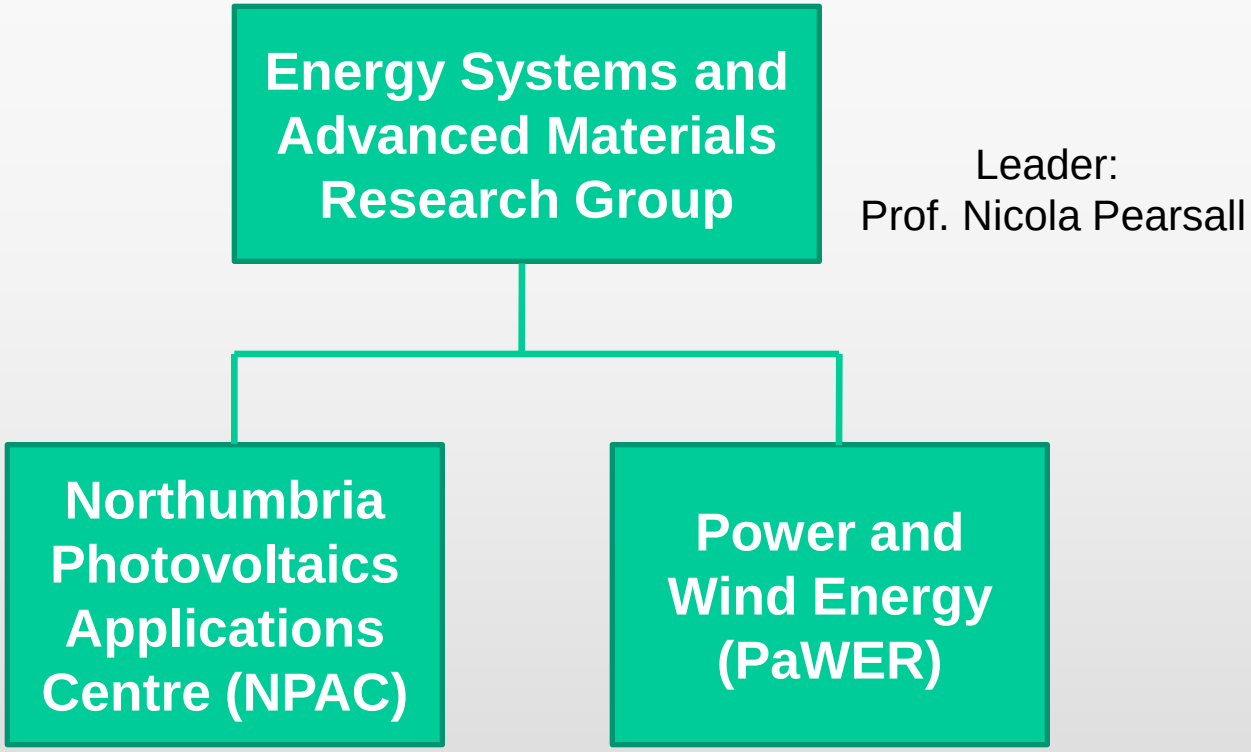
