



# Electricity Research Centre (ERC)

Director: Professor Mark O'Malley

<http://ee.ucd.ie/erc/>

University of New South Wales

Sydney, Australia

31 January 2005





# Professor Mark O'Malley

- BE (1983 Electrical) & Phd (1987 Electronic)
- Research Interests
  - Modelling, control and optimisation
  - Electrical Power Systems
  - Biomedical Engineering
- Research Team
  - Two postdocs
  - One administrator
  - Seven PhD students
  - Graduated 8 PhDs & 10 Masters
  - €2M funding in past 5 years
- Publications
  - 52 Journals – 22 in IEEE Transactions
  - 83 – conference, letters, book chapters & reports
- Awards & Professional activity
  - FIEE, FIEI, SMIEE
  - Two Fulbright Fellowships (University of Virginia & University of Washington)
  - Chair IEEE UKRI PES Chapter
  - Member Renewable Energy Development Group & Co Chair of Short Term Analysis Group, Dept. of Communications, Marine and Natural Resources (DoCMNR)

# Electricity Research Centre (ERC)



- Pooling of resources – APT University of Washington
- Power Systems Research Group at University College Dublin (UCD)
- Members
  - Electricity Supply Board (ESB)
    - Power Generation
    - Networks
  - ESB National Grid
  - Cylon Controls
  - Commission for Energy Regulation (CER)
  - Airtricity
  - Viridian ?
- Associates
  - Economic and Social Research Institute (ESRI)
  - Sustainable Energy Ireland (SEI)
  - Department of Communications Marine and Natural Resources (DoCMNR)



# Activities

- Research
  - Industry led
  - Policy dimension
  - High academic standard
- Education
  - Undergraduate
  - Postgraduate
  - Industry
  - Policy Makers
- Consultancy
  - Industry
  - Government



# Managing the ERC

- Pooling agreement
  - Finances
  - Intellectual property
- ERC Board
  - Members
  - Chairperson
  - Monitoring the projects
  - Budget
- Executive
  - Director
  - Administrator



# ERC Team

	Planned	Current
Academic (UCD payroll)	1	1
Undergraduate students (€0)	4	0
Postgraduate students (€20K)	4	5
Post doctoral fellows (€50K)	1	>1
Visitors (€100K)	0.25	0
Research Engineers (€50K)	1	0
Administration and technical (€50K)	0.75	0.5



# Financial Resources

- €1.092M 2001 – 2005
- Fees from members (€0.557M)
- Matching funds (€0.535M)
  - Enterprise Ireland (EI)
  - Sustainable Energy Ireland (SEI)
  - IRCSET
- Other funding sources
  - Science Foundation Ireland (SFI)
  - European Union (EU)
  - DoCMNR



# ERC Projects

- Wind Power & Operation of Power Systems – Optimal generation mix – Ronan Doherty
- Frequency Control on an Island Power System - Reserve markets for an Island power system – Gill Lalor
- Locational marginal pricing of electricity – Shane Rourke
- Optimal Allocation of Embedded Generation – Andrew Keane
- Emissions and Wind Power – Eleanor Denny
- Economics of Embedded Generation – Andrew Keane & Eleanor Denny
- Tidal Energy Assessment for Ireland – Garth Bryans
- Wind Turbine Generator Modelling – Alan Mullane



# Selected Publications



## Published

Doherty, R., Llor, G. and O'Malley, "Frequency Control in Competitive Electricity Market Dispatch", *IEEE Transactions on Power Systems*", in press, 2005.

Mullane, A. and O'Malley, M.J., "The inertial-response of induction-machine based wind-turbines", *IEEE Transactions on Power Systems*, in press, 2005.

Doherty, R. and O'Malley, "New approach to quantify reserve demand in systems with significant installed wind capacity", *IEEE Transactions on Power Systems*", in press, 2005.

Bazilian, M., Denny, E. and O'Malley, M.J., "Challenges of Increased Wind Energy Penetration in Ireland", *Wind Engineering*, vol. 28, pp. 43-56, 2004.

Dillon, J., Walsh, M. and O'Malley, M. J., "Novel initialisation of the augmented Hopfield network for improved generator scheduling", *IEE Proceedings Generation, Transmission and Distribution*, Vol. 149, pp. 593 – 599, 2002.

Flynn, M., Sheridan, P., Dillon, J. and O'Malley, M. J., "Reliability and reserve in competitive electricity market scheduling", *IEEE Transactions on Power Systems*, Vol. 16, pp. 78 – 87, 2001.

Flynn, M., Walsh, M. and O'Malley, M. J., "Efficient use of generator resources in emerging electricity markets", *IEEE Transactions on Power Systems*, Vol. 15, pp. 241 – 249, 2000.

## In review

Llor, G., Mullane, A., and O'Malley, "Frequency Control and Wind Turbine Technologies", *IEEE Transactions on Power Systems*", in review, 2005.

Llor, G., Ritchie, J., Flynn, D. and O'Malley, "The Impact of Combined Cycle Gas Turbine Short Term Dynamics on Frequency Control", *IEEE Transactions on Power Systems*", in review, 2004.

Denny, E., and O'Malley, "Wind Generation, Power System Operation and Emissions Reduction" *IEEE Transactions on Power Systems*", in review, 2004.

Keane, A and O'Malley, "Optimal Allocation of Embedded Generation on Distribution Networks", *IEEE Transactions on Power Systems*", in review, 2004.



## CEEM Seminar

# Technical Challenges of Integrating large amounts of wind power onto electricity grids

Prof. Mark O'Malley

Thursday 3 February, 2005 1-2:30pm

Room G3, Electrical Engineering Building, UNSW



# ERC The Future

- Research
  - Cannot meet the demand
- Education
  - Falling student numbers
  - Bologna
- DoCMNR Research Proposal - €5M
- Leveraged by industry
  - Add Viridian, etc.
- Closer links with ESRI & QUB
- All Island basis
- More and stronger collaborations



# ERC Future Team

	Planned
Academic (UCD payroll)	5
Undergraduate students (€0)	16
Postgraduate students (€20K)	16
Post doctoral fellows (€50K)	4
Visitors (€100K)	1
Research Engineers (€50K)	4
Administration and technical (€50K)	2



## ERC Collaborators

- Queen's University Belfast (QUB)
- University of New South Wales (UNSW)
- University of Washington (UW)
- University of Manchester Institute of Science and Technology (UMIST)
- University College Cork (UCC)
- ILEX Energy Consulting
- AREVA

# Collaboration with UNSW



- Morgan Bazilian – Sustainable Energy Ireland
  - PhD from UNSW
- Hugh Outhred
  - Met in Ireland on two occasions
- Centre for Energy and Environmental Markets (CEEM)
- PhD students – 3/6 month placement
- Ronan Doherty
  - Frequency Control in Competitive Electricity Market Dispatch”, *IEEE Transactions on Power Systems*”, in press, 2005.
  - New approach to quantify reserve demand in systems with significant installed wind capacity”, *IEEE Transactions on Power Systems*”, in press, 2004.

