



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Weston D. Braun	Project Number S0905
Project Title High Voltage DC to DC Conversion for Power Distribution	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Design, build, and test a DC-DC switch-mode converter that could replace conventional iron core high voltage distribution transformers and provide more efficient DC power transfer. A switch-mode converter would provide a more flexible power grid that could be controlled remotely. This is compatible with the goals of the "smart grid" initiative.</p> <p>Methods/Materials A switch-mode converter was designed and built with the design criteria of 2000 volt input, an output of 2kW at 300 volts, and 85% efficiency. For design, the switch-mode converter was split into subsections (control circuitry, output circuitry, high frequency transformer and an IGBT switching bridge) with a separate approach to the challenges presented to each part. A design was finalized, built, and tested at various load resistances.</p> <p>Results Verification testing at 100 volts led to initial design modifications and a subsequent complete redesign of the switch-mode converter after a short circuit failure. After redesign, testing at input voltages of 1000 volts and 2000 volts with three different resistance loads produced the desired power output. Measured efficiencies ranged between 44% and 74%.</p> <p>Conclusions/Discussion The final switch-mode converter successfully converted 2000 volts DC to 300 volts DC and demonstrated the feasibility of using a series IGBT configuration for high voltage switching. While the efficiency target was not met, there is good indication that actual efficiencies were higher than measured due to excessive noise on the input current measurements. The system as designed can be easily scaled up to provide DC to DC conversion for the 7kV and 14kV distribution voltages used today.</p>	
Summary Statement The feasibility of high voltage DC to DC conversion for power distribution was explored and a prototype system was designed, built and tested.	
Help Received My mother helped assemble the display board. Dave Fleming, P.E. supervised the high voltage testing conducted at my home lab.	