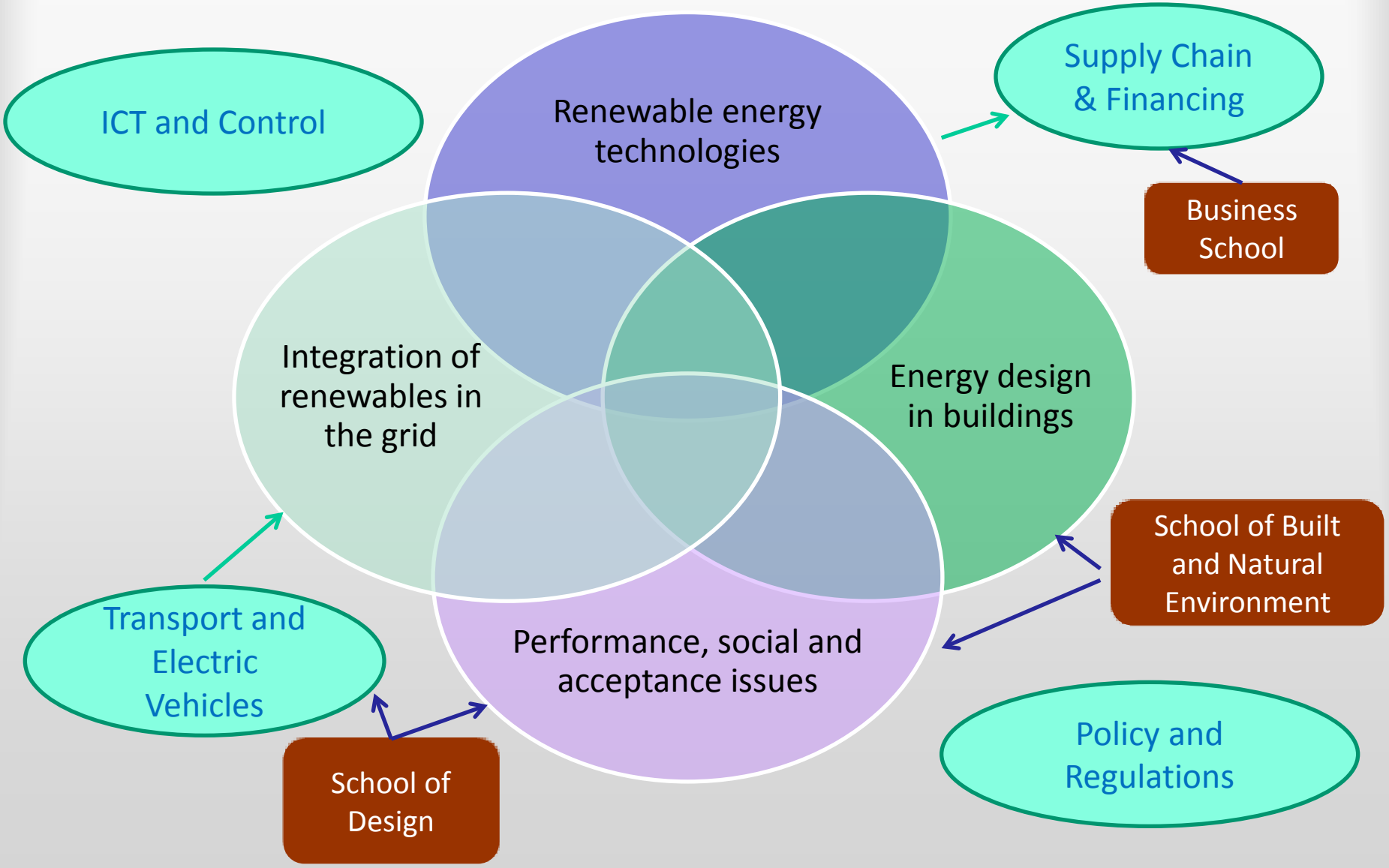
CEIS Research in Renewable Energy



