



CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s) Atul Raghunathan	Project Number 35333
Project Title Harvesting the Excess Thermal Energy Produced by Light Emitting Diodes	
Abstract Objectives/Goals Current LED Technology converts electricity into light very efficiently compared to Incandescent or Fluorescent light bulbs; however around 60 percent of electricity supplied to LEDs is converted to heat. Current LEDs use large bulky heat sinks to extract this heat from the LED. This heat is radiated into the surrounding air and wasted, but by using an inexpensive thermoelectric generator as an alternative to a large heat sink, a part of that energy can be recaptured and converted into electricity. I intend to feasibly convert this heat from a Cree XTE 3UP Indus Star into electricity of at least 3 milliwatts. Methods/Materials I built an apparatus that was able to use a Peltier wine cooler as a thermoelectric generator. I used a steady source of DC current from a nickel cadmium battery and I used a 2.7 ohm resistor to provide the LED with the current specified by the manufacturer. I used a 30 ohm resistor and a multimeter to measure the amount of power by using ohms law. I charted the data every five seconds and was able to generate an accurate representation of the power over time and a function that was able to predict the future data over time. The temperature was also measured over time with an IR thermometer and charted similarly. With the data received, the design was modified constantly until a stable result was achieved. Results The LED was 80-90 degrees cooler than without the thermoelectric generator; it reduced from 210 degrees to 120 degrees fahrenheit. The generator also converted this heat that it captured into, at most, 7.5 milliwatts of electricity. Over time the power produced stayed consistently at 5.4 milliwatts as the heat input and heat exchange stabilized. Conclusions/Discussion The LED lifespan curve shows that this decrease in temperature can increase the lifespan of this LED (Cree XTE 3UP Indus Star) by 10 or more years. Also, over the extended life of the bulb, it can save 8.8 kilowatts.	
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.	