CESI National Centre for Energy Systems Integration

EPSRC National Centre for Energy Systems Integration

Research Conference Programme

6 July 2018
Newcastle University, Urban Sciences Building

EPSRC Engineering and Physical Sciences Research Council
Newcastle University
Durham University
Heriot Watt University
University of Sussex
The University of Edinburgh

National Centre for Energy Systems Integration

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About

This 1-day event provides a project team wide update on CESI research to date and a review of future plans.

The conference enables all CESI academics and researchers to meet and discuss their CESI research. The agenda for the day comprises sessions hosted by each CESI work package, providing a showcase of current CESI research and the chance to hear about future plans. Early Career Researchers and PhD students will have the opportunity to present their own work in presentation or poster form.

CESI Work Packages

CESI's research is arranged in seven work packages. Although each work package focusses on one aspect of integrated energy systems, they link with each other in many ways. The topics of the Work Packages investigate the many aspects of the energy system from policy through to demand.

WP1: Commercial, Regulatory and Policy Aspects

We are looking at issues affecting energy supply and demand, including regulation, policy, commercial and social aspects. This work will inform all CESI's energy system models.

WP1 Lead: Gordon MacKerron — *University of Sussex*

Gordon is Professor of Science and Technology Policy at the Science Policy and Research Unit (SPRU), at the University of Sussex. He specialises in the economics and policy issues of electricity, especially nuclear power, and more broadly in energy security questions. In addition to leading Work Package 1, Gordon works on a number of other CESI Work Packages, including WP6 Multi-scale Architectures, Planning & Operation and WP7 Impact, Engagement & Management.

WP1 Research Team

Simone Abram, Durham University
Claire Copeland, University of Sussex
Tooraj Jamasb, Durham University
Manuel Llorca, Durham University
Gareth Powells, Newcastle University
Antti Silvast, Durham University
Steven Sorrell, University of Sussex
Harry Van der Weijde, University of Edinburgh

WP2: Energy Supply

Through this research, we aim to learn more about current and future UK sources of energy supply, including: wind, geothermal, solar, tidal and traditional technologies.

WP2 Lead: Simon Hogg — *Durham University*

Simon is Head of the Department of Engineering at Durham University and holds the DONG Chair in Renewable Energy at the University. He is a member of the Advisory Board in Durham Energy Institute. Simon is a mechanical engineer with research interests in the general areas of power generation conventional steam and gas turbine plant, wind turbines, energy systems and waste heat recovery. In addition to leading Work Package 2. Simon works on a number of other CESI Work Packages, including WP6 Multi-scale Architectures, Planning & Operation.

WP2 Research Team

Charlotte Adams, Durham University
Chris Dent, University of Edinburgh
Carlos Ferrandon-Cervantes, Durham University
Jon Gluyas, Durham University
Michael Goldstein, Durham University
Gareth Harrison, University of Edinburgh
Behzad Katemabrizi, Durham University
Zihao Li, University of Edinburgh
Tony Roskilly, Newcastle University
Wenshuo Tang, Heriot-Watt University
Mingyue Wei, University of Edinburgh
Kevin Wilson, Newcastle University

WP3: Infrastructure and Storage

In this work we are developing models of a variety of energy infrastructures. Systems evaluated include: ammonia; biofuels; compressed air; electricity; hydrogen; natural gas; petroleum and thermal.

WP3 Lead: Tony Roskilly — *Newcastle University*

Tony is Professor in the School of Engineering at Newcastle University and Director of the University's Sir Joseph Swan Centre for Energy Research. His research interest include CHP, trigeneration and energy storage; renewable thermal energy system design and the use of biofuels and hydrogen as alternative fuels. In addition to leading Work Package 3, Tony works on a number of other CESI Work Packages, including WP6 Multi-scale Architectures.

WP3 Research Team

Charlotte Adams, Durham University
Faisal Farooq, Newcastle University
Gareth Harrison, University of Edinburgh
Desen Kirli, University of Edinburgh
Renaldi Renaldi, Newcastle University
Andrew Smallbone, Newcastle University
Neal Wade, Newcastle University
Robin Wardle, Newcastle University

WP4: Energy Demand

In this research we are looking at how moving to low carbon energy forms will affect the demand of energy in buildings, industry, services and transport. We explore the interdependencies between demand profiles and future operational and planning models of our energy systems. When looking at low carbon energy technologies, we take into account factors such as consumer preferences and choices, consumer habits and cost.

