CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

J0215

Project Title

Active vs. Passive: Which Sun Tracking Solar Panel System Is More Efficient?

Abstract

Objectives/Goals

The objective of this experiment is to determine whether a solar panel which follows the sun using a passive mechanism can compare favorably to a solar panel with active sun tracking when the energy used by the active tracking process is taken into account.

Methods/Materials

One solar panel rotated by stepper motor with single board computer (Raspberry Pi) running Python program, one solar panel rotated by two glass tubes of volatile liquid (dichloromethane) interconnected by copper tubing, one solar panel in a fixed position, 3D printed mounting hardware. Measured power produced by each panel at frequent intervals from sunrise to sunset for several consecutive days.

Results

The active panel tracked the sun accurately and produced the most power, but consumed some as well. The passive panel failed to track accurately and produced the least power. The power production of the fixed panel (non-tracking) was intermediate.

Conclusions/Discussion

The efficiency gained by the passive system not requiring electrical energy to operate was more than offset by its failure to track reliably. It may have performed better in warmer weather, improving the effectiveness of the volatile fluid. The active tracking solar panel system did not produce enough power compared to the fixed (non-tracking) panel to make up for the power required to operate it and the cost for and anticipated maintenance requirements of the tracking mechanism. It appears that the fixed panel may be the most efficient in the long run with its simplicity, low operating and maintenance costs, and dependability at various temperatures.

Summary Statement

I compared active to passive solar panel tracking and found no convincing advantage over a fixed panel.

Help Received

I wired and programmed the computer for both controlling the stepper motor and collecting data, and designed and 3D printed the mounting hardware. I received informal instruction on the use of copper tubing and fittings.