CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35031

Project Title

How Do Nature's Elements Affect a Solar Panel's Power Production?

Abstract

Objectives/Goals

The objective of our project is to examine how nature's elements, namely, the panel's angle to the sun, shade, wind, rain, temperature, and dust will affect a solar panel's power production, for the purposes of determining the most ideal natural conditions in which a solar panel will be most efficient.

Methods/Materials

Using a multi-meter, we measured a monocrystalline solar panel's voltage and amperage output to determine it's power production under various elements of nature. We first established the optimal angle of the solar panel to the sun and measured how changing the angle of the panel would affect the output. Using the optimal angle as a constant for the rest of the project, we then tested the panel under shade conditions and various wind speed conditions using a leaf blower and an anemometer for wind speed. In addition, we tested the panel under rain conditions using a sprinkler and local rain chart information to estimate a typical rain event. We also tested the panel under cold temperatures by lowering the panel's surface temperature with ice. Finally, we measured how dust would alter the power output of the panel.

Results

From the data gathered, we found that the greatest change to the power output of a solar panel was determined by the amount of direct sunlight that was able to hit the panel. There was a drop off of power production in our sunny day trials, from an average of 94.5 watts to only 3.5 watts, when the panel was in full shade. The other greatest change was due to the angle. When the panel was angled 40 degrees away from the sun, it caused the average to drop from 87.9 watts to 59.6 watts. Wind and rain had very little or no affect on the power production, while dust only created an average change of 2.5 watts. Contrary to our hypothesis, a lower temperature actually increased the panel's efficiency by an average of 19.9 watts when cooled down by about 68 degrees.

Conclusions/Discussion

To provide the most production from a monocrystalline solar panel, the ideal conditions would be to keep it away from shade, in direct sunlight, and at an optimal angle to the sun if possible. Keeping the panel clean and dust free would be preferred, but this does not change the output that drastically. Wind and rain had little to no affect. If there is a way to keep the temperature of the panel cool, while still maintaining full sunlight, overall power production would be increased.

Summary Statement

We examined how nature's elements affected a solar panel's power production.

Help Received

Preliminary