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A Review on Different Techniques Employed for Enhancing Performance of Solar Cell

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Abstract- The use of solar energy as a strategy to reduce global warming's devastating consequences is a promising area of research. Due to solar energy's low greenhouse gas emission rate, it has the potential to replace a large number of traditional energy sources. The goal of this research is to increase the output of energy generated by Photovoltaic cells by increasing the amount of solar radiation and sunshine they receive via the use of mirrors. The result is increased energy production from a concentrated area of solar panels. The study's goals are to (1) assess if simplified mirror methods may enhance solar cell performance, (2) identify which features of solar cells can be enhanced by such approaches, and (3) verify that the solar cells' performance has been enhanced as a consequence of the enhancements. Using flat reflectors, more sunlight may be focused onto the solar panel's surface. Parabolic reflectors might potentially be used in this situation, but they are more expensive to make than flat reflectors, thus that route wasn't taken. This kind of mirror can only focus sunlight in a certain direction onto a smaller area if placed in just the right spot. Because of this, the solar panel's temperature might rise, requiring a cooling system. Considering that radiation levels are greatest towards the middle of the day, this is to be expected.

Keywords: *Solar panel, battery, mirror technique, PV panels, Solar photovoltaic systems, Solar PV plants, solar PV systems, energy storage.*

1. Introduction

Solar energy is clean, renewable, and available all except in the coldest months of the year. It is estimated that in a single hour, the Earth gets enough solar energy to provide the whole world with energy for an entire year. Similarly impressive is solar energy's ability to mitigate global warming. Solar power has the potential to substitute many conventional energy sources due to its low carbon impact. Carbon dioxide emissions are little released during manufacturing thanks to the use of conversion devices. Solar energy may be used for many different purposes, such as providing light, warmth, distillation, and the production of fuels. Solar energy may be utilised to create electricity thanks to the photoelectric effect and the later development of PV cells (Emetere, Akinyemi and Edeghe., 2016). Solar panels are commonplace in areas where it would be impractical to build transmission and distribution lines because they generate power for local inhabitants. Researchers Richard Evans Day Adams discovered that selenium exposed to light generated electricity, although at low efficiency, in 1876. Following this, researchers dived deeply into investigating and testing methods to improve solar cells' efficiency. They negotiated a reduction in the exorbitant electricity prices to where they are now, only a few cents per unit. It is expected that in the and William Grylls future, thanks to innovations like titanium oxide (TiO2) cells, which have a peak efficiency of 32% in the lab and an average efficiency of 15-20%, the cost would drop, making it competitive with other power generating sources (Jahagirdar, Khot and Joshi., 2019). Unfortunately, the price of converting solar energy into usable form is still far higher than the price of electricity produced by burning fossil fuels. The sun's rays are a valuable resource, and it is important to capture as much of them as possible.

2. Discussion

Enhancing Solar Panel Performance with an Easy-to-Implement Cooling Scheme

The study that was carried out by Jahagirdar, Khot, and Joshi came to the conclusion that the production of solar systems and their overall performance are reliant on the amount of natural sunshine that is available. Despite this, temperature also plays an essential part in the efficiency of these systems and is one of the most critical impacts. It is also one of the most influential factors. The goal of this study was to determine how the temperature of solar panels may be lowered while they are functioning by applying a cooling mechanism, both on the surfaces of the panels and on the panels themselves. This was done in order to improve the efficiency of solar energy production (Jahagirdar, Khot and Joshi. 2019). During the course of the tests that were performed, it was discovered that the solar photovoltaic system generates different levels of output power, output voltage, current, and efficiency depending on whether or not it is paired with a cooling system. This was discovered as a result of the findings that the solar photovoltaic system produces

different levels of output power, output voltage, and current.