Energy Systems Research



Putting Photovoltaics into Practice – Activities at NPAC

- PV cell development
  - NPAC works on new semiconductor materials within the Supergen project
- Transfer of technology to production
  - We are involved in environmental impact assessment to assist in defining the route to sustainable module production with European industry
- Maximising system performance
  - NPAC undertakes system performance analysis and has recently completed a major project on updating the European PV system monitoring guidelines
- Integrating into a smart electricity grid
  - Working with our PaWER group considering the integration of large amounts of PV into the grid distribution network
- Education
  - PV is taught at Masters level to RE specialists and electrical power engineers and at UG level to a range of disciplines

Power and Wind Energy Research (PaWER) group

- Research areas:
  - Integration of new and renewable energy sources (Distributed Generation) and their interaction with the electricity grid
  - Impact of Electric Vehicles and their integration into the grid
  - Wind energy conversion systems (develop new technologies, wind turbine designs and control systems)
  - Electrical Machines and Drives
  - Power electronic applications in power systems (FACTS and custom power technology)
  - Power Quality
  - Smart grids
- Projects supported/funded:
  - EPSRC, DTI, NEDL/CE Electric, Reyrolle/Siemens, NGC, Econnect/Senergy, Narec, ONE, European Commission.

Recent Projects

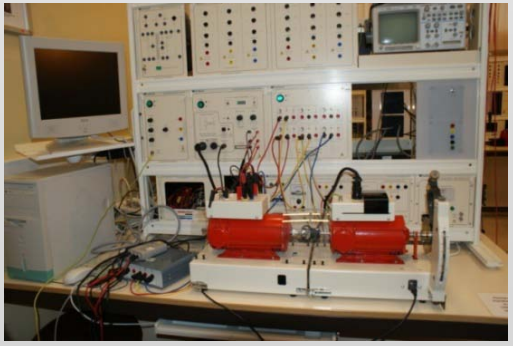
- Electric Vehicle Infrastructure – Smart Grids and EV Infrastructure Regional Impact.
- Development of Training Modules in the Renewable Energy Field.
- Performance Comparison of Conventional and Emerging Doubly-Fed Generator Topologies for Grid Connected Wind Power Applications.
- Optimal Control Strategies for Small–Scale Wind Energy Conversion Systems.
- Development of an Intelligent Power Quality Monitoring System.
- Development of a Smart Controller for Small-Scale Combined Heat and Power (CHP) system.
- Power Quality Analysis of Future Power Networks (Smart Grids).
- Development of a Grid Interface Controller for Dynamic Energy Management of Electrical Vehicles (EVs).

Recent Projects

- Electric Vehicle Infrastructure – Smart Grids and EV Infrastructure Regional Impact.
  Funded by ONE

  J:\EV - voltage drop - One North East - v2 DEMO.xls

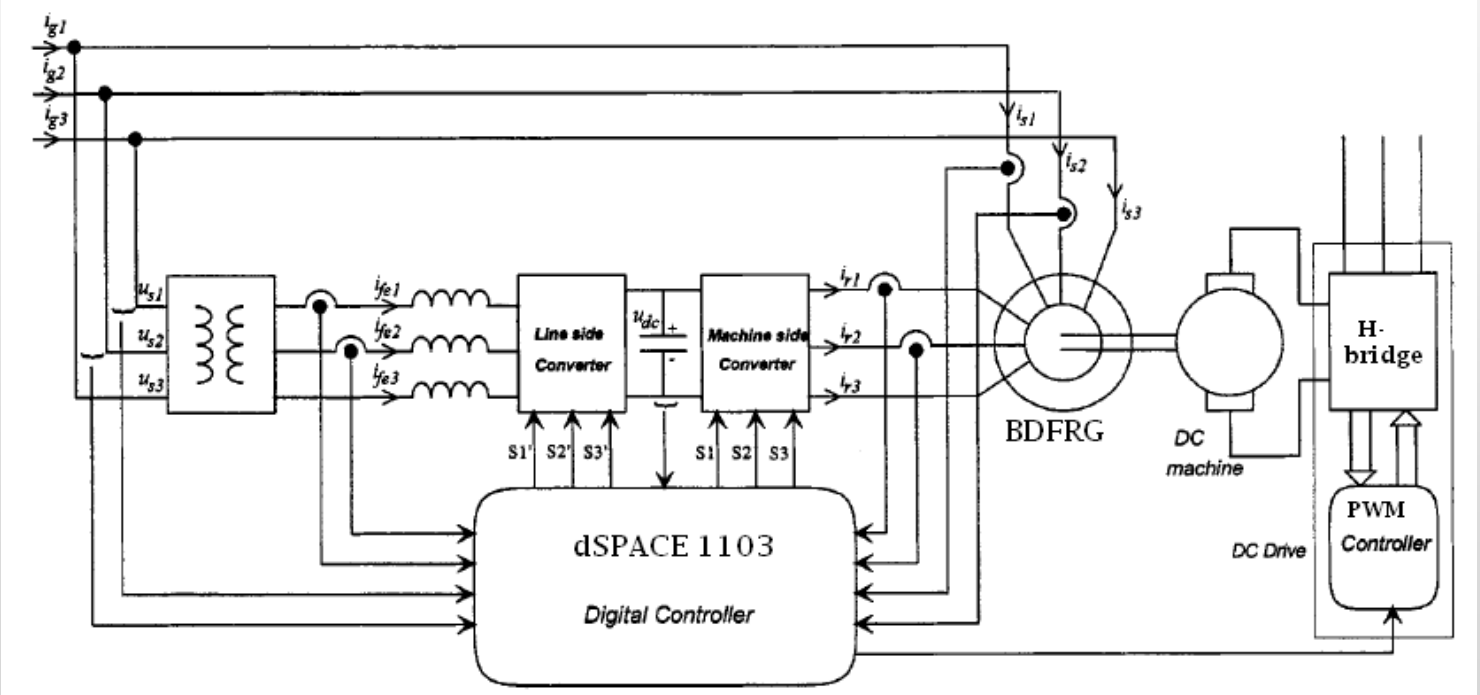
- Development of Training Modules in the Renewable Energy Field.
  Funded by Feedback Group
  - PV Emulator
  - WT Emulator



