CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
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Project Number
29103

Project Title
Comparison of the Efficiency of a Photovoltaic and a Solar Hot Water System

Abstract

Objectives/Goals
The objective was to measure the efficiency of our family's photovoltaic (PV) and solar hot water (SHW) systems in order to determine which technology does a better job of turning the sun's energy into an alternate form. The cost effectiveness of each technology was examined.

Methods/Materials
For the solar hot water panels, the efficiency was found by measuring the temperature of the water flowing into and out of the panels, the flow rate, the solar irradiance, and the area of the panels. Data from the temperature sensors and a pyranometer was taken once per minute and logged by two computers. The efficiency of the photovoltaic panels was found using the output power of the photovoltaic inverter and the pyranometer. A third computer was used to log the output of the pyranometer once per minute. Data from the text files was put into Excel for calculations and plotting.

Results
Data was taken over a three day period from 1/31/09 to 2/2/09. All three days were clear and sunny. The data from each day was similar. In the morning, the solar irradiance (W/m2) rose gradually dropped and reached a maximum around noon. The solar irradiance fell off suddenly at 3:15 pm each day as shade from our neighbor#s tree fell across the meter. The efficiency of the solar hot water panels was determined to be about 20% for most of the day. The efficiency of the photovoltaic panels was 12%.

Conclusions/Discussion
It was found that a solar hot water panel is more efficient at turning the Sun#s energy into an alternate form than a photovoltaic system. The solar hot water system was also less expensive than the photovoltaic system by a factor of about two. Since the SHW system is about twice as efficient as the PV system at about half the cost, the SHW is about four times as cost effective as the PV system.

Summary Statement
I measured the efficiency (output/input x 100 %) for our photovoltaic and solar hot water systems.

Help Received
My dad built both the PV and SHW systems. I helped to get the SHW system working. Dad also helped me to set up the three computers to take the data.