



Interdisciplinary research for energy systems integration:

understanding and promoting good practice

Monday 24th June, 10.30am to 3pm

Assembly Room, 2nd Floor, Edinburgh Centre for Carbon Innovation (ECCI),

High School Yards, Edinburgh EH1 1LZ

<https://edinburghcentre.org/contact/how-to-get-here>

Agenda

Introduction

There is an accumulating body of knowledge on whole energy systems research designs and methods, but this is scattered among different centres and networks – creating missed opportunities to learn from experience. The workshop will report early findings from a CESI Flex Fund project on interdisciplinary research for energy systems integration and allow a structured discussion between CESI researchers and other senior researchers with experience of other interdisciplinary whole systems research centres. The agenda for the meeting is built around the generic challenges facing all interdisciplinary whole systems energy research initiatives:

1. Overall research designs: managing disciplinary diversity
2. Integrative research methods and outputs: modelling, scenarios and more
3. Decision support for policy and strategy

Note: speakers have each been allocated 15 minutes – including time for questions during and immediately after their talk. We advise speakers to restrict their presentation to no more than 10 slides.

Refreshments from 10.00am

10.30am Introductions (Chair: Dr Mark Winskel, University of Edinburgh and ClimateXChange)

- Attendee introductions
- Introduction to the CESI interdisciplinary project
- Aims of the day

10.45am Theme 1: Managing Disciplinary Diversity (Chair: Dr Matthew Hannon, University of Strathclyde)

- The Transition Pathways approach Professor Geoff Hammond (University of Bath) and Professor Peter Pearson (Imperial College) (15 mins)
- The UKERC approach, Dr Mark Winskel (University of Edinburgh and UKERC) (15 mins)
- Discussion (20 mins)



11.35am: Theme 2: Integrative Methods and Outputs (Chair: Professor Gareth Harrison, University of Edinburgh)

A range of methods and outputs are used for interdisciplinary research integration: whole energy system modelling and scenario development, multi-model linking, integrative analysis of demonstration projects, interdisciplinary report writing etc. This session will consider some of these methods – and their challenges and achievements

- The Energy System Catapult's Clockwork and Patchwork scenarios approach, Scott Milne, Head of Insights, Energy Systems Catapult (15 mins)
- Combining bottom-up analysis with systems modelling to analyse demand-side transformation Dr Charlie Wilson, University of East Anglia and IIASA (15 mins)
- Discussion (20 mins)

12.25pm Lunch Break

1pm Theme 2: Integrative Research Designs, Methods and Outputs (continued) (Chair: Professor Stuart Galloway, University of Strathclyde)

Continuing from the pre-lunch session, this session considers how newer research initiatives such as CESI and EnergyREV are developing and implementing integrative whole system research designs.

- The CESI approach, Professor Phil Taylor and Dr Sara Walker (University of Newcastle and CESI) (15 mins)
- The EnergyREV approach, Dr Rebecca Ford (University of Strathclyde and Energy REV) (15 mins)
- Discussion (20 mins)

1.50pm Theme 3: Whole systems analysis for decision support (Chair: Claire Copeland, University of Sussex and CESI)

This session addresses the key whole system analytic challenges for effective policy and stakeholder decision support. Issues here include decision-making under uncertainty, synthesising dispersed data from trials and demonstrations and working across research-business-policy divides.

- Whole systems analysis for decision support: ...a personal view, Alec Waterhouse (Head of Modelling, BEIS) (15 mins)
- A view from the Scottish Government, Andrew Mortimer (Statistician, Scottish Government) (15 mins)
- Managing uncertainty in modelling – good decisions for the real world, Dr Chris Dent (University of Edinburgh and CESI) (15 mins)
- Discussion (20 mins)

2.55pm: Summary and Next Steps (Dr Mark Winskel, University of Edinburgh and Dr Matthew Hannon, University of Strathclyde)

3pm: Close (Refreshments, with an opportunity to continue informal discussions)



Speaker and Chair Biographies

Claire Copeland is currently undertaking doctoral research degree at the Science & Technology Research Unit (SPRU), University of Sussex. Her research is investigating global net energy over time from the range of energy supply technologies using a system dynamics modelling approach. After many years in the actuarial profession under various guises as consultant, project manager, account manager and software trainer, Claire changed direction in 2007 to pursue environmental interests. Her research interests include Net Energy Analysis (energy return on energy invested), System Dynamics Modelling and Ecological Economics. Within CESI, she is developing combined qualitative and quantitative approaches to energy scenarios.

