A REVIEW OF VARIOUS SHAPES OF EXTENDED SURFACE TO INCREASE THE HEAT DISSIPATION FOR PV MODULE

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ABSTRACT
A solar cell is an electrical device that transforms the energy of light straight into electricity by the photovoltaic result. Photovoltaic is that the field of technology and analysis associated with the practical application of photovoltaic cells in manufacturing electricity from lightweight, although it's typically used specifically to refer to the generation of electricity from daylight. Cells may be described as photovoltaic even once the light supply isn't essentially sunlight (lamplight, artificial light, etc.). In this paper various literatures on solar cell efficiency, effectiveness, and the effect of weather change i.e. temperature variation on solar cell has been studied to find out the most vital parameter which affect the whole solar system and by considering these parameter work has been carried out to optimize and analyses these parameter.
Keywords: Solar Energy, PV Module, Solar Power Generation

1. INTRODUCTION

A few years ago when the electricity was not discovered, Even then life was duly forthcoming .But in 1600, the English physician William used the term “electricus” and in 1876 Thomas Alva Edition discovered the bulb which consolidate and enhance the power of science. Who knew that this bulb would be an integral part of discussion of human life .Various types of conventional sources (coal, natural gas, oil, and fire woods) were used to light up the bulb. But due to the limitations of their source, their use started decreasing. Slowly these traditional sources were replaced by non-conventional sources.

1.1. Review of Solar Energy across the World

The energy from the sun reaching the earth per day ranges from about 633kJ/sq. ft. for Northern Europe to about 2110kJ/ sq. ft. for dry region near the equator. Germany and Spain were leaders in solar system installation and utilization across the world. Solar PV produced only a small fraction of the world’s total electricity in 2010, but installed solar PV capacity has grown rapidly in recent years and is expected to continue to do thus within the future [4]. within the New Policies state of affairs, electricity generation from solar PV in 2035 is over 26-fold that of 2010, increasing from 32 TWh to 846 TWh. Total generation rises to only over 2 in 2035. Put in solar PV capacity will increase from 67 GW in 2011 to only over 600 GW in 2035, because of continued value reductions and government support [5].

1.2. Review of Solar Energy in India

India receives a solar energy equivalent of over 5000trillion (i.e. five × 107lakh) kWh per year that is much over its total consumption. The daily radiation showers is around 5kWh per sq.m per day with sunshine ranging between 2300 and 3200 hours annually in most elements of India. The daily average solar power incident varies from four - seven kWh/m2depending upon the location. There are around 5-6 months sun showers in most elements of the country. The potential of the solar power in meeting the country growing energy desires was recognized in middle 70s.Effortswere created in each solar thermal and photovoltaic routes initiation.

Throughout the 80sseveral applications were developed and demonstrated. These efforts received a momentum with the establishment of Ministry of New & Renewable Energy Sources (MNRE). The Ministry's programmes helped in R&D, demonstration, commercialization and utilization activities in respect of a wide variety of renewable energy technologies [6].

India has one amongst the largest solar power programmes in world. a considerable analysis and technology, a growing producing capability and a countrywide infrastructure for the distribution and after-sales service of solar power product have emerged. Solar power is beginning to be used for a large variety of applications. Still, the achievements thus far add up to only a little fraction of what's possible. The effort initiated throughout the last few years by MNRE to structure the programmes and giving them a market orientation are contributing considerably in fast the use of solar power commercially within the country. The JNNSM launched in India (Jan 2010) has set associate ambitious target of 22GW of solar installation by 2022. This mission is associate encouraging sign for the longer term of solar power in India. The Charanka solar Park, at 214 MW the biggest within the world, was commissioned on April 19, 2012, beside a complete of 605 MW in Gujarat, representing 2/3 of India's put in photovoltaic. Giant solar parks have additionally been announced within the state of Rajasthan. The 40 MW Dhirubhai Ambani solar Park was commissioned on March 31, 2012 [7].