WP4 Lead: David Flynn — *Heriot-Watt University*

David is an Eminent Overseas Professor of Nagasaki University and Associate Professor (Reader) in the School of Engineering and Physical Sciences of Heriot-Watt University. His research interests include prognostics and health management, energy systems, sensing technologies, data analysis for complex systems and microsystems. His research activities include Offshore Robotics for Certification of Assets (ORCA), the UKs largest AI and Robotics hub, HOME Offshore, CEDRI and the Centre for Doctoral Training in Embedded Intelligence. David is the associate editor of IEEE Access, SPEN stakeholder board member, advisor to the Scottish Government on Energy Systems and an Institute of Engineering and Technology (IET) Scholar, as a recipient of the Leslie H Paddle Prize (2006). In addition to leading Work Package 4, David works on a number of other CESI Work Packages, including WP5 Validation & Demonstration.

WP4 Research Team

Merlinda Andoni, Heriot-Watt University
Phil Blythe, Newcastle University
Sasa Dkokic, University of Edinburgh
Graeme Hill, Newcastle University
David Jenkins, Heriot-Watt University
Alexander Kell, Newcastle University
Aristides Kiprakis, University of Edinburgh
Peter McCallum, Heriot-Watt University
Myriam Neaimeh, Newcastle University
Edward Owens, Heriot-Watt University
Sandhya Patidar, Heriot-Watt University
Andrew Peacock, Heriot-Watt University
Gareth Powells, Newcastle University
Valentin Robu, Heriot-Watt University
Mohammad Royapoor, Newcastle University
Jonathan Swingler, Heriot-Watt University
Wenshuo Tang, Heriot-Watt University
Sara Walker, Newcastle University

CESI Work Packages

WP5: Validation and Demonstration

Our full scale Demonstrators make an important contribution to our research. They help us to understand the whole energy system in real world situations. Our Demonstrators include Newcastle helix, Findhorn, Cockle Park Farm and Integrated Transport Electricity Gas Research Laboratory (InTEGReL).

WP5 Lead: Phil Taylor — *Newcastle University*

Phil is Director of CESI and Siemens Professor of Energy Systems and Head of the School of Engineering at Newcastle University. He is an international leading research and industrial expert in energy systems, electrical distribution networks, smart girds and energy storage integration and control. In addition to leading Work Package 5, Phil works on a number of other CESI Work Packages, including WP6 Multi-scale Architectures.

WP5 Research Team

Adib Allahham, Newcastle University
David Flynn, Heriot-Watt University
Jon Gluyas, Durham University
Hamid Hosseini, Newcastle University
Stalin Muñoz Vaca, Newcastle University
Myriam Neaimeh, Newcastle University
Haris Patsios, Newcastle University
Zoya Pourmirza, Newcastle University
Mike Simpson, Newcastle University
Neal Wade, Newcastle University
Mansoureh Zangiabadi, Newcastle University
Natalia Zografou-Barredo, Newcastle University

WP6: Multiscale Architectures, Planning and Operation

We are developing whole energy systems models to examine future energy system scenarios in the areas of demand, supply, storage and consumer behaviour. These models will interconnect all CESI's research incorporating the many vectors and disciplines. We use a co-evolutionary process to develop these scenarios.

WP6 Lead: Gareth Harrison — *University of Edinburgh*

Gareth is Director of Research in the School of Engineering and currently holds the Bert Whittington Chair, both at the University of Edinburgh. His research focuses on renewable energy integration within smart energy grids, with emphasis on the application of meteorological modelling and optimisation methods. In addition to leading Work Package 6, Gareth works on a number of other CESI Work Packages, including WP2 Energy Supply and WP3 Infrastructure and Storage.

WP6 Research Team

Simone Abram, Durham University
Adib Allahham, Newcastle University
Ali El Hadi Berjawi, Newcastle University
Chris Dent, University of Edinburgh
Hailiang Du, Durham University
Duo Fang, University of Edinburgh
David Flynn, Heriot-Watt University
Rodrigo García, University of Edinburgh
Damian Giaouris, Newcastle University
Michael Goldstein, Durham University
Andreas Grothey, University of Edinburgh
Hamid Hosseini, Newcastle University
David Jenkins, Heriot-Watt University
Aristides Kiprakis, University of Edinburgh
Marion Lemery, University of Edinburgh
Ken McKinnon, University of Edinburgh
Nicòlo Mazzi, University of Edinburgh
Andrew Peacock, Heriot-Watt University
James Robertson, University of Edinburgh
Valentin Robu, Heriot-Watt University
Tony Roskilly, Newcastle University
Andrew Smallbone, Newcastle University
Wei Sun, University of Edinburgh
Phil Taylor, Newcastle University
Sara Walker, Newcastle University
Robin Wardle, Newcastle University
Paul Watson, Newcastle University
Amy Wilson, University of Edinburgh
Kevin Wilson, Newcastle University
Jingjie Yang, University of Edinburgh
Mingzhe Zou, University of Edinburgh

WP7: Impact, Engagement and Management

To maximise the impact of our research, we engage with the energy research in industrial sectors. We coordinate a wide range of events and workshops to facilitate this, including workshops for energy experts, CESI Demonstrator open days and policy briefings. Where new opportunities emerge for collaboration, we can use the Centre's £1M Flexible Fund which is administered by our Executive Operation Committee.

WP7 Lead: Sara Walker — *Newcastle University*

Sara is CESI Associate Director and Senior Lecturer in the School of Engineering at Newcastle University. Her current interests include energy efficiency and renewable energy in buildings, buildings as power plants, energy policy and energy systems. In addition to leading Work Package 7, Sara works on a number of other CESI Work Packages, including WP4 Demand and WP6 Multi-scale Architectures, Planning and Operation.

WP7 Research Team

David Flynn, Heriot-Watt University
Jon Gluyas, Durham University
Gareth Harrison, University of Edinburgh
Gordon MacKerron, University of Sussex
Tony Roskilly, Newcastle University
Phil Taylor, Newcastle University

Programme

08:30	**Registration / Tea and coffee** **Location: Atrium**
08:45	**Conference opening** **Sara Walker, Newcastle University** Welcome and Introduction **Location: Lecture Theatre**
09:00	**Work Package 1: Commercial, regulatory and policy aspects** Session Chair: **Gordon MacKerron, University of Sussex** **Location: Lecture Theatre, Floor 1** **Claire Copeland, University of Sussex** A hybrid scenario approach for improvement in UK energy futures **Gareth Powells, Newcastle University** Decarbonising practices with hydrogen **Antti Silvast, Durham University** The social construction of whole systems and energy models: a qualitative study on energy modelling research groups **Antti Silvast, Durham University** What is Energy Systems Integration For? Reviewing Advances in Collaborations between Social Sciences and Energy Systems Modelling
10:00	**Work Package 2: Energy supply** Session Chair: **Simon Hogg, Durham University** **Location: Lecture Theatre, Floor 1** **Carlos Jesus Ferrandon-Cervantes, Durham University** Response surface model for PV output in Findhorn village **Zihao Li, University of Edinburgh** Developing a wind farm power curve model by machine learning **Mingyue Wei, University of Edinburgh** Operational, economic and environmental benefits of conservation voltage regulation

11:00	**Tea & Coffee Break**
11:30	**Work Package 3: Infrastructure and storage** Session Chair: **Tony Roskilly, Newcastle University** **Location: Lecture Theatre, Floor 1** **Charlotte Adams, Durham University** Energy supply and storage potential of the UK's abandoned coal mines **Faisal Farooq, Newcastle University** Using distributed energy storage and demand side response combinations for relieving future power network constraints **Desen Kirli, University of Edinburgh** Battery-based energy storage for balancing the transmission system in presence of renewables
12:30	**Lunch Session and Lab Tours** **Location: Seminar Room, USB 4.005**
13:00	**Work Package 4: Energy demand** Session Chair: **David Flynn, Heriot-Watt University** **Location: Lecture Theatre, Floor 1** **Merlinda Andoni, Heriot-Watt University** Blockchain technology in the energy sector: A systematic review of challenges and opportunities **Peter McCallum, Heriot-Watt University** Stochastic and probabilistic behavioural patterns for building simulation **Wenshuo Tang, Heriot-Watt University** Optimisation of Hybrid Energy Systems for Maritime Vessels

Programme

14:00	**Work Package 5: Validation and demonstration** Session Chair: **Phil Taylor, Newcastle University** **Location: Lecture Theatre, Floor 1** **Martin Feeney, Hamid Hosseini & Phil Taylor, Newcastle University** Demonstration and Validation: Data, Models and Experiments **Mike Simpson, Newcastle University** Exploring smart meter data using Power BI **Natalia-Maria Zografou-Barredo, Newcastle University** Using multi-vector demonstrators as enablers of energy network modernisation
15:30	**Tea & Coffee** **Location: Seminar Room, USB 4.005**
15:45	**Work Package 6: Multi-scale architectures, planning and operation** Session Chair: **Gareth Harrison, University of Edinburgh** **Location: Lecture Theatre, Floor 1** **Adib Allahham, Newcastle University** The operational model of Integrated Gas and Electricity Networks **Hailiang Du, Durham University** Optimisation-based decision support via uncertainty quantification **Ali El Hadi Berjawi, Newcastle University** Trilemma evaluation framework for integrated energy systems **Duo Fang, University of Edinburgh** An affine arithmetic-based method for optimal operation of active distribution network with high wind penetration **Alexander Kell, Newcastle University** Segmenting residential smart meter data for short-term load forecasting **Jingjie Yang, University of Edinburgh** Studying the value of thermostatically controlled load in integrated energy systems using multi-objective optimisation
17:05	**Thanks and closing remarks** **Sara Walker, Newcastle University** **Location: Lecture Theatre, Floor 1**
17:15	**Close**

