



CALIFORNIA STATE SCIENCE FAIR 2015 PROJECT SUMMARY

Name(s) Erik N. Lamp	Project Number S0913
Project Title DC/DC Hybrid Converter for High Power Energy Harvesting	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this experiment was to demonstrate the successful design and construction of a DC/DC hybrid converter for the purpose of high power energy harvesting through powering a standard DC/DC converter with a conventional energy harvester.</p> <p>Methods/Materials The performance of a LT1619 DC/DC converter was compared to a custom-designed DC/DC hybrid converter by setting the output voltage of each to 5.33 volts and determining which had the lower activation voltage (without a load on the output). This indicated that a DC/DC hybrid converter is possible. For an additional test, two different power MOSFETs were used in both DC/DC converters. The first MOSFET had a gate threshold of 1.9 volts. The second MOSFET had a lower gate threshold voltage of 0.8 volts. The MOSFETs were compared to see which gave the two DC/DC converters the lowest activation voltage.</p> <p>Results The data collected, showed that an output voltage of 5.33 volt, without a load, was achieved with an input voltage of 0.85 volts, compared to the 3.06 volt input from the standard DC/DC converter. By using a conventional energy harvester to power the power MOSFET of the standard DC/DC converter, the input voltage required to output 5.33 volts, decreased by an estimated 72.2%.</p> <p>Conclusions/Discussion A DC/DC hybrid converter is possible by powering the power MOSFET of one DC/DC converter with the output of another. By using a conventional energy harvester, the standard DC/DC converter was activated at a lower activation voltage than it would without it. Achieving a lower activation voltage also means a lower input voltage. With this new technic for DC/DC converters, new possibilities of energy harvesting can be explored. This includes enabling solar panels to function in the shade and maximizing the storage capacity of a supercapacitor.</p>	
Summary Statement In this research project, the idea of a DC/DC hybrid converter for a high power energy harvester, in the use of solar cells and energy storage, was explored.	
Help Received My father funded my project and mentored me through basic electronics. In addition, a couple of my teachers proofread my research paper.	