2. LITERATURE SURVEY

K.A.Moharrama[1]The objective of this analysis is to cool the PV panels using the least} amount of water and energy. A non-pressurized cooling system has been developed supported spraying the PV panels by water once in a very whereas. A cooling rate model has been developed to determine however long it'll want cool the PV panels by water spraying to its operational temperature. A mathematical model has been used to verify the heating rate of the PV panels, so as to determine once to begin cooling. an experimental setup has been developed to validate each models, i.e., the heating and also the cooling rate models, by experimentation, and to check the influence of cooling on the performance of PV panels. It may be all over from the results of this study that; it's attainable to chill and clean the PV panels using the planned cooling system in hot and dusty regions. The cooling rate for the solar cells is approximate 2 °C/min supported the involved operational conditions, which suggests that the cooling system are operated every time for 5 min, so as to decrease the module temperature by 10 °C. The results of the cooling rate model have shown good agreement with the experimental measurements. Each the heating rate and also the cooling rate models are valid by experimentation. The PV panels yields the best output energy if cooling of the panels starts once the temperature of the PV panels reaches the utmost allowable temperature (MAT), i.e., 45 °C. The MAT could be a settlement temperature between the output energy from the PV panels and also the energy required for cooling.

Stefan Krauter [2]suggested a method of reducing reflection to coolthe PV by replacing the front glass layer with a thin layer of 1 mm running directly over the PV face. As a result, the PV temperature reduced to 22 °C and the electrical performance increased to 10.3 % over the day. One of the drawbacks of this design is the non-homogenous thickness of the water filmwhich is necessary to determine the optimum water film in order to improve the optical performance

L. Dorobantu, M. O. POPESCU[3] To achieve an electrical yield near about 9.5% by cooling the PV front surface using a thin film of water. These thin film of water reduce reflection losses and also reduces the panel temperature to the desired limit by this we also can get some changes in pv efficiency.

Calebe Abrenhosa Matias, Licínio M. Santos, Aylton J. Alves, Wesley P. Calixto [4] This paper presents the event of a cooling equipment using water during a commercial photo-voltaic panel so as to research the increased efficiency through decreased in operation temperature. The system allows the appliance of apply water flow, at close temperature, over the front surface of photo-voltaic (PV) panel and consists of an machine support, a perforated Al profile and a water gutter.

Aluminaire was specially developed to simulate the solar radiation over the module under test in a closed room, free from the influence of external climatic conditions, to carry out the repetition of the experiment in controlled situations. The first case study was published at EEEIC2016 conference where the panel was submitted to different rates of water flow, from 1 L/min to 4 L/min. In the test conditions without cooling apparatus, the panel reached about 70°C and produced approximately 63Wh. With the cooling apparatus with water flow rate of 2 L/min, the module reached about 50°C and produced approximately 77Wh. However, it has been observed that this water flow was overestimated. A second case study was carried out in order to perform the threshold between the flow and the energy produced. The best ratio was flow of 0.6 L/min and net energy of 77.41Wh. Gain of 22.69% compared to the panel without the cooling system.

This work shows that decreasing the panel operating temperature, when subjected to cooling apparatus, is the factor responsible for the increase of thevoltage and consequently the increase of the amount of energy produced. In initial conditions,without cooling apparatus, the photo-voltaic panel produced 63.09 Wh, for 70ºC on the panel, and after using a water flow rate of 0.6 L/min it produced around 78.74Wh, for about 50ºC on the panel, a gain of 24.80%. A hypothetical case of water transport was implemented to simulate the amount of energy needed to cool the panel for 1 hour. Then the comparative analysis of the increase in efficiency using the apparatus reveals that the water flow of 0.6 L/min on the front surface of the panel provides the highest net power increase, 22.69%. The apparatus, consequently can be implemented in industrial facilities, where there is reuse water potential, in order to increase the amount of energy produced and/or reduce the payback period of the investment. The results show that the water distribution system, under the PV panel can be improved to optimize the efficiency of the water flow used.

