



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

Name(s) Atul Raghunathan	Project Number S1019
Project Title Harvesting the Excess Thermal Energy Produced by Light Emitting Diodes to Generate Electricity	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Current LED Technology converts electricity into light very efficiently compared to incandescent or fluorescent light bulbs; however around 5-40 percent of electricity supplied to LEDs is converted to heat. The LED bulbs use large bulky heatsinks to extract this heat from the LED. This heat is radiated into the surrounding air and wasted. This project aims to replace the standalone heatsink with an inexpensive thermoelectric generator, which recaptures part of this thermal energy and converts it into electricity. I intend to convert the thermal energy produced by a Cree Xlamp CXA 1304 into electricity of at least 3 milliwatts.</p> <p>Methods/Materials I constructed an apparatus using a Peltier wine cooler as a thermoelectric generator. I used a steady source of DC current from a nickel cadmium battery and 3.3 ohm resistors to provide the three LEDs with the current specified by the manufacturer. I used a 2.7 ohm resistor and a multimeter to measure the amount of power generated by using ohm's law. I charted the data every five seconds and continually modified the design until I received consistent results. The fifth and sixth prototype delivered consistent results with the sixth one demonstrating the scalability of the fifth version. With the data collected, I was able to generate an accurate representation of power over time. This enabled me to create a function that was able to predict the future data.</p> <p>Results The thermoelectric generator was able to produce 166 milliwatts at first, but that declined and stabilized at 86 milliwatts. In the fifth prototype, the LED was 80-90 degrees cooler with use of the thermoelectric generator; it reduced the temperature on an average from 210 degrees to 120 degrees Fahrenheit.</p> <p>Conclusions/Discussion I created a mechanism that effectively draws heat away from an LED to generate electricity. My experiment shows that the decrease in temperature caused by utilization of the thermal energy increases the lifespan of the bulb by 10 years. In addition to this, utilization of these devices save between 101-253 kilowatts of power in an average American home.</p>	
Summary Statement I created a device that increases the lifespan of an LED by efficiently drawing heat away and uses that heat to create electricity.	
Help Received Mr. Charles Williams helped with soldering and machining of apparatus.	