CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Joshua M. Arreola

Project Number
S1902

Project Title
On the Verge of Solar Success! Phase II of Creating the Most Efficient Solar Collector

Abstract

Objectives/Goals
In 2008, my goal was to determine the optimum material to place inside of a solar collector in order to maximize the collector's energy efficiency. This year, I first validated the results of my previous experiment by retesting all of the materials along with an additional material. The main objective this year was to determine if placing various reflective materials near the collector would further maximize its efficiency.

Methods/Materials
Five identical solar collectors were constructed using cardboard boxes, black paint, flexible black tubing, and glass. The collectors were each filled with soil. Four of the collectors were then placed on a 45 degree angle support and pointed away from the sun, while the last collector was placed towards the sun. This collector was the first control variable. A frame support to hold mirrors, aluminum foil, and sheet metal flashing was placed parallel to the angle support holding the solar collectors. These reflective materials were pointed at the sun and reflected the light on three of the collectors. The other collector without any reflective material being shined upon it was another control variable. The inside temperature of the panels was measured with a thermocouple. Then the temperature of the water was measured with a digital thermometer before and after it went into the collectors. The water was left in each collector for ten minutes with a total of seven trials being conducted for each collector.

Results
The overall results showed that the mirrors were the greatest reflective material to maximize the collector's efficiency, followed by the sheet metal flashing, and finally the aluminum foil. The control facing towards the sun turned out to be the most efficient, while the control facing away from the sun was the least efficient.

Conclusions/Discussion
My results show that my hypothesis was correct. I found that placing reflective materials near a solar collector has the potential of greatly improving its efficiency, even when the sun is not pointing directly at the collector. For future experiments, I will further try to maximize the collector's efficiency by adding the reflective materials on to the actual collectors themselves, essentially imitating a solar oven. This experiment can help scientists and consumers by creating an energy and cost-efficient way to provide warm water to homes.

Summary Statement
This experiment was conducted to continue my research on solar collectors in order to discover different techniques to maximize their energy and cost-efficiency.

Help Received
Mom assisted with purchasing the materials, taking pictures, taking the readings, and pasting some of my board. Dad advised on how to construct the frame support that holds my reflective materials. I received mentoring from Dr. Bryan Hallmark, and from my Biology teacher, Mr. Barry Lindaman.