B. Balamuralikrishnan, B. Deepika, K. Nagajothi, S. Shree, P. Subasini.[5] Tested the improvement of efficiency of PV module by applying many techniques. In this paper a system consisting of cooling unit and sun tracking unit. The cooling unit consists of an electronic controller circuit that excites DC pump-to-pump water and form water film on the PV surface, by a signal from a temperature sensor that sends the signal once temperature of PV exceeds 35^0C. It saves energy as well as water. Their system reduced the temperature by 8^0C and increases efficiency by 3%.

Mohd Ehtishaan Md Rizwansaifee[6] Solar cells are sensitive for temperature. With the rise of temperature, the bandwidth of cell additionally changes, thereby effecting most of the semiconductor material parameters. During a cell, the parameter most suffering from a rise in temperature is that the open-circuit voltage. Because the temperature will increase corresponding open-circuit voltage decreases, thereby decreasing the fill issue and eventually decreasing the efficiency of a cell. One among the most obstacles that face the operation of photo-voltaic panels is overheating because of excessive radiation and high close temperatures. Overheating reduces the efficiency of the panels dramatically. “Hence we've to use cooling systems to avoid the overheating of the system” Active cooling units are examined in 2 groups; Air cooled systems• Water or refrigerant liquid cooled systems• Air cooled systems can't be utilized in each region and on each system, as a result of if the air temperature is higher than 20 °C, effectiveness for PV cooling would be very low. Water or refrigerant liquid cooled systems has no such a limitation therefore, during this study only water or refrigerant liquid cooled systems can take into thought whereas comparison. During this project Water cooling system with AI for photo-voltaic systems are introduced to maximize the created energy. The overall model is dead on MATLAB, and accepts irradiance and temperature as variable parameters and outputs drawn into I-V characteristic and P-V characteristic. These days solar power has great importance. as a result of it's simply accessible resource for energy generation. However the only drawback is efficiency of scheme and to extend its efficiency several techniques are used. Here we tend to are using the cooling result on the PV panel improves the efficiency.

D. Revati , E. Natarajan[7];The main objective of this work is to research an impact of the temperature on the performance of the photovoltaic cell. so as to accomplish this study, solar array has been tested below 3 totally different conditions like, solar panel while not cooling, solar panel placed in grass field and solar array with air cooling. Throughout testing, cell parameters like circuit voltage, contact current, surface temperature, panel temperature and close temperature are observed. The results obtained clearly show that solar array with air cooling has generated the maximum circuit voltage and contact current whereas comparison to different 2 check conditions. For each 15 minutes, solar array has been created to cool with air therefore on decrease the temperature rise of the solar array. Supported the check results, it might be complete that solar array integrated with air cooling system is predicted to attain higher electrical efficiency due to improved power generation. This work might be helpful to know the impact of temperature on the cell parameters and performance of the solar array.

Pascal Biwole [8] This paper investigates the utilization of phase-change materials (PCM) to maintain the temperature of the panels close to the part temperature. The most focus of the study is that the CFD modeling of heat and mass transfers in a very system composed of an impure phase change material located within the back of a solar panel (SP). AN alternation of the heat content, methodology permits simulating the material thermo-physical modification of properties. For validation functions, isotherms and rate fields are calculated, this mathematical value is compared to those from an experimental set-up. Results show that adding a PCM on the rear of a solar battery will maintain the panel's in operation temperature up to optimum limit for around 2 hours below a continuing radiation of 1000W/m². This description doesn't take into thought the majority specific capability of real panels. The second limitation comes from the very fact that the impact of sky temperature wasn't enclosed within the numerical model, because of experimental validation difficulties. Within the last paper conclude to use PCM backside of panel is good however by experimentation is way away.

3. SYSTEM DESCRIPTION

In present study a model using the solar power cells and panels (poly-crystalline) is proposed. Since solar cells were first developed in 1954, there has been enormous effort put into increasing their efficiency, developing new types of solar cells, and reducing the cost of manufacturing cells.