Chris Dent is Chancellor's Fellow and Reader in Industrial Mathematics at the University of Edinburgh, a Fellow at the Alan Turing Institute, and a Co-Investigator of the national Centre for Energy Systems Integration (CESI). He has previously worked in engineering science, and physics at Durham, Edinburgh, Marburg, Heriot-Watt and Loughborough Universities. His principal interests are in energy systems analysis, and wider issues in the use of modelling to support policy and planning decisions.

Rebecca Ford is a Chancellor's Fellow at the University of Strathclyde. Her work focuses on socio-technical energy transitions, bringing together social science and technical insights to support policy and practice shifts. She is the Research Director of the EnergyREV research consortium, which brings together over 50 researchers from 22 universities to work alongside policymakers, businesses, and energy industry organisations to inform the UK's transition toward smart local energy systems. In addition to her academic work, Rebecca serves as a Member on Ofgem's Electricity NIC (Network Innovation Competition) Expert Panel, and as Science Advisor to US based See Change Institute.

Stuart Galloway is Professor of Compact Power Systems in the Department of Electrical and Electronic Engineering at University of Strathclyde, where he leads research groups in Novel Electrical Systems and in Data Analytics and his research is concerned with multi-domain modelling of micro-grid applications for smart energy, and behavioural change. He is an invited member of the Scottish Government expert panels advising on delivery of local low carbon community demonstrator projects and recent projects with industry and government have investigated the effectiveness of policies and interventions related to technical aspects of local energy systems.

Geoffrey Hammond is Professor Emeritus in the Department of Mechanical Engineering at the University of Bath, and was founder Director of the University's Institute of Sustainable Energy and the Environment (I.SEE). His research interests are mainly concerned with the technology assessment of energy systems, industrial decarbonisation, and energy transition pathways to a low carbon future. This employed methods derived from the engineering and environmental sciences. He was the Principal Investigator [and Co-Leader] of the EPSRC 'Realising Transition Pathways' Consortium of nine university partners, and Co-Director of the EPSRC 'Centre for Industrial Energy, Materials and Products' (CIE-MAP). He was co-originator of the 'Inventory of Carbon and Energy' database, jointly funded by the Carbon Trust and the EPSRC, now widely used for the calculation of 'carbon footprints' for products and in construction.



Matthew Hannon is Senior Lecturer at the University of Strathclyde's Business School. His research examines the policy and market conditions necessary to accelerate low-carbon energy technology and business model innovation, with a special focus on offshore and local renewable energy. He is a Co-Investigator for UKRI's £8m EnergyREV Consortium on smart, locally led energy systems and a UK Energy Research Centre's community energy finance project. Prior to joining Strathclyde he worked at Imperial College's Centre for Environmental Policy (2012-2016) examining the effectiveness of energy innovation policies both in the UK and overseas (e.g. China, Finland). He completed his PhD at the Sustainability Research Institute (SRI) at the University of Leeds, examining the role that business model innovation plays in driving a low-carbon energy transition.

Gareth Harrison is Bert Whittington Chair of Electrical Power Engineering and Deputy Head of the School of Engineering at the University of Edinburgh. He holds a Bachelor's degree and a Doctorate from the same institution. He leads research activity across a wide area including integration of renewable energy within multi-vector energy systems, renewable resource assessment, climate change impacts on energy systems and carbon footprints of energy systems. He is Associate Director of the National Centre for Energy Systems Integration (CESI), was previously Principal Investigator of the Adaptation and Resilience in Energy Systems project and is currently a Co-investigator on a range of EPSRC and EU projects covering energy storage, hydrogen, conventional generation and offshore renewable energy.

Scott Milne is Business Leader for Insights & Evidence at the Energy Systems Catapult. He leads the ESC's work on whole energy systems analysis at the national scale, and recently published the 2018 edition of 'Options, Choices, Actions' describing the Clockwork and Patchwork scenarios for a low carbon UK energy system. Most recently, Scott delivered 'Living Carbon Free: exploring what a net zero target means for households', a report for the UK Committee on Climate Change as part of their advice to Government. He completed a PhD in Energy Economics at the University of Surrey in 2011.

Andrew Mortimer is a Statistician in the Office of the Chief Economic Adviser, Scottish Government. Andrew has played a key role in the development and co-ordination of energy systems analysis for the Scottish Government and the development of systems modelling support tools, particularly Scottish TIMES, which have been used to inform the development of the Scottish Climate Change Plan (2018) and Energy Strategy (2017). He is now informing the development of the current Scottish Change Bill and preparing for anticipated revisions to the Scottish Climate Change Plan in light of the Scottish Government's commitment to 'Net Zero' GHG emissions by 2045.

