



COMPARATIVE ANALYSIS OF SOLAR REFRIGERATION SYSTEM WITH POLYCRYSTALLINE SOLAR PANEL AND THIN FILM

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ABSTRACT

Solar energy is the most substantial sources of renewable energy present in the atmosphere and it will last till the end of the earth. But still solar energy is not much preferred for the domestic purposes due to its higher installation cost and lower efficiency. Solar energy is stored through solar panel and it is available in different type such as poly crystalline solar panel, mono crystalline solar panel, string ribbon cell, and last but not the least thin film solar technologies. Among them thin film solar technologies is latest technologies. So there is lot of research going on this panel. So in this research effort is put by the comparative analysis between the two panels one of them is thin film solar technologies and another one is poly crystalline solar technologies. Poly crystalline solar panel named as conventional system and thin film as modified system.

Keywords: solar panel, polycrystalline solar technologies, mono crystalline panel, inverter, battery etc.

1. INTRODUCTION

In this study a research is performed on different solar panel. The solar panels are poly crystalline solar technologies and thin film technologies, because these solar panels have different properties. Renewable energy has different advantage and it has many types such as solar power, wind power, hydro power, but the solar energy has maximum efficiency than other and installation is also easy than other renewable energy resources. Thin film technologies are the latest technologies in the solar industry so the several researches are going on this panel. PV solar panel generates direct current and it is transferred into AC current by battery. Solar energy does not lead any pollution and are also clean. They also decrease our reliance on fossils fuels and traditional power sources. Installation of solar panel in homes helps in combating the harmful emissions of greenhouse gasses and thus helps reducing global warming. However the main concern regarding of solar panels that is quiet costly. Some of the research regarding this has performed like Daghigh. Investigate the theoretical and experimental details of solar thermoelectric cooling-heating system. [1] Daffallah also investigated on the photovoltaic refrigerator (dc) with and without loading to get result. [2] Verma analysed that the renewable energy has great potential to meet the demands of energy in which solar energy has to play important role. [3] Ghafoor investigated a brief analysis of different type of installed solar thermal power technologies which is available and actually used for cooling of air conditioning purpose have been presented. 4] Makki studied on the photovoltaic cells that can absorb 80% of solar energy that is coming from sun light however it changes only some part of this solar energy which is totally related to the efficiency of these solar cells. [5] Sarbu talked about the two type of thermally powered refrigeration technology which is sorption technologies (open system or closed system) and thermo mechanical technologies (ejector system). [6] Yen shows that to making steady heat generator temperature is very difficult because of irregular supply of heat irradiation of sun. So it resist or decrease the performance of solar refrigeration system so to reduce

this and upgrade the performance of ejector, this experiment have variable throat ejector (VTEJ) and its performance analysed by using CFD simulation. [7] Hou investigated that, the thermoelectric device is basically runs on the theory of peltier cooler when PV/T modules supplied electric power to this thermoelectric system. The cold sides absorbs from indoor to decrease the temperature of the room. [8] Afshar detailed analysis the best utilisation of solar energy's necessary due to its advantage such as it provides the balance in energy production, solar economics. The utilisation of solar energy also helps to improve solar efficiency. [9] Saidur investigation shows that usages of solar energy in different kind of system provide scope for several studies on exergy analysis, because solar energy is the cleanest energy in the atmosphere. Solar energy is comfortably available in the atmosphere most important it is present in abundant and enough and never ending. [10]

1.1 Types of solar panel

1.1.1 Mono crystalline solar cells

Mono crystalline solar technologies are made up of mono crystal silicon (mono-Si). It is also going by the name of single crystal silicon (single crystal-Si). This solar panel are easily distinguishable due to its uniform colour and look. It contains highly pure silicon. Mono crystalline solar technologies consist of silicon ingots. It is cylindrical in shape. That gives this panel a characteristics look.

1.1.2 Poly crystalline silicon solar cells

The solar panel based on poly crystalline silicon, which is also going by the name of poly silicon (poly-Si) and multi crystalline silicon (mc-Si). Unlike mono crystalline based solar panel, this solar panel do not required the czochralski process.

1.1.3 String ribbon solar technologies

Poly crystalline solar technologies are the main reason to make string ribbon solar cells because it is made from poly crystalline solar cells.



1.1.4 Thin film solar cells (TFSC)

Thin film solar cells are latest technologies in the field of solar energy and many researchers have studied the thin film technologies to improve their performance. The biggest advantage to thin film technology is, it has tuneable material properties. It means that thin film can be substrate to any material after making the panel.

1.2 Wind energy

Wind is defined as the motion of air across the earth. Wind power is produced by the wind which is air is passes or flow through the wind turbine and wind mill to run the generator to produce electrical energy. Wind power convert kinetic energy of wind into electrical energy by the help of wind turbine and wind mill. Wind power provides variable power throughout the year because of inconsistency air flows in the environment and area.

