CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

J1028

Project Title

A Thermo-Mechanical Sunflower: Developing a Passive Concentrator/Tracker for Photovoltaic Panels

Abstract

Objectives/Goals

My goal is to find a robust, low-cost method (or methods) of increasing the power output of solar panels.

Methods/Materials

In this two-part project, I first investigated the effect of reflection angle on power generation in a system of non-parabolic light concentrators. I then constructed example reflectors and tested the designs by measuring the power generated vs. a control panel without reflectors.

To be effective, reflectors must track the Sun, so I developed a novel, simple and cost-effective solar tracker based on bimetallic coils. Four coils mounted on a rod formed a differential thermometer. Shades were arranged so when the Sun was located to one side of the tracker, two of the bimetallic coils heated up and turned the panel towards the Sun. During the development, I constructed and tested seven prototypes. I tested the final prototype by measuring the power output of a tracking solar panel in relation to a static panel over a series of days, using a data logger.

Results

In tests, the panels with reflectors generated 2.25x the power generated by a control panel (where the theoretical gain was 3x).

The final tracker prototype (prototype 7) tracked up to 40 towards the sun, and gave 13% more power than a control panel (theoretical limit 30%).

Conclusions/Discussion

The tracker I designed is inexpensive, simple and needs no electricity. I have demonstrated a 13% power gain for my tracker, with up to 30% gain possible. Combining the tracker and reflectors (the sunflower configuration), projected gains of 3.9x could be achieved. My tracker and reflectors design could help generate power in third world applications, in remote sensing stations, and in space, with potential to help developing economies and the environment.

Summary Statement

I created a novel tracker and low-cost reflectors which improved PV panel power output by 13% and 2.25x respectively.

Help Received

My father helped me with trigonometry in the reflectors section and using power tools, and my mother helped edit my report. Laura Hood of Crest co. and Mike Helbig of Hood co. donated bimetallic coils for use in my tracker.