CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

33448

Project Title

Excellent, Efficient, and Economical Solar Tracking

Abstract

Objectives/Goals

The overall objective is to improve solar panel efficiency by aiming the solar panels at the sun. Improved efficiency allows fewer panels to produce the required electric energy. In addition, the difference in efficiency between a static solar panel and a tracking panel will be evaluated. The goals are to reduce overall system cost and reduce the roof space needed for the solar panels.

Methods/Materials

Methods followed three (3) steps: designing and building a working model sun tracker using an innovative shadow box sun sensor, measuring the power output of solar panel at various sun angles (power vs. sun angle), and evaluating data to determine if the system is cost-effective.

Materials:
Demonstrator model: a wood frame, innovative shadow box sun sensor, amplifier, battery and actuator.
Power measurement vs. sun angle experiment: small-scale solar panel, non-reflective test box, shop light and meters.

Results

It is feasible to build an effective, simple and inexpensive shadow box driven solar tracker. Testing showed a static solar panel was 54% less efficient than an east-west tracking solar panel thereby demonstrating that solar tracking more than doubles efficiency. The shadow box tracking system would cost 45% less than a static system providing approximately the same power output. Tracking the sun north to south is much less important and was determined to be unnecessary.

Conclusions/Discussion

Solar panel efficiency was substantially improved with a sun tracker. The shadow box sun sensor was shown to be inexpensive while doubling the power output and was therefore determined to be cost-effective. The tracker reduces both roof space and panel cost. Complex sun sensors and logic used by many described in the literature is eliminated using an innovative shadow box sun sensor. The project demonstrator shows it operates well.

Summary Statement

Designing, building, and testing an innovative, shadow box driven solar tracker proved that solar tracking can be cost-effective, double the power output of a static solar panel, and decrease the roof space required for solar panel systems.

Help Received

Philip Lane (grandfather, mentor and retired aerospace engineer) assisted with understanding reports on other sun trackers, higher level math, and electrical circuitry work. Mrs. Elaine Gillum guided me through the project stages. My mom, a CPA, helped with Excel spreadsheets.