Improving the Performance of Solar Cells Using Thermal Cooling

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The goal of my project was to design a system that cooled a solar cell using the renewable energy of the sun. Knowing that a cooled solar cell performs better than a non-cooled solar cell I hypothesized I would be able to use a cooling system powered by renewable means. I designed a system that converted solar heat energy into thermal cooling energy, to cool a solar cell through a series of components. The system uses a Fresnel lens, Stirling Engine, generator, and Peltier plate to cool a solar cell via the sun. I designed the system's apparatus to move on a full 3D plane using two mechanisms. The tilt mechanism allows the system to tilt various degrees to align with the inclination of the sun. The swivel mechanism allows the system to spin 360 degrees. Through a series of testing trials, I was able to collect data that supported my hypothesis with the lowest achieved temperature being 44.8 degrees fahrenheit and the highest voltage being 5.97 volts. With proof of concept I took 50 more data points and ran a systical analysis. From the statistical analysis I found that the maximum recorded value (36.19%) is 3.37 times the average of the 50 data sets and the minimum recorded value(1.6%) is 0.15 times the average of the 50 data sets. My design was able to power a cooling system that increased the efficacy of the solar cell powered by renewable means. The concept itself was proven correct with only component shortcomings preventing full functionality of the system. In all cases, the enhanced solar cell produced greater voltage output than the control. On average the enhanced solar cell performed 10.74% better than the control. I can say with 95.5% accuracy that the modified solar cell will perform 3%-21% better on average than an unmodified solar cell.