CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Linnea L. Motts

Project Number
S0711

Project Title
The Effect of Temperature Regulation on the Power Output of Solar Cells

Abstract

Objectives/Goals
How does temperature regulation affect the power output of various solar cells (photovoltaic cells) in a concentrator system? The six photovoltaic cells - single-crystal silicon, polycrystalline silicon, gallium arsenide, thin film amorphous on steel, thin film amorphous on glass, and thin film amorphous silicon - were tested at 20°C, 25°C, 30°C, and 35°C. It was hypothesized that in a concentrator module the gallium arsenide solar cell at 20°C would produce the greatest power output of the cells tested.

Methods/Materials
1 IR (infrared) temperature probe
4 digital multi-meters
2 DC power supplies
1 Fresnel magnifying lens
75-watt halogen spotlight
6 various solar cells

A solar cell module was constructed, consisting mainly of a solar cell, heat sink, thermoelectric module, and a DC brushless fan. At each temperature voltage, current, and resistance were recorded, and overall power output was calculated for each individual cell. Furthermore, voltage and current were recorded for the power supplies of the thermoelectric module and fan.

Results
Although each solar cell varied in individual measurements for voltage, current, power output, and resistance; the solar cells generally had a negative temperature coefficient, meaning that as temperature increased resistance decreased. However, power output decreased as temperature rose.

Conclusions/Discussion
The data supports earlier findings that as temperature rises, cell materials overall lose efficiency. Additionally, the initial hypothesis supported the data in that solar cells perform more efficiently at lower temperatures. In the hypothesis, gallium arsenide at 20°C was predicted to have the highest power output; however, the thin film amorphous on glass cell at 20°C had the greatest power output.

Summary Statement
The experiment investigated the effect of temperature regulation on various solar cells.

Help Received
Father provided equipment and materials, including solar cells.