Useful information

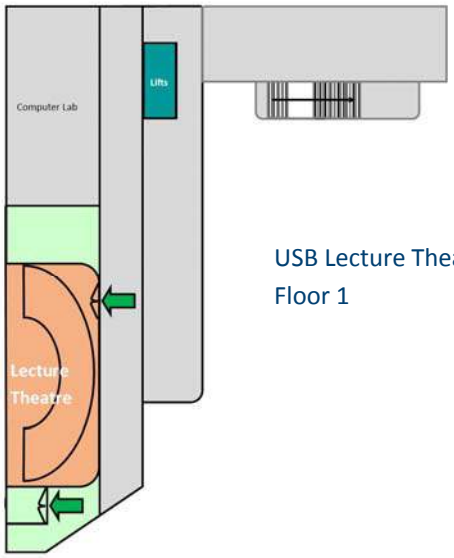
Wifi Connection

Wireless internet access is available campus-wide. Visitors can connect using the eduroam network (using your home institution login) or from the Wireless Guest service.

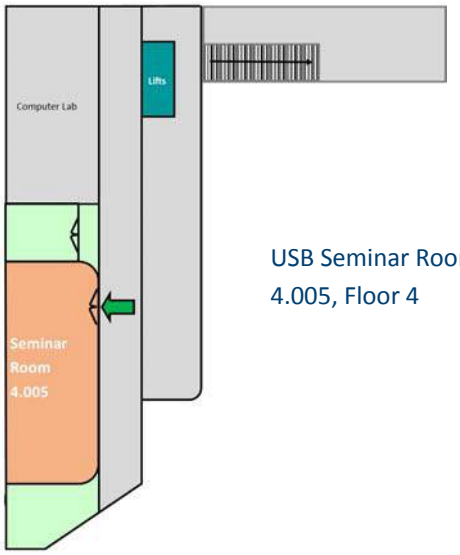
Photography

Please note that photographs will be taken by CESI photographers throughout the conference. These photographs may appear on the CESI website or in other forms of publicity material.

CESI Conference Rooms at the Urban Sciences Building



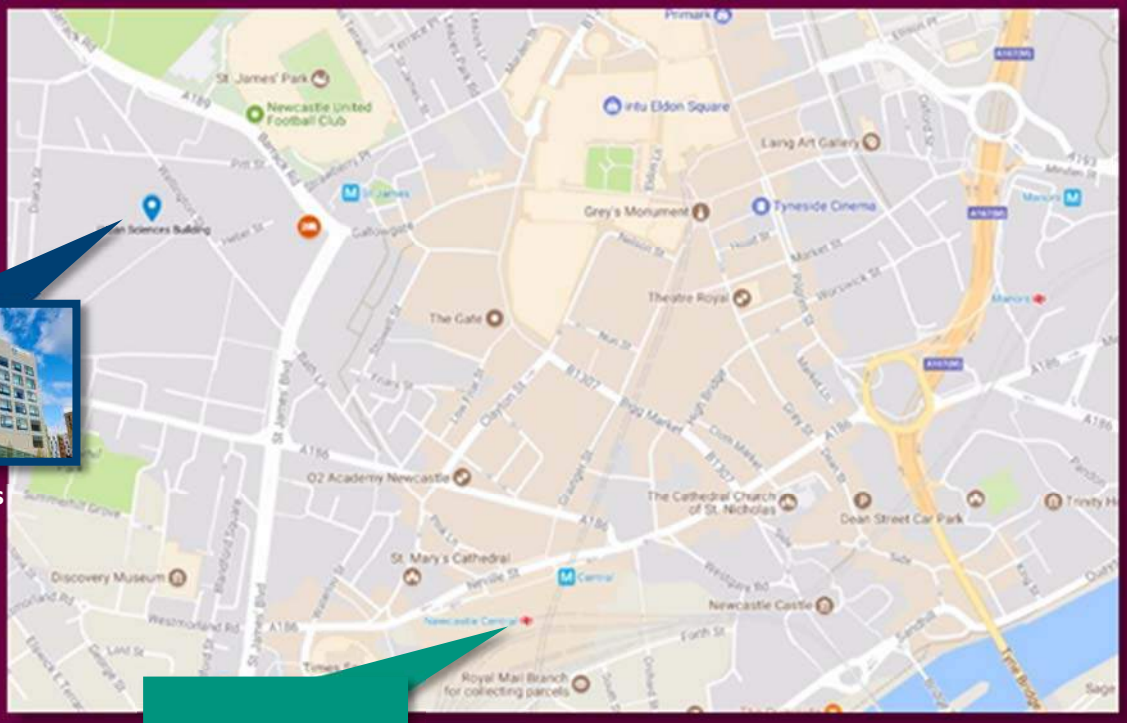
USB Lecture Theatre
Floor 1



USB Seminar Room
4.005, Floor 4

Map

Urban Sciences Building



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