Performance Comparison of Conventional and Emerging Doubly-Fed Generator Topologies for Grid Connected Wind Power Applications

Assess an emerging technology of energy conversion systems based on the Brushless Doubly-Fed Reluctance Machine (BDFRM) throughout a comparative study with a conventional and well-established counterpart known as Doubly-Fed Induction Generator (DFIG).

This application is for wind power and especially offshore farms.

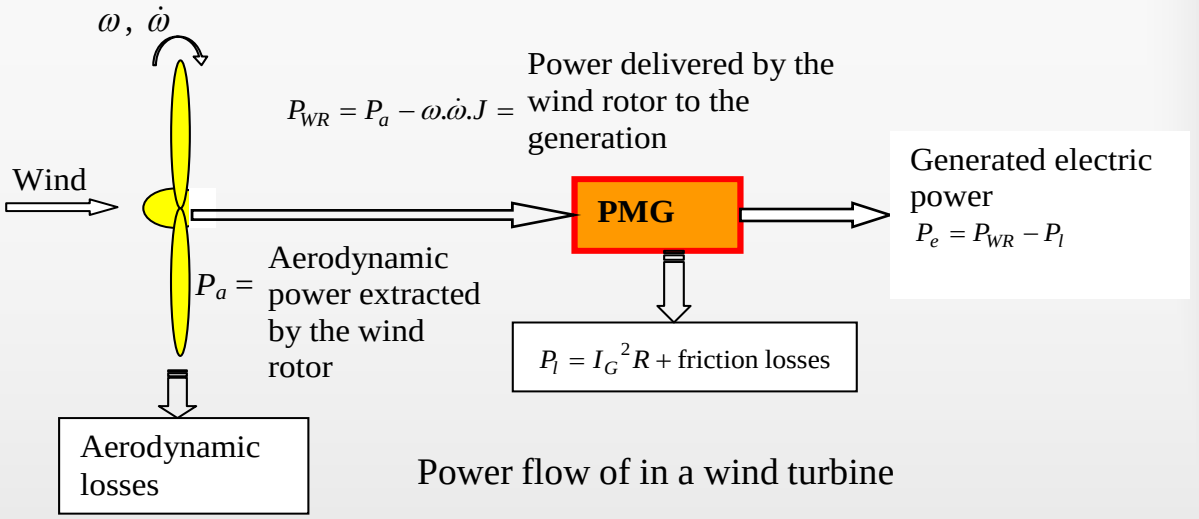


Schematic block diagram of the experimental setup.