The solar cells start losing their efficiency, when they are subjected to sunlight for long hours, as the temperature of the solar panel increases, there is a reduction in power output. The PV system and solar panels is effective tool for it. We utilize the fins to reduce the excessive heating of solar cells (poly-crystalline) and the analysis is carried out for poly-crystalline panel. This may of optimum utilization of easily available solar energy can bring a revolution in the lives of the people [11].

In high temperature regions between tropics, both poly-crystalline and mono-crystalline performances are critical for long term energy production. The purpose to explain the fundamental of solar photovoltaic cell at higher temperature operation affects the power output, efficiency and cell reliability over the solar power plant's life. Silicon is one of the most important semi-conductor materials used for solar cell fabrication. Solar cells are fabricated using specialized technique, like laser governing, selective diffusion for selective emitter formation, photolithography and metal evaporation for contact placement.

3.1.Hybrid Solar PV -Thermal System Working

Thermal photovoltaic solar sensors hybrids, sometimes known under the name of hybrid systems PV/T are systems that convert the solar radiation into thermal energy as heat and electrical energy as current. These joint panel converts sunlight directly to electricity with a solar collector thermal, which stops the rest of the energy and eliminates the residual heat of the 'module PV. Encapsulate the electricity and heat to medal to have of energy and then be more effective from the photovoltaic solar energy Solar thermal or alone. PV panels ache from a decline in the energy efficiency with the increase in atmospheric temperature or heat due to increased tolerance. Proper designed of hybrid systems can be modeled to evacuate the heat away from the PV panels thereby cooling the cells and thus improve their potential in reducing the resistance and increase the energy output. Although this method is effective, it causes the sub-thermal component to perform by report to a Solar System thermal.

The hybrid solar-thermal work of PV system depends on two different solar systems each other. First is the production of solar photovoltaic electricity system, which operates on the photovoltaic effect at the same time solar thermal works on Phonic effect thermos. By the combination of these two systems in a same framework the working group of the hybrid PV-T system passes that generates electricity as well as heat (hot water) at same time. PV is the effectiveness for the efficiency of solar panel or the electrical energy and energy efficiency is synonymous with PV/T sharpness of PV systems and solar thermal heating System.

3.2.PV module

A solar cell produces small power, in the range of less than a watt to few watts. However, for our application we need the power in tens of watts and some kilowatts. Therefore, in order to generate large power using solar cells, many solar cells are connected together to make a PV module. A solar PV module comes in various power ratings, ranging from few watts to few hundred watts. The most common technology for solar PV modules uses crystalline Si solar cells. The crystalline Si solar cells are fabricated using two types of crystalline Si wafers, (1) mono-crystalline and (2) poly-crystalline. The mono-crystalline Si solar cells are either circular in shape of pseudo-square, while the poly-crystalline Si solar cells are normally square or rectangular. Due to the shape of mono-crystalline solar cells, the solar PV module made using these cells have empty space between the cells. On the other hand, the solar PV modules made using poly-crystalline Si cells are tightly packed and do not have empty space between the cells

The crystalline Si solar cell technology is known as the first generation solar cell technology. There is also a second generation solar cell technology which include CdTe (cadmium Telluride), CIGS (copper indium gallium sellenide) and a-Si (amorphous Si). These second generation technologies are also referred as the thin film technologies. These technologies are also commercially available. The PV modules that are made using crystalline Si appear bluish in colour and also have thin metal contact lines (appear white) on the top. These metal contact lines are separated by few mm. In case of thin film solar PV modules, these visible metal contacts are not there, because instead of metals, transparent oxides are used to make metal contacts. The colour of thin film PV module can be dark grey