3. Maintaining Solar Energy Generation in Highly Convective Coastal Areas

According to the findings of the research project that was carried out by Emetere, Akinyemi, and Edge, it is essential to take into consideration the local climate when building a solar farm that is dependable and operational in coastal areas. This conclusion was reached as a result of the research that was carried out. Researchers were able to get a better understanding of how minute shifts in the values of other meteorological components impact the quantity of irradiance received from the sun by using simulations that took place in three dimensions. During these computer simulations, a connection was shown to exist between the level of solar irradiation, the quantity of daylight, and the surface temperature (Emetere, Akinyemi and Edeghe., 2016). In order to offer a dependable source of power supply, the concept of a solar farm was brought up for discussion. The key issue that was brought up as a consequence of the installation of an electronic concentrator pillar was the anticipated lifespan of the solar module. This was the primary subject of debate (CP). By making use of reflectors that are flat in shape, it is possible to acquire an additional degree of sunlight concentration on the surface of the solar panel (mirrors). In this case, it is also conceivable to use reflectors that have a parabolic shape; however, the manufacturing cost of these reflectors is more than the manufacturing cost of flat reflectors; as a result, this alternative approach was not followed. This particular kind of mirror can only be used in a certain spot to focus the sunlight into a more condensed area that is oriented in a specific course (Patel and Gupta. 2022). Because of this, there is a possibility that the temperature of the solar panel will rise, which would need the use of an extra cooling mechanism. As a consequence of this, the concept would call for the use of two mirrors, both of which would be positioned at certain angles, and each of them would be responsible for reflecting more sunlight onto the solar panel. The setup will be exactly as stated below, and you can see an illustration of it in figure 1. Although India's geographical location is favourable for the generation of solar energy due to the fact that it is a tropical country that is exposed to solar radiation for almost the entire year, the cost of the entire system would be higher if it required two separate tracking mechanisms (for mirror) to track the sun. This is because India's geographical location is favourable for the generation of solar energy due to the fact that it is a tropical country that is exposed to solar radiation for almost the entire year (Adak, Bhattacharyya and Barshilia., 2022). This is due to the fact that India is a tropical nation. Therefore, utilising permanently directed mirrors was more convenient than using moveable mirrors, both in terms of cost and the complexity of the design and layout. This is because movable mirrors need more planning and space than permanently directed mirrors. A relay was used in an effort to achieve the goal of managing the flow of power to both the solenoid valve and the stepper motor. The output and intake pipes of the system were respectively linked to the solenoid valve and the bottom cooling unit of the SOLAR panel. Both of these pipes were connected to the system. In order to cut a circular hole in the panel, it was required to make use of the hydraulic pressure that was stored in the reservoir tank that measured 1.5 metres. When the hole was finally opened, gravity was able to move the cooled liquid all the way through the panel. Throughout the duration of the experiment, each and every piece of apparatus was allowed to sit in the open and was subjected to the heat of the sun. The tracking data from a reflecting system was utilised in an effort to monitor the open- and short-circuit voltage and currents of solar panels. This was done with the help of a reflecting system. Because of this, the only way that data could be obtained was by coating the mirror with a substance that was opaque. When the power is turned on and the solenoid valve is activated, water will start to circulate through the cooling system until it reaches a temperature of 25 degrees Celsius. This process will continue until the water achieves the desired temperature. This procedure will be repeated until the water reaches the target temperature (Huang et al., 2013). The microprocessor was in charge of recording data in an effort to keep an eye on the solenoid valve that controlled the cooling system. When the temperature at the output fell to less than 25 degrees Celsius, the valve was closed off. In order to achieve this objective, the mirror cover had to be taken off, after which the light was made to reflect and was then cooled. Due to the fact that the Standard Test Condition (STC) mandates that the temperature of the surrounding environment be maintained at 25 degrees Celsius at all times, it is not practicable to put this condition into actual practice. This refers to the actual implementation of solar energy projects that are being carried out in the here and now. Between the hours of eleven in the morning and four in the afternoon, the sun's rays are at their most intense. This is the best time to go outside. So that we could draw the clearest and most accurate findings possible from our investigation, we carried it out between the hours of noon and three in the afternoon (Hall et al., 2016). However, when solar panels were cooled with air rather than water, an increase of around 18–20 percent was noticed rather than the 26–28 percent that was reported when solar panels were cooled with water. When we take into consideration the fact that the blower that was used to cool the panel in the air-cooling system required

the utilisation of electricity, we are able to arrive at the conclusion that cooling solar panels with water gives a significantly larger number of advantages than air cooling. In addition, we found that the efficiency of the solar panel grew by a respectable 12 percentage points when it was exposed to a water layer of 400 millilitres, but it only rose by 20 percentage points when it was exposed to a water layer of 100 millilitres (Husain et al., 2018). Therefore, it is possible to say that the performance enhancement of the P.V. panel in this instance only grows up to a particular thickness limit of water, and then it begins to decrease in comparison to the optimal thickness limit. This is because the maximum amount of water that can be present at any given time is limited by this particular thickness limit. This specific thickness restriction places a cap on the quantity of water that may be present at any one moment, which is why this is the case.

4. Conclusion

Solar energy will, for the foreseeable future, continue to have both a promising future and a wide variety of applications from which to choose. This will be the case for quite some time. Even farther into the future, this will continue to be the case. The primary expense, on the other hand, that is associated with the use of this technology is much greater. By using reflectors in conjunction with solar panels, it is possible to increase the amount of light that is gathered while simultaneously lowering the cost of generating electricity using solar energy. The results of the tests and the analysis suggest that using the mirror system leads to increased output of power in contrast to circumstances in which it is not used. This conclusion was reached based on the facts. According to the results of the tests that were performed on the solar panels, the system that makes use of mirrors produces more power than the system that does not make use of mirrors based on the data pertaining to current and voltage.

These findings were derived from the tests that were carried out on the solar panels. It is advised that, when employed for the generation of electricity, two mirrors, such as those shown in Setup No. 03, be used, with the mirrors being held at an angle of sixty degrees from one another. This configuration may be seen in the diagram. Setting no. 3 (Solar Panel with Reflecting Mirror) is preferable to the other settings that we have examined, which is set no. 3 (Solar Panel with Reflecting Mirror) is preferable to the other settings that we have examined, which is set no. 3 (Solar Panel with Reflecting Mirror) is preferable to the other settings that we have examined. Setting no. 3 (Solar Panel with Reflecting Mirror) is preferable to the other settings that we have examined. Setting no. 3 (Solar Panel with (flat solar panel arrangement and inclined solar panel arrangement). The fruitful efforts that have been made in research and design have directly led to an increase in the maximum power output, which has increased as a direct consequence of the increase in the maximum power output.

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