2. EXPERIMENTAL DETAILS

2.1 Experimental set up

In this study experimental set up are very important processes to employ. So this experiment process have different instrument which calculate the important data. So the list regarding the experimental set up is as follows. So this study consist two types of solar panel, poly crystalline solar technology and thin film technologies. This study revolves around these panels as mentioned earlier. So in this study the solar power is stored in battery and run refrigerator through this power.



Figure-1. Pictorial view of experimental set up.

2.2 Instrument used

In this study there is many instrument used such as measuring devices, calculating devices etc. the instrument used in this study are as follows:

2.2.1 Multi metre: It calculate the AC current, DC current, AC voltage, and DC voltage and many more uses. In this experiment multi meter help to find out volt and ampere at solar panel, Which help to find the exact energy received by the solar panel.

2.2.2 Hygrometer: Hygrometer calculate ambient temperature which helps to find the energy received at that temperature and humidity present in the environment, which are very important criteria for the solar refrigeration system.

2.2.3 Solar power meter: Solar power meter calculate solar intensity comes from the sun. W is ultimately shows the power and intensity of the solar power in different units such as W/m^2 and Btu units. It also shows the maximum and minimum solar intensity coming from the sun.

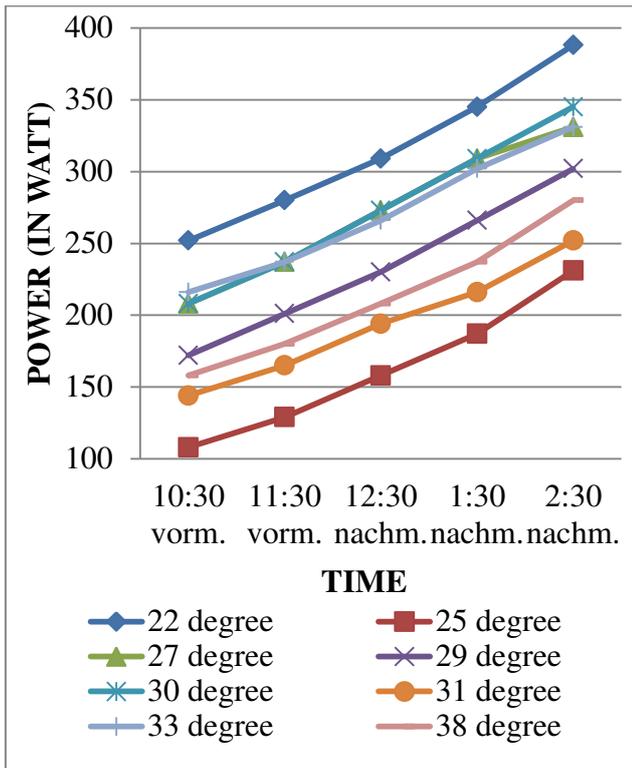
2.2.4 Battery meter: This is the best meter which shows the battery charge percentage. This experiment is based on this meter.

So after all this experimental procedure is are as follows:

- Placing solar panel at different angles.
- Store solar energy in battery.
- Convert DC current of battery in AC current through inverter.

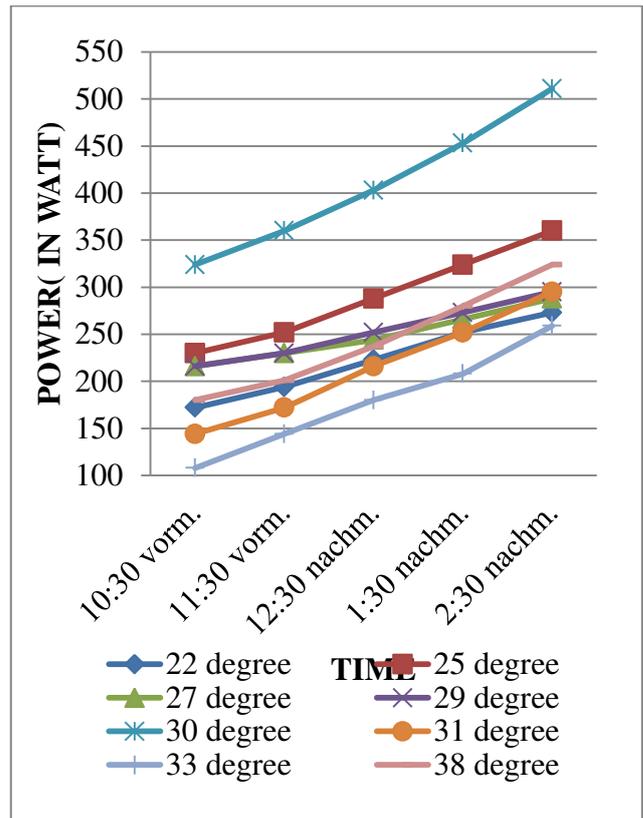
3. RESULTS AND DISCUSSIONS

Power stored by both the solar panel at different angle is shown with the help of graph. This helps in calculation of result. The below graph shows the power produced by modified solar panel at different angle. This graph helps to determine the maximum power produce by the solar panel at different angle. In thin film solar panel maximum power produced at an angle 30 degree which is 34.2 watt per hour.