Peter Pearson is Honorary Professor, Centre for Environmental Policy, Imperial College. He was previously Director of the Low Carbon Research Institute of Wales (LCRI), based at Cardiff University and Director of the Imperial College Centre for Energy Policy & Technology (ICEPT); before that, he directed Surrey University Energy Economics Centre (SEEC). His research focuses on past and prospective long run energy and infrastructure transitions and their policy implications. He has been Economic Adviser to the World Bank Inspection Panel and twice Chair of the British Institute of Energy Economics (BIEE). He was the academic leader, with Prof Geoff Hammond (Bath), of the EPSRC-funded 9-university consortium, 'Realising Transition Pathways: Whole systems analysis for a UK more electric low carbon energy future ' (2012-16), and of its predecessor project 'Transition Pathways to a Low Carbon Economy ' (2008-12) - see <http://www.realisingtransitionpathways.org.uk/>



Phil Taylor is Head of the School of Engineering, Director of the EPSRC National Centre for Energy Systems Integration (CESI) and Siemens Professor of Energy Systems. He is an internationally leading researcher and industrial expert in energy systems, electrical distribution networks, smart grids, and energy storage integration and control. He is also the Leader of the EPSRC Supergen Energy Networks Hub <https://www.ncl.ac.uk/supergenhub/>. Phil and his research team are behind the smart grid lab in collaboration with Siemens, and the energy storage test bed facility at Newcastle University. Both are located at the Helix site. Newcastle University researchers at these unique facilities are working with industry to pave the way for the UK's future as an international leader in energy storage.

Sara Walker is Senior Lecturer and Director of Expertise for Infrastructure Research in the School of Engineering, University of Newcastle. She was previously Degree Programme Director for the MSc Renewable Energy Flexible Training Programme (REFLEX) and MSc Renewable Energy and Enterprise Management (REEM) until 2017. Her research focuses on renewable energy and energy efficiency in buildings, energy policy, energy resilience, and whole energy systems. She is interested in the active role of the urban environment and buildings in the energy sector, particularly low-energy and low-carbon buildings, building-scale renewables, small scale energy storage, and electric vehicle charging/discharging load profiles. She is also interested in concepts of resilience as they are used in other disciplines, and whether these concepts are transferable to the energy sector.

Alec Waterhouse is Head of the Central Modelling Team in the Department for Business Energy and Industrial Strategy (BEIS). His team are responsible for working out how much greenhouse gas the United Kingdom are projected to emit. He and his colleagues develop a range of models that make these projections, taking into account the effect of government policies and a host of other factors. The team also work on models that help to understand how we can meet our long term emissions targets and how government energy policies affect consumers. They have designed and built a bespoke policy simulation language for household energy modelling. He also leads for the department on quality assurance programme for analytical models. Alec started his working life as an engineer. After getting fed up of getting wet and dirty he moved into Operational Research. Since then he has worked in a wide variety of organisations ranging from the retail to public sector.

Charlie Wilson is Reader in the School of Environmental Sciences at UEA. Charlie's research interests lie at the intersection between technologies, behaviour and policy in the field of energy and climate change mitigation, working at both a systems level and a micro level. Charlie's research is either directly policy-relevant, or has implications for policy. At a systems level, Charlie is interested in long-run historical as well as future energy transitions, and the use of historical patterns of technology diffusion to inform scenarios and modelling projections of low carbon system transformation. He collaborates extensively with colleagues at IIASA (the International Institute for Applied Systems Analysis) in Austria. Charlie is a part of the Tyndall Centre for Climate Change Research, and a co-ordinator of its Energy & Emissions research theme

Mark Winskel is an interdisciplinary energy academic and Senior Lecturer in the School of Social and Political Science at the University of Edinburgh. He is a Co-Investigator with the UK Energy Research Centre (UKERC), and supports UKERC's policy engagement efforts in Scotland. He led UKERC's review of interdisciplinary energy research in the UK and recently led a major survey of energy experts' views on the UK energy system transition for UKERC. He was previously UKERC's national Co-ordinator and co-led the 4 year UKERC whole systems interdisciplinary project, *Energy 2050* and co-edited the Earthscan book on the project. He is also Policy Director for ClimateXChange (CXC), Scotland's national Centre of Expertise on climate change mitigation and adaptation. Mark has been researching energy systems, policies and organisations for over 25 years.