



# Energy systems challenges in a world in transition

## Conference programme

22–23 March 2016

Lady Margaret Hall, Norham Gardens, Oxford, UK

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It is the hub of UK energy research and the gateway between the UK and the international energy research communities. Our interdisciplinary, whole systems research informs UK policy development and research strategy.

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# Welcome message

Despite controversial changes to its energy policies in recent months, the UK government remains committed to meeting its statutory carbon budgets and targets. The Committee on Climate Change provided advice on the 5th budget late last year, and the government is now undergoing an intensive process to prepare a response.

At the same time, the international context for energy is continuing to change rapidly, with significant implications for the UK. The Paris Agreement was a diplomatic success when compared to the disappointing Copenhagen conference of 2009. Meeting the aims of the agreement will require an unprecedented shift towards low carbon energy systems and support for adaptation by the poorest countries. This reinforces the need for countries like the UK to strengthen and implement their low carbon plans and policies.

In parallel, the world is once again experiencing low fossil fuel prices. Partly because of this, there is downward pressure on gas prices too. How long oil prices will remain at these levels is hard to determine, but this too has significant energy system implications. Whilst low prices may be good news for consumers in the short-term, it could make life more challenging for cleaner fuels and technologies.

Against this background, I'm very happy to welcome you to the first of a series of annual conferences that UKERC intends to hold. The focus this year is on future energy systems challenges for policy, research and practitioners.

We aim to publish a conference report that will make recommendations for energy systems research in the UK. Your contributions at the conference will help us write it, so I encourage you to participate actively, and to interact fully with one another in conference sessions. We want to see some great discussion!

Prof Jim Watson, UKERC Director

## Conference steering group

Prof Jim Watson, UKERC (chair)

Dr Mike Weston, UKERC

Dr William Burns, UKERC

Lindsay Wright, UKERC

Jo Coleman, Strategy Development Director, Energy Technologies Institute

Dr Jane Dennett-Thorpe, Deputy Head of Science, Department of Energy & Climate Change

Prof Geoff Hammond, University of Bath

Lacey-Jane Davis, University of Bath  
Roisin Quinn, Head of Energy Strategy and Policy, National Grid  
Nigel Fox, Stakeholder Strategy & Outlooks Manager, National Grid  
Dr Catherine (Frin) Bale, University of Leeds  
Dr Katy Roelich, University of Leeds  
Prof Catherine Mitchell, University of Exeter  
Richard Hoggett, University of Exeter  
Prof Jim Skea, Imperial College London  
Dr Matthew (Matt) Hannon, Imperial College London  
Prof Neil Strachan, UCL  
Liz Milner, UCL

### **Energy system challenges: what you told us**

We issued an open call to energy researchers asking what topics we should address, and used responses to inform content development. All responses from the open call are available online: <http://www.ukerc.ac.uk/events/energy-systems-challenges-in-a-world-in-transition.html> (look under the 'Supporting documents' tab).

For further details on UKERC, the meeting, or energy systems, please contact William Burns; email: [william.burns@ukerc.ac.uk](mailto:william.burns@ukerc.ac.uk); tel.: 020 7594 3129.

# Day 1 programme

## 10.00 Registration & coffee (Monson Room)

### 10.30 Plenary: Energy systems challenges (Simpkins Lee Lecture Theatre)

Following a brief welcome and introduction to the programme, this session will ask three high-level speakers from government, industry and academia to talk about energy systems challenges from their own perspective.

Chair: Prof Jim Watson, UKERC Director

#### Speakers:

- Prof Arnulf Grübler, Acting Program Director, Transitions To New Technologies, International Institute for Applied Systems Analysis, Vienna
- Phil Sheppard, Director, SO Operations, National Grid
- Joan MacNaughton CB, Chair, WEC Trilemma & Member, UKERC Advisory Board

#### Rapporteurs:

- Dr Matthew (Matt) Hannon, Imperial College
- Dr Catherine (Frin) Bale, University of Leeds

## 12.00 Lunch (Deneke Dining Hall)

### 13.00 Parallel sessions:

Session topics have been chosen to reflect five crucial areas for interdisciplinary insights on the energy transition. Speakers will each talk for 10 minutes. This will be followed by general discussion and questions from the audience.

#### **Governance of energy systems transformation: emergence or design? (Mary O'Brian Room)**

The transition to a low carbon, sustainable energy system does not only mean changes to resources, technologies and infrastructures. It is already clear that changes in governance, institutions, policies and regulations will also be required.

At the moment, decision-making within the UK energy system is characterised by a mixture of markets and regulation. The extent of government intervention in markets has increased in recent years, and this has led to a debate about the desirability of more co-ordination or a return to a more market-led approach.

This session will seek to identify what knowledge we have about how the governance of the UK's energy system is already changing, and how governance arrangements could change in future.

Critical questions include:

- What are the common problems of coordination, investment and management across the energy system – and what are the solutions?
- To what extent is more co-ordination – or even planning – required as part of the transition to a low carbon energy system?
- How could alternative ownership models solve the problems we face, and what other problems and solutions might different ownership models produce?
- What is the role of institutions at different scales in energy system governance, and how might the balance change between European, national, devolved and local institutions?

Chair: Nigel Fox, National Grid

Rapporteur: Dr Mike Weston, UKERC

Speakers:

- Duncan Botting, Managing Director, Global Smart Transformation Ltd & Member, IET Energy Policy Panel
- Prof Frank Geels, Professor of System Innovation and Sustainability, University of Manchester
- Prof Catherine Mitchell, Professor of Energy Policy, Exeter

### **Energy security: beyond keeping the lights on (Old Library)**

Energy security is a key government energy policy objective. It has risen up the policy agenda during the past few years for a number of reasons, including an increasing need for energy imports as indigenous production declines; tighter margins between electricity supply and demand; and – until recent falls – increases in fossil fuel prices. Cybersecurity is, additionally, raised as a key risk as we transition to smarter energy systems.

According to the DECC Energy Security Strategy (2012), 'when discussing energy security the Government is primarily concerned about ensuring that consumers have access to the energy services they need (physical security) at prices that avoid excessive volatility (price security).'

Given how interdependent the UK energy system is with international trends, meeting energy security objectives requires an understanding of both global and UK-specific energy system changes.

This session will look at: how the risks to energy security might change in future, particularly as we transition to a low carbon energy system; how strategies to respond to these risks might also need to change; and what ought a systems approach to energy security look like?

Critical questions:

- What are the risks of energy security now, and how could these change? Which risks are likely to diminish, which are likely to emerge?
- Government and industry responses – are they fit for purpose, and how will they need to change in future as the system changes?
- Energy security for whom? What are the impacts of energy security risks and strategies on different energy system actors?
- Do our energy security strategies take a sufficiently system-wide approach – are they broad enough? Do these strategies strike the right balance between action on energy supply, