minority carrier given for silicon as a function of doping in the Silicon Material Parameters page, L is the minority carrier diffusion length, N_D is the doping; and n_i is the intrinsic carrier concentration given for silicon in the Silicon Material Parameters.

The general equation for estimating the voltage of a given material at a given temperature is:

$$V_{OC} = \frac{kT}{q} \ln\left[\frac{I_{SC}}{I_o}\right]$$

Where, kT/q is the thermal constraint, I_{SC} is the short-circuit current and I_o is the open-circuit current

Depending on the concentration ratio, temperature of the solar cell can rise above 1000C. At such a high temperature the solar cell efficiency decreases due to reduced Voc. If temperature rise is kept within limits with the help of proper cooling arrangements, with use of heat sinks or heat pipes, thermal losses could be maintained within limits. **Solar cells love cold sunny environments.** So, our propose method is reduced the temp or maintained temp upto room temperature.

IV. LIGHT PIPES ARCHITECTURE

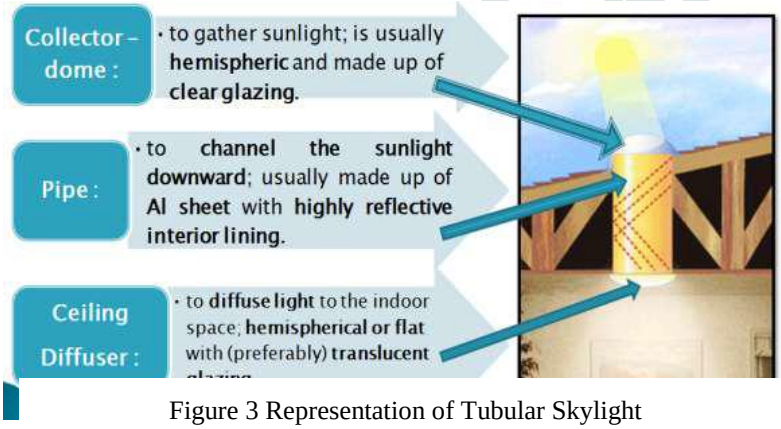

Figure 3 Representation of Tubular Skylight

Tubular Skylights consist of typically three parts: Collector dome – to gather sunlight, pipe to channel the sunlight downward and ceiling diffuser to diffuse light to the indoor space. The collector is usually hemispheric and made up of clear glazing. It may include some devices to enhance the lighting output of the skylight, especially at low sun altitude angles.

The pipe is usually made up of Aluminum sheet with highly reflective interior lining. The diffuser is hemispherical or flat with translucent (preferable for better light diffusion) or clear glazing (good light transmission, but poor diffusion, so lenses may be required to enhance diffusion). Fig. 3 shows a schematic representation of a Tubular Skylight. In view of such facts, many offices, industries and residences can adopt/have started adopting (at some places in India and many places in the USA, Australia and Europe) the use of tubular sky lights. Light pipe technology actually has commercially exploited over the past fifteen years. [4] Recently, light pipe systems are commercially available in market such as Monodraught, Solatube, Skydome, light ways etc. At mid-2000, more than 2000 light pipe systems had been installed throughout the United Kingdom in comparison to about only 50 in the year 1997. [5] However, it is not yet popular in Malaysia.

V. OUR PROPOSAL

In proposal method we just combine solar tube and solar panel in single structure. We know how to work solar tube and solar panel. Solar tube collect sun light and pass upto diffusor. While solar panel converts the light energy to electric form. As per previous discussion solar panel effects the temperature. Even UV rays and dust are reducing the output performance. We just combine both this thing and make one simple solution product for better performance.

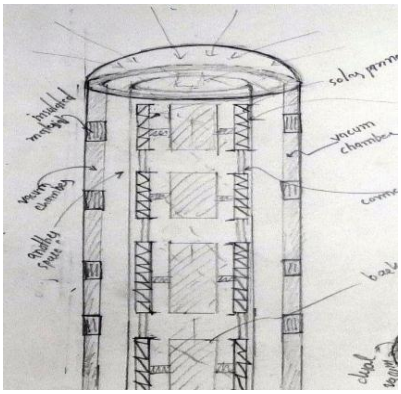

Figure 4 Concept of Solar Shield.

