Name(s)
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Project Number
38763

Project Title
The Photovoltaic Effect: Maximizing the Efficacy of Solar Panels through Variation in Exposure and Wavelength

Abstract

Objectives/Goals
The main objective of my research was to find ways that the efficacy of polycrystalline solar panels could be maximized by testing the effects of exposure, light frequency, and temperature on model solar panels.

Methods/Materials
Three experiments titled "Exposure" "Wavelength" and "Temperature" respectively were conducted on a series of polycrystalline solar panels. "Exposure" tested the effect of varying angle tilts, "Wavelength" tested the effects of various color frequencies on the panels, and "Temperature" tested the effect of varying temperature. During all three experiments, an "UltraBrite Desk Lamp" was used to simulate the movement of the sun in a controlled environment. Finally, voltage (v) was calculated using an open source software called Logger Lite and was taken using hardware from Vernier. 300 calculations were conducted for each trial using Logger Lite and scores were tested for significance with 87.4% power at $P<0.01$. Average voltage was compared across variables using one-way ANOVA tests. A post-hoc Tukey HSD Test was used to test the significance, statistical power, standard deviation, and standard distribution of the data.

Results
My research illustrates that in Experiment 1, 15 degrees was the optimal angle for the solar panels to be titled towards the sun. In Experiment 2, the control group did test the best (an average of 1.8 volts) however, a 600 nm (Yellow) filter was the highest performing when it came to color filters (average of 1.7 volts). Finally, Experiment 3 showed that the panels under a cold treatment performed the best and were significantly better than the control group and the hot group. The cold solar panels produced the greatest result which was about 9% better than the control and was 33% than the hot panels.

Conclusions/Discussion
The central conclusion is that solar panels can be improved in many ways that don't require expensive reinstallation. The first experiment used a setup mimicking 0 degrees longitude which indicates that solar panels should be tilted 15 degrees, according to the longitudinal location of the panel. Changing the temperature and frequency of light are also globally applicable and in the end, my research hopes to serve as a baseline to improve solar technology.

Summary Statement
My research indicates that variations in exposure, light frequency, and temperature should be used to increase the voltage and overall performance of solar panels.

Help Received
My parents were with me throughout the duration of my research and provided financial and moral support.