CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
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Project Number
J1037

Project Title
A Novel Method of Improving the Efficiency of a Photovoltaic Solar Panel using Flexible Thin-Film Solar Cells

Abstract

Objectives/Goals
The objective is to determine if a flexible photovoltaic solar panel made to a wavy geometry can increase the amount of electric energy generated per projected area.

Methods/Materials
The project involved various materials such as 2 flexible thin film solar panels, multi-meter, resistor, bread board, wires with alligator clip ends, soldering iron, solder, wire stripper, wood stapler, mounting tape, curved wood pieces, and ply wood board. I measured both the current and voltage of Panel #1(curved panel) and Panel#2(flat) using a multi-meter. Measurements were taken at three different angles, 0°, 13°, and 29°, and at four different times of day.

Results
Many calculations were obtained in my experiment. The maximum measured value of open circuit voltage was about 4.8 volts, which was close to the stated manufacturer#s value of 4.6 volts. Power was also calculated, using current and resistance. The higher the angle, the panel generated more power within the range of angles used. Also, the amount of power generated was higher around noon. The maximum power calculated was 0.29 watts, which compares to the manufacturer#s specification of 0.36 watts. By dividing the power by the projected area for each panel, power per square meter was calculated. Finally, I calculated the ratio of power per square meter, for the curved panel to flat panel, which varied between 2-40%.

Conclusions/Discussion
The observed data in my project proves my hypothesis correct; showing the adjusted power for the curved panel per projected area was higher than that of the flat panel. The power ratio of the curved panel to the flat panel ranged from 2-40%. This may be due to the fact that the curved panel had more surface area for a given roof area. The higher ratio of 10-40% occurred at zero degree angle. At a zero degree angle, some portions of the curved panel have a more favorable angle to the sunlight, causing the overall effect to be much better compared to the flat panel. However, in practical uses panels are always kept at an angle close to the latitude. This means that the improvement using curved panels may be in the lower range of the power ratio stated (2-9%). Nonetheless, my experiment proved ideal in improving the efficiency of solar energy conversion, and can be advantageously used in practical applications such as in PV (photovoltaic) solar panels installed in homes, commercial buildings, and PV solar power plants.

Summary Statement
My project demonstrates a novel method of using flexible solar film to make high-efficiency photovoltaic solar panels, which is likely to reduce the cost of power generation.

Help Received
My dad helped me decide how to conduct my experiment. He soldered wires and sawed woods for use in my experiment. Ms. Julia Stone from Power Film Inc., supplied me with free solar panels. My science teacher, Mr. Lobato, reviewed my topic and report, and guided in general.