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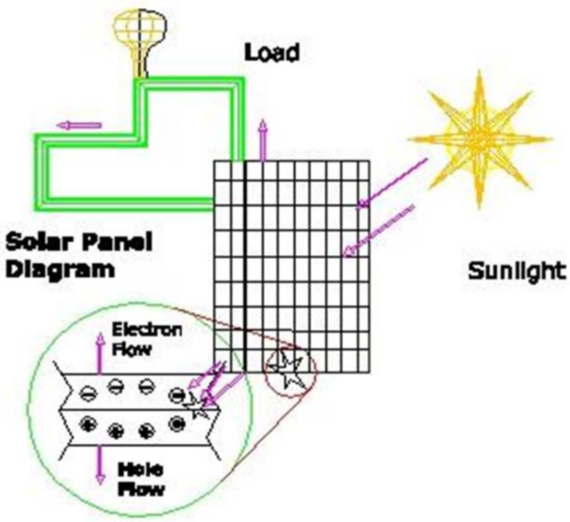

Fig.1 Solar Photovoltaic System Working

3.3.Solar Current Generation Principle

Production of current from solar radiations depends on the photovoltaic effect. The most general kind of semiconductor commonly in use is fabricated by silicon crystal. Semiconductor or si crystals are coated into p-type and n-type layers, stuffed on top of each other. Sun rays imposing on the crystals convince the "photovoltaic effect," which produce current as electricity. Depletion section is creates at the meeting point of two different layers because of motionless ions. When sunrays strike on the PV cell, it easily reaches up to p-n junction layer. The Junction p -n absorbs the photons of light from the sun and rays accordingly, product of electron pairs holes in the junction. .The free or the movement of electrons, are located in the depletion region will easily go to the upper part of the Layer n due to the force of attraction of the positively charged ion p-layer in the depletion surface. This phenomenon creates a kind of difference in charge between the layers and resulting from a small difference of potential between them. The necessary components can include major components such as a voltage converter DC-AC, Bank of Battery, Battery, Controller of the system and of the sources of auxiliary energy and sometimes the electrical load.

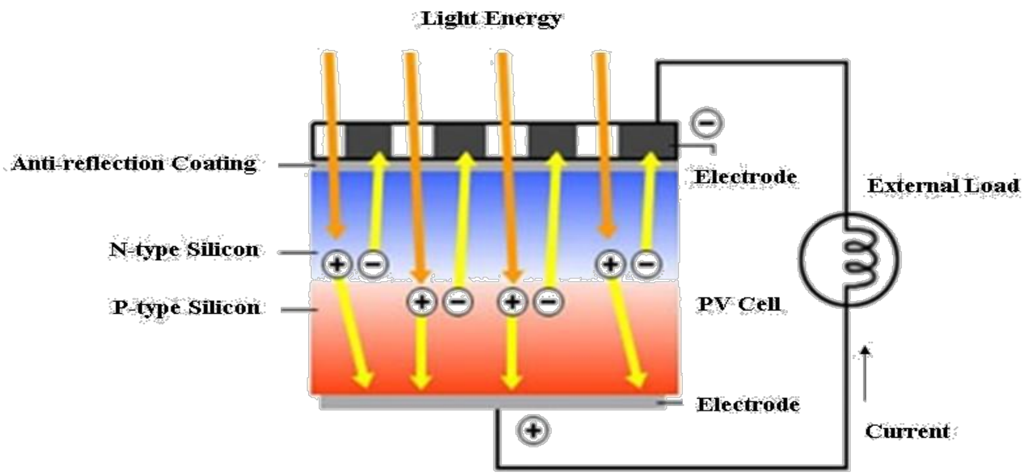

Fig.2 working principle for solar electricity

4. CONCLUSION

The work will embody a review of research relating to the development of the photovoltaic plant-thermal (PVT) modules. To deploy, several aspects should be examined to obtain a share of the market, including: the levels of solar radiation, the hot water of dominant and of government policy that places one or the other of the barriers or incentives for the levels of use. It will take account of the experimental studies. It will then be necessary to a market where it would be positioned to gain work experience as well as to allow for the innovation.

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