2007 Future Energy Challenge

Monash University Team
Melbourne, Australia
http://fec.eng.monash.edu.au

About Monash University
• Established in 1961
• Monash University is one of the eight leading universities in Australia
• Offers a full discipline teaching program to more than 49,500 students located across eight campuses around the world
• The university has a long-standing commitment to excellence in innovative research and quality education at all levels

The Team
• Consists of 12 undergraduate students
• Disciplines include:
  – Electrical Engineering combined with computer science, mathematics and law
• Faculty Advisor: Professor Grahame Holmes

Team Management
• Organized into subgroups
  – Battery Management group
  – System Control group
  – Power conversion group
  – Sponsorship team
• Online Information Management
  – Website http://fec.eng.monash.edu.au
  – Team Discussion Forum

Technical Overview
• Two main power conversion stages
  – Flyback converter
  – Buck Converter
• Fully digital charge control by Micro Controller Unit (MCU)
Flyback Converter

- Completed design, simulation and construction of two flyback converter topologies
- Presently evaluating which circuit is to be used

Buck Converter

- Complete the prototype for the converter
- Have successfully achieved close loop current regulation
- Ready to implement control loop in MCU

Converter Efficiency

- Buck Converter Efficiency
- Flyback Converter Efficiency

Converter Prototypes

- Buck Converter
- Flyback Converter
Battery management
• Using a step load method to determine the battery chemistry
• Testing of battery profiles using LabView and NI ELVIS

Sponsorship Activities
• Generous sponsorship from Monash University
  – Allocated access to tech support service and workshop facilities
  – Initial seed fund
  – Allocated faculty and postgraduate advisors for the team
• Secured sponsorship support from Industry
  – Technical advice
  – Parts, PCB and equipment
  – Monetary

Sponsorship Obtained

Next Phase of Work
• Integrating circuit design with proposed MCU to make full prototype charger
• 2 cycles of PCB prototype planned
• Continuous verification and improvement of battery charging algorithms

Educational Impact
• Accreditation
  – 25% of normal course loading in one semester
  – Work experience program
• Learning Experience
  – Large team-based environment
  – Gaining practical skills relating to real technical problems
• Crystallization of theoretical concepts learned in class
• Feedback towards development of undergraduate courses

Conclusion
• Substantial progress has been made – all planned initial trials and experiments have been concluded successfully
• Work is now commencing on design of first complete prototype charger
• Project is on time and following the scheduled timeline
• Team will have a leading edge product available for the competition finals in August