Cal Poly Sustainable Power for Electrical Resources (SuPER) Project

Brief Summary of Project Development:
The Cal Poly SuPER project begins its third year of development of a low-cost, sustainable source of electrical power for the 2 billion people who do not have access. The overall goal of the Cal Poly SuPER system is to provide electrical power for a family unit over a 20 year life cycle for a total cost of $500. The initial prototype has been developed as shown in the photo below. It uses a solar photovoltaic source with battery storage, provides a standard DC output voltage, is digitally controlled, and is documented as an open source product. A complete MatLab/Simulink simulation model for the SuPER prototype has been developed. The technology is based upon existing technology, but the final development will extrapolate existing technical performance into the future using a Moore's Law model. Two graduate students (Eran Tal and Tyler Sheffield, right and left in photo, respectively) have completed their master’s thesis, eleven undergraduate students have completed their senior projects, and three independent study students have participated on the Cal Poly SuPER project. In Spring 2006 under the direction of Dr. Lynn Metcalf, four business students in BUS 454 completed their senior project with a marketing study for the Cal Poly SuPER system. For more details, review the Cal Poly SuPER website at: http://www.ee.calpoly.edu/~jharris/research/super_project/super_table_of_contents.htm

Opportunities for Research:
The goal for this academic year is to continue the development of the prototype of the Cal Poly SuPER system and its simulation model, providing a system completely developed and fabricated at Cal Poly except for the PV panel and the battery. Project opportunities exist for both undergraduate and graduate students. In addition, students will gain experience working as a multidisciplinary project team; students meet with faculty once a week for a one hour seminar in addition to working with advisors on their senior project or thesis. Funds are available to purchase components and materials. Some of the areas for student projects are:

Graduate students are the technical leaders of the undergraduate engineering student team:
- Continued development of simulation of system with MatLab/Simulink, including the study of optimal digital control algorithms and system parameters
- Power system optimization using ETAP
- Porting of control and status software system to FPGA-based technology with integration of sensor and switch capability
- System engineering development of the next generation SuPER system

Undergraduate students perform specific engineering projects for the SuPER system:
- DC-DC converter development: PV to battery, DC output bus to robust loads
- Modularization and enhancement of the switchboard PCB prototype design
- Battery and ultra-capacitor technology: electrical power storage research and modeling
- Enhanced design of interface to robust set of DC loads: LED, DC motor, battery charging, refrigerator, computer, TV
- DC network power distribution and protection: NEC code compliance, grounding
- Sensor data acquisition and processing: voltage, current, temperature and sun insolation
- System engineering: PV input modeling and DC output load scenarios for testing
- Continued development to optimize the white light LED load system
- DC motor characterization and load performance

If interested, then please contact either Dr. James G. Harris or Dr. Ali Shaban

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