We use thermos, vacuum insulated bottle. So, this system exactly same as the bottle. First consider one solar tube/light pipe placed inside vacuum chamber. So, outside whether cannot be affected. Top most section is collector, collect the sun rays. At middle section solar cells are placed. With specific design light cannot be reached upto last solar cell. Even series/parallel connection differ at particular section. Here the solution of reach each of sun ray upto last one,Just consider cross board / chess board. And consider black color as solar cell and white color as mirror. So, one cross one mirror cell combination create perfect structure. This kind of structure helps for reflect light more as possible.

This kind of silicon weber and mirror are placed on bendable sheet and bend each of edge. Solar cells are placed based on how much watt you need to produce each of this system.

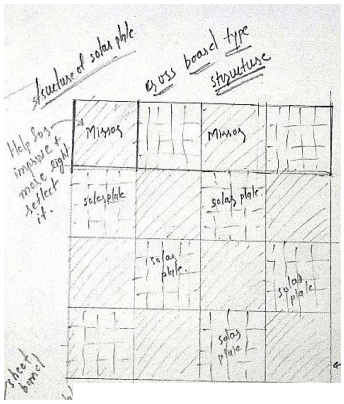

Figure 5 Cell and mirror position.

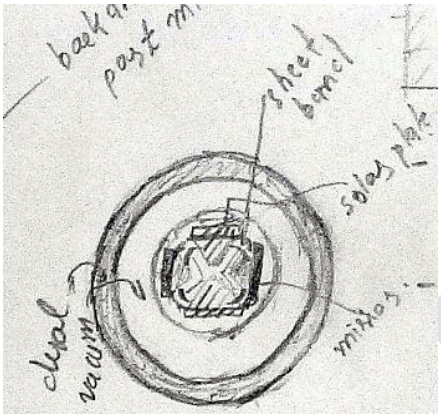

Figure 6 Top view.

As per top view part, we proper understand for how to placing this solar cell and mirror. In between two insulation layer over there. So, temperature may not be affected. Dust does not collect over panel. So, No need for washing or cleaning solar plates. Only light travel in central part, cell may be not damaged due to heavy sun light or warm temperature. Collector with UV filter available again it does not affect with solar plate.

Collector can be collect sun rays from all direction. We don't need tracking circuit for sun. Even space problem has been solved out with tube type structure. One solar cell connects with other solar cell via this single sheet which actually bend as per cube side (top and bottom part open).We place sheet inside easily and output cable comes out form bottom of tube. Our proposal system protect many of thing of solar panel. So, I called as solar shield, which protect from dust, temperature, UV light, fix position structure and many more. This is just concept of solar panel. Yet we do not test practically. First drawback for this system in bad weather condition solar panel cannot be worked properly. Second one if tube bend and utilize after some meter place panel set than may not be worked other side after certain meter inside solar tube light may not be reached.

We can use this proposal method in varies sector. In future develop wireless power transmission for phone than this system places at road side area. So, your mobile will be charged from this system. Actually wireless system already installed in this solar shield. Even high rise apartment area where space is very less. So, you can easily install it. Not even this kind of sector also use this system in the solar power generation plant.

VI. CONCLUSION.

In this study, we have investigated the solar shield for protect solar panel and increment power output. We have also investigated the practicability of employing solar concentrators to enhance the output power of the solar panel to a considerable level. We hope that our proposal towards an efficient way to electrify the streets of all the city corporations under the prevailing "Solar Photovoltaic-Powered LED Street Lighting" project will help to more effectively implement the project within the budget and thereby reducing pressure on conventional power use and current generation. Also utilize this system in power generation plant.

VII. ACKNOWLEDGMENT

I really thanks to my parents for valuable guidance, encouragement and support. Without your moral support, this project report could not be accomplished without your (mom) **Mrs. Ashaben P. Acharya** and (dad**) Mr. P.T. Acharya.** Thank you so much.

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