



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) Dylan L. Beyermann	Project Number J0299
Project Title Solar in the Cold	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this experiment was to study how temperature affects the maximum power produced by a photovoltaic. The performance of batteries decreases when the temperature is lowered because the chemical reactions that produce the electrical energy slow down. If photovoltaics work like batteries, then the maximum power they produce should decrease at lower temperatures.</p> <p>Methods/Materials A photovoltaic was connected to a load resistor. When lit with a halogen light, the current and voltage produced by the photovoltaic depends on the value of the load, which is called the operating point. Two multimeters were used to measure the current versus voltage curve of the photovoltaic as the load was changed. From these data the power was calculated for different operating points. These measurements were repeated with the photovoltaic at room temperature, in a refrigerator and in a freezer.</p> <p>Results The current-voltage graph changed with temperature. The power produced by the photovoltaic was a maximum at an intermediate operating point. When the power was calculated from these graphs, the maximum power was produced at a higher load resistance, and the power at the maximum increased from 83.0 mW to 98.1 mW as the temperature decreased from 37 °C to -10 °C.</p> <p>Conclusions/Discussion The experimental data showed that the peak power produced by a photovoltaic increased as the temperature was lowered. This contradicts the hypothesis, which means the operation of a photovoltaic does not rely on chemical reactions in the same way as a battery. This is important for determining how much energy can be collected from photovoltaics in different climates. Also, this project showed that the operating point for the maximum power changes with temperature, so the load resistance has to be readjusted to optimize performance.</p>	
Summary Statement This project examines how the maximum power produced by a photovoltaic changes with temperature.	
Help Received My father helped me build the box and circuit. My mother helped me prepare the display board. My parents purchased some materials. The two multimeters were borrowed from University of California, Riverside.	