CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Rishabh R. Bose

Project Number

S1003

Project Title

Modeling and Improving the Performance of a Thermoelectric Generator

Abstract

Objectives/Goals

The purpose of my Science Fair Project is to model the performance of thermoelectric elements, which uses Seebeck and Peltier effects to generate electricity and temperature difference. Thermoelectric generators are important for harvesting energy from wasted heat. The harvested energy has the potential to be stored in batteries for later use.

Methods/Materials

The thermoelectric effect is an interchange between temperature differences and electric voltage. My project explored two main aspects of thermoelectricity, the Seebeck effect and the Peltier effect, and I experimented with five hypotheses to investigate some of the practical aspects of these effects. Hypotheses related to the Seebeck effect were tested using semiconductor-based Peltier modules. The Peltier effect was tested using the modules and DC voltage.

Results

Based on my experiments, the appropriate thermoelectric efficiency for an application depends on few parameters. These parameters are the hot surface temperature, the cold surface temperature, the temperature difference (∆T), current and the heat load to be absorbed at the cold surface.

Conclusions/Discussion

The aim of my experiment was to evaluate the performance of Peltier module and modeling the parameters for improving the efficiency of the modules. The efficiency tests of the operation of the Peltier modules were carried out. I observed that the surface temperature on the hot and cold side and the ∆T has a direct impact on the efficiency of the Peltier module. In order for improving the electricity generation capabilities of the thermoelectric modules, a high temperature gradient will be required. Capturing waste heat and high degree of cooling the other side of the thermoelectric generator will be required to generate electricity.

Summary Statement

Identify important parameters for modeling and improving the performance of a thermoelectric generator

Help Received

My father was my guide. My mother helped me with the printouts and display of the science board.