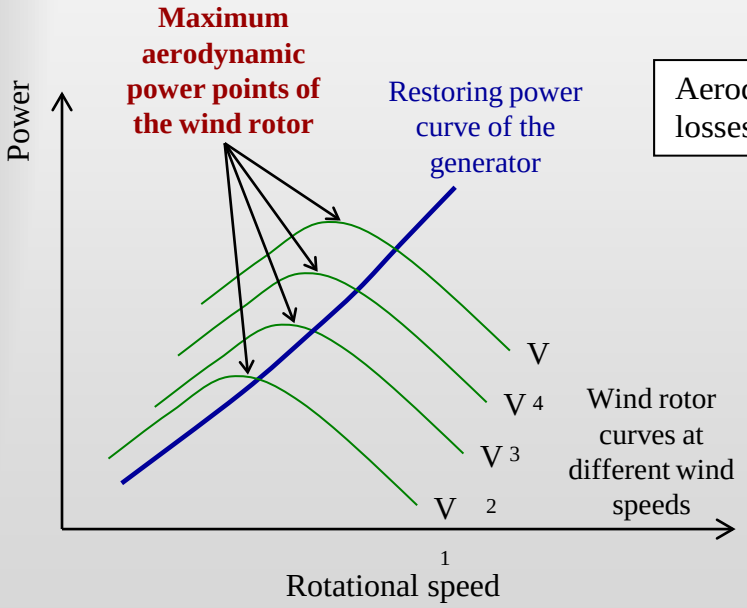
EPSRC
Engineering and Physical Sciences Research Council

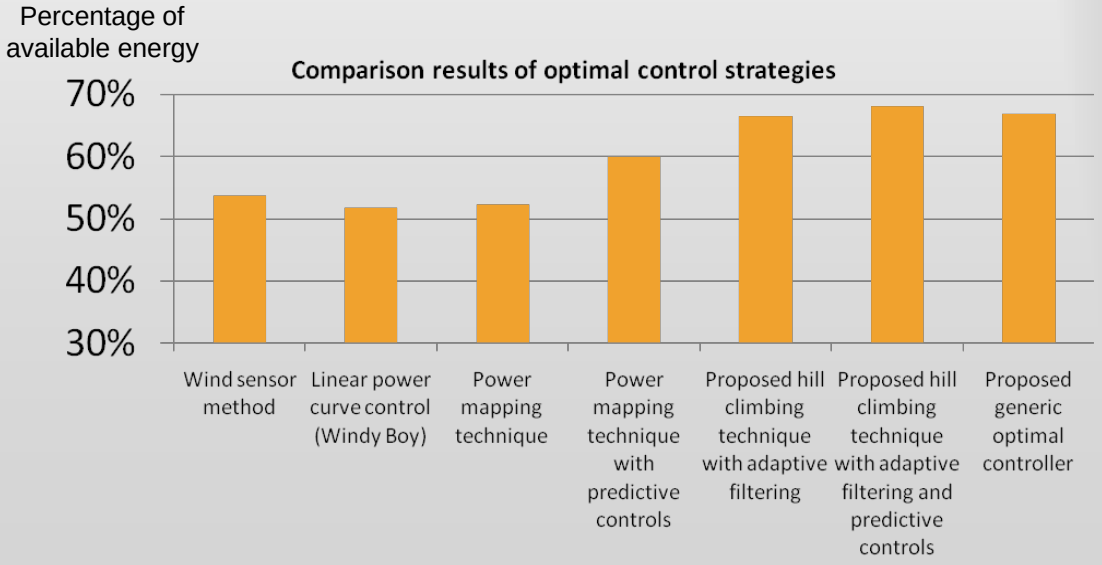
Optimal Control Strategies for Small–Scale Wind Energy Conversion Systems

Partly funded by Narec



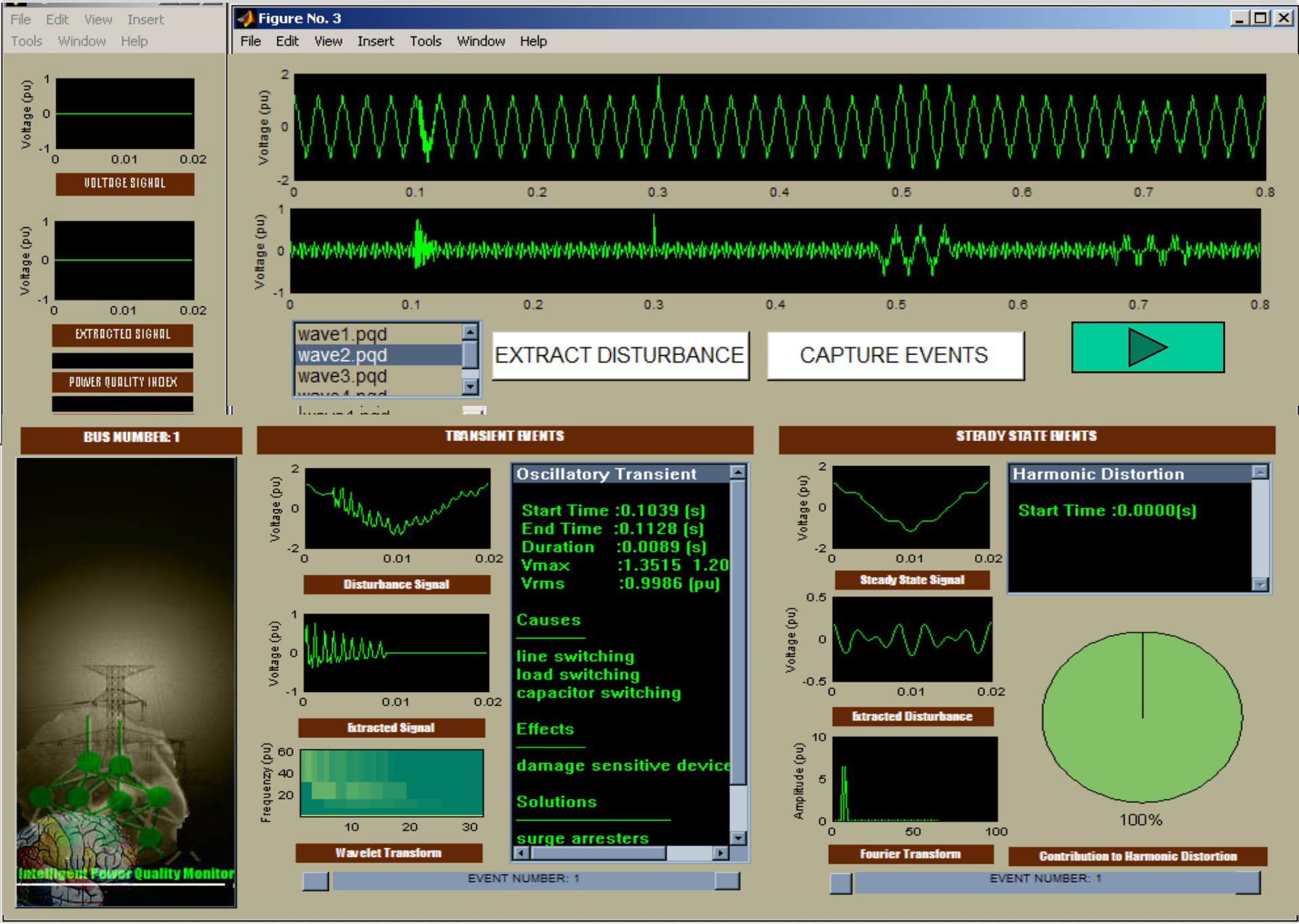
Power flow of in a wind turbine





Intelligent Power Quality Monitoring System (IPQMS)

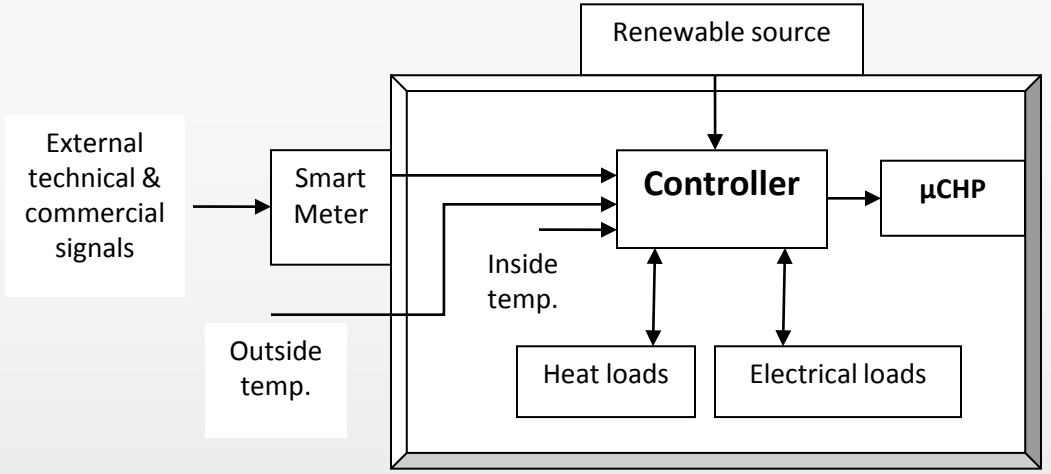
Partly funded by Narec



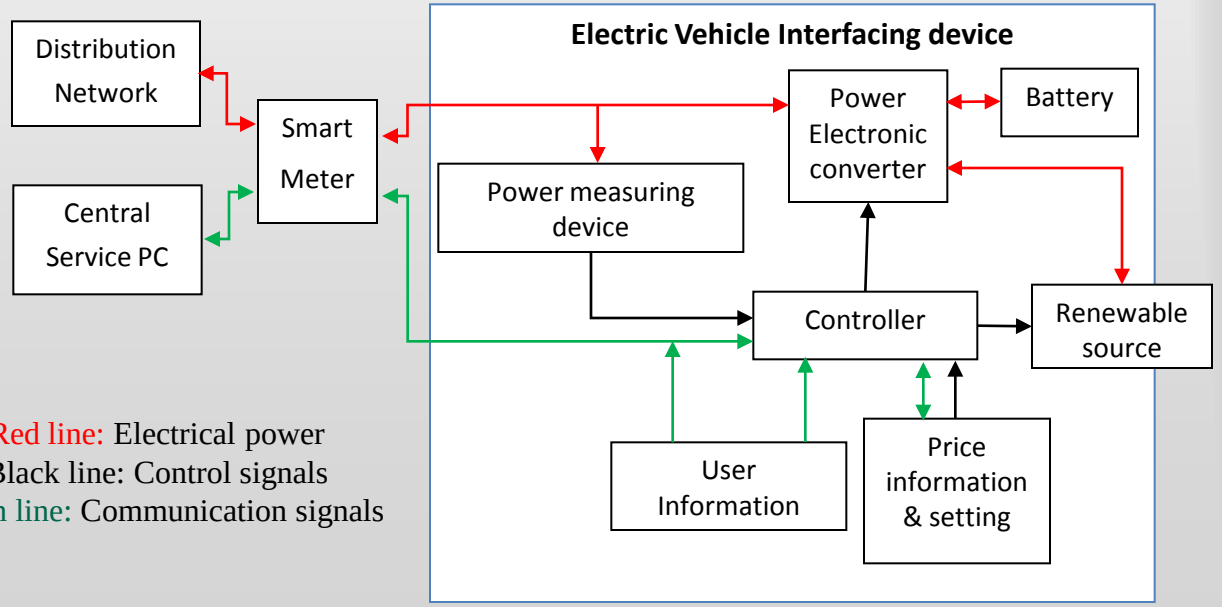
Development of Smart controllers for Dynamic Energy Management

