

Centre for Sustainable Power Distribution



Research Activities

Prof Raj Aggarwal

Introduction

- The Centre has substantial co-operative research grants and contracts from the Research Councils, manufacturing and the utilities and welcomes many Visiting Fellows from overseas institutions and companies.
- Members of the Centre are heavily involved in the EPSRC's Supergen programmes dealing with issues of sustainable power generation and supply.

Staff

- Prof Raj Aggarwal (Director of Centre)
- Dr Rod Dunn (Senior Lecturer)
- Dr Furong Li (Reader)
- Dr Miles Redfern (Senior Lecturer)
- Pending new appointment (Reader/Senior lecturer in Sustainable Power & Energy Systems)
- Affiliated staff: Dr Martin Balchin (Senior Lecturer), Dr Francis Robinson (Lecturer)
- Dr Miles Davis (EPSRC-funded Energy Programme Manager)

- 3 Research Officers; 25 PhD Research Students
- + 2 Senior visiting fellows (Dr Aslan Erinmez & Dr David Tolley)
- + John Scott, Chris Harris- Visiting Professors

Sponsors



EPSRC

National Grid

**WESTERN POWER
DISTRIBUTION**
Serving the South West and Wales



ofgem

ScottishPower
gas and electricity

**A
AREVA**

mEB
Midlands Electricity plc

TOSHIBA

 **Scottish and Southern
Energy plc**

Research Areas

- Numeric protection & fault location (transmission & distribution systems)
- Condition monitoring & asset management
- Power systems control, planning & operation
- Dynamic stability & security analysis
- Market design & operation
- Flexible AC Transmission Systems
- Power Quality
- Sustainable & renewable electrical power systems, including integration/smarter networks

Expertise relevant to Smarter Networks

- Innovative protection & fault location techniques for grids with mix generation-large and small scale centralised with distributed generation
- Condition monitoring & asset management of smart networks; self healing techniques (adaptive autoreclosure)
- Flexible AC networks; HVDC networks: off-shore and on-shore wind farms
- Power Quality

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- § Wide Area Measurements, WAMs, used to enhance the security and control of transmission networks
- § Co-ordinated control actions to increase the power transfer capability of transmission networks by using critical cluster identification
- § Energy storage technologies for use in enhancing the operational range of power controllers to enhance system stability
- § New system security assessment algorithms aimed at maintaining power system security levels without disadvantaging renewable generation
- § Integration of energy storage devices within both micro-grid and isolated power system scenarios to allow the greater use of variable renewable generation

Funding: EPSRC/Supergen – FlexNet & EPSRC/Supergen – Energy Storage

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- § Smart pricing: real-time pricing, capacity pricing to reflect the cost and benefit to the overall supply chain from energy consumption and generation
- § Cost-effective planning of a smarter network (trade-offs between cost, performance and risks)
- § Network performance and risk assessments against different mixes of conventional and renewable energies – production cost, emission cost, spinning reserve cost, value of wind
- § Capacity credit assessment of intermittent generation
- § Benefit assessment of introducing greater flexibility or automation to distribution systems

Sponsors: Ofgem, National Grid, Scottish Power, Scottish Southern, WPD, CE Electric and Areva

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- **Control of Embedded Generation.**
How to get the most from these units.
 - System constraint management- voltage and capacity
 - Continuation of supply following network disturbance
 - Rebuilding networks following disturbances.
- **Grid to Vehicle.**
The move to electric light vehicles is essential if CO₂ emission limits are to be met.
 - Can the existing electricity supply network meet the challenge?
 - How?
 - What other benefits could be gained?

Strengths

- Track record of activities
- Links to major research programmes
- Strong reputation of existing staff & alumni
- Academic programmes – undergraduate, MSc fulltime & Distance Learning
- University/EE Department fully committed to maintaining a strong research centre
- Cross-disciplinary research across other Departments/Universities
- All round practical experience with major UK network companies

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Substantial research grants & contracts from the research councils and the industry with world-class research

- The only Distance Learning programme in the world offering an Electrical Power Systems MSc programme
- Part of the prestigious IET Power Academy (only 7 UK Universities as members)
- The principal strength of the CSPD is in finding efficient, economic and effective solutions to the security and quality of electrical power transfer over networks, with particular attention to the challenge of Distributed Energy and SMART GRIDS.

Facilities

- RTDS, real-time digital transient simulator
- Multi-machine power system simulator
- Chemical and kinetic energy storage
- Software: ATP, EMTDC, ERACS, ANSYS, PSSE, DigSILENT
- Electrical power market simulator
- Microgrid System (under construction)