Graph-1. Power produce (in watt) by modified system (thin film) at different angle.

After calculating the modified system it is required to calculate same for conventional system because for comparison it is required to be same basic criteria so after that same criteria is used to measure the power produce by the conventional system (poly crystalline solar technologies). The graph 2 shows the same experiment method that is used to calculate the power produced by the modified system (thin film technologies)

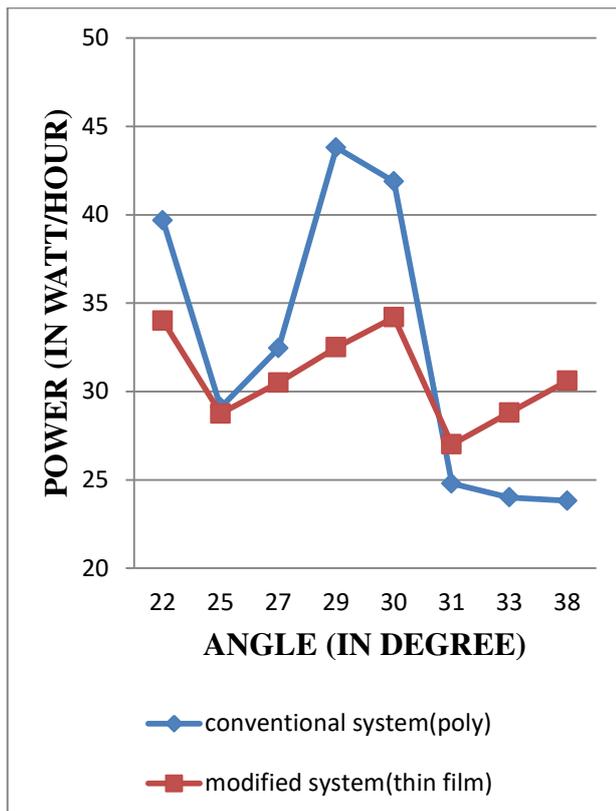


Graph-2. Power produced (in watt) by Conventional system (poly crystalline) at different angle.

After calculating all the power at different angle a table is formed in the form of power produced by both the panel in watt per hour are below.

Table-1. comparison of conventional system (poly crystalline) and modified system (thin film technologies) at different angle.

Angle (in degree)	Power produced in conventional system (watt/hour)	Power produced in modified system (in watt/hour)
22	39.67	34
25	29.1	28.75
27	32.44	30.5
29	43.8	32.5
30	41.88	34.2
31	24.79	27
33	24	28.8
38	23.81	30.6



Graph-3. Comparison of conventional system (poly crystalline solar panel) vs. modified system (thin film solar panel) at different angle.

So the above graph shows the variation of time with power generation of modified system (thin film technologies) and conventional system (poly crystalline solar panel). The variation of both the panel as shown in above graph is as follows. This graph shows the power stored in one hour by the poly crystalline solar technologies and thin film technologies. It is clear from the graph that at different angle the power stored per hour is different and some of the angle the difference is high and for some difference is not big. And for some it is almost same. The most important criteria are stored solar intensity measurement which is comes from sun. It is best parameter which shows and helps to analysed the result. So comparing at different angle as it is seen that at the angle 22 degree thin film technologies has less power storing capacity than the poly crystalline solar technology. Poly crystalline solar technologies have more capacity to generate heat. At an angle of 25 degree it is shown that the power stored by both the panel is almost same. Now at 27 degree the power stored by the thin film technologies and poly crystalline solar technologies is not much difference but there is difference which shows the effectiveness of poly crystalline solar technologies. This criterion is same for the angle 29 degree and 30 degree. But after that the solar intensity and solar power capacity is greater than poly crystalline solar technology and it gives the result that for some angle such as 31 degree, 33 degree, and 38 degree the solar power intensity is much higher than poly crystalline solar technology.

4. CONCLUSIONS

In this experiment, there are two solar panel used one of them is conventional system (poly crystalline solar technology) and other one is modified system (thin film technologies). As it is mentioned in the abstract that this experiment is performed to find the solar panel, which provide the maximum power in the similar condition of environment and different angle. The power that is stored by this solar panel is different in different condition. After completing this study it comes out as conclusion that as the angle increases the poly solar cell is not a good option for the power generation. For poly maximum power stored at an angle 29 degree and for thin film it is at 30 degree when it comes to power stored. Thin film has different construction process so its tuneable properties can be change for desired result to get maximum benefits. So thin film technology produces maximum power when the angle is increases.

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