Partly funded by Narec

- Development of a smart controller for Small-Scale Combined Heat and Power (CHP) system



- Development of a grid interface controller for dynamic energy management of Electrical Vehicles (EVs)



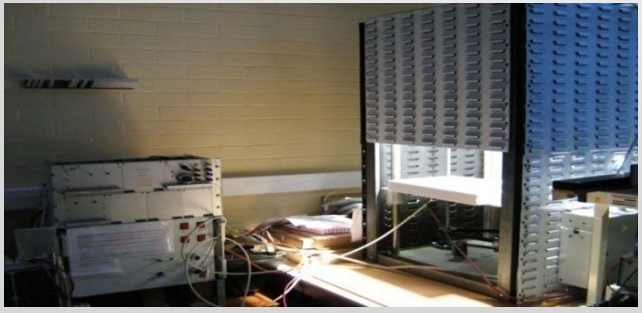
Red line: Electrical power
Black line: Control signals
Green line: Communication signals

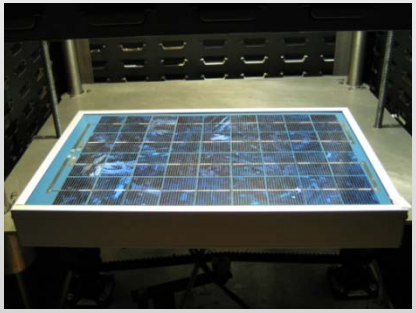
Development of Renewable Energy laboratory (Wind Turbine , Photovoltaic and µCHP)

- The lab will provide test facilities and support teaching, research and development of new technologies.
- A PV laboratory test rig has been developed and tested.
- 1.5 kW Horizontal-Axis Wind-Turbine and 0.93 kW PV system have been installed and currently being tested.
- 6 kW Vertical-Axis Wind-Turbine will be installed in January 2009 and a 1.1 kW µCHP later in the year.
- Data acquisition and power quality monitoring facilities is being developed to allow streaming of data to a host computer at the University.
- Captured data will be monitored and analysed at the University and at authorized remote terminals through IP address.

HA WT and PV system

QR5 VA WT



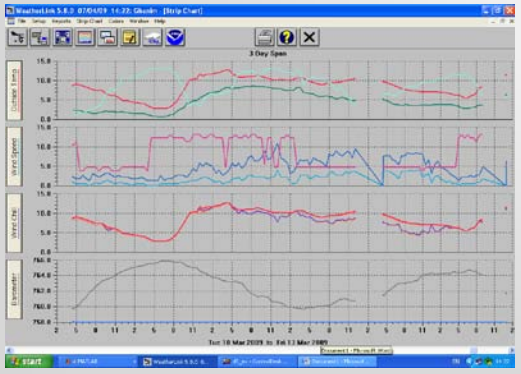


PV test rig

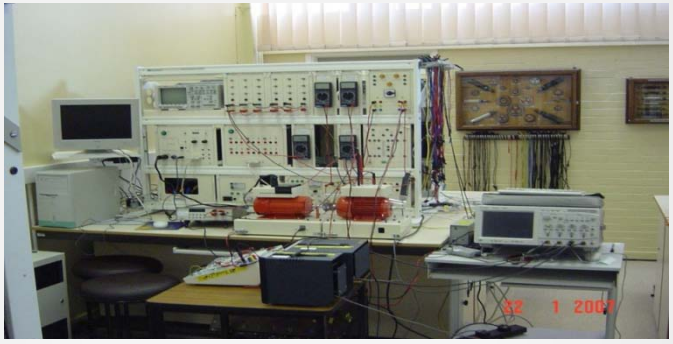
The Power and Renewable Energy Laboratory

The laboratory provides design, research and test facilities to support research and development of new technologies

Advanced data acquisition (fast sampling rate) and power quality analysis system that allows computer controlled tests and measurements.



Data acquisition system



Modern Equipment

Plans for further development

6 kW VWT, 1.5 kW HWT and 1 kW PV