Low losses power conversion for battery systems
PhD

**Funding:** EPSRC funded for 3.5 years (UK student)
**Supervisors:** [Prof Richard McMahon](mailto:prof.richard.mcmahon@warwick.ac.uk)
**Start Date:** As soon as possible

**Project overview**
An exciting opportunity to work for your PhD as part of our [Energy Systems](http://www.wmg.ac.uk) research group at [WMG, University of Warwick](http://www.wmg.ac.uk).

Battery packs, predominantly comprising lithium batteries, are increasingly seen as a route to practical to energy storage as well as being key to the success of electric vehicles. The increasing use of electric vehicles is behind the need for an extensive charging infrastructure which, as well as placing a high gross energy demand on the grid, imposes high peak power flows at all points in the network and a resultant high demand on generating capacity. The latter may come from renewable sources which are not dispatchable. Static energy stores are seen as a solution enabling load to be shifted to match generation. A further important use is supporting rapid charging which places very high short term loads at points in the network; battery stores are likely to be a cost effective alternative to network reinforcement.

All battery applications rely on power electronics to convert AC to DC, DC to AC and DC to DC, in some cases with galvanic isolation. Minimizing losses in these conversion stages is important not just to avoid the significant waste of energy but also because higher losses require larger and more expensive battery pack, this being most critical in electric vehicles.

This project focuses on low-loss power electronic conversion. Two routes will be explored, one using recently available wide band gap (WBG) semiconductor devices (MOSFETs and BJTs in silicon carbide and FETs in gallium nitride) and the other using advanced bipolar devices in silicon. WBG devices offer higher switching frequencies than conventional devices, enabling more compact converters to be realized but the lowest on state voltage drops are achievable with silicon bipolar devices. Converter topologies using both classes of devices will be investigated, initially by modelling followed by the testing of at scale prototypes.

The project will be carried out in collaboration with ST Microelectronics, WeEn Semiconductor and end users such as Zapinamo and JLR.

**Entry requirements**
Candidates should have a minimum of an upper second (2.1) honours degree (or equivalent) in a relevant discipline such as a Physical Science or Engineering-based discipline.

For funding requirements, the applicant should be eligible as a UK student. A stipend of £14,296 will be paid per annum for 3.5 years.

**To apply**
To apply please complete our [online enquiry form](http://www.wmg.ac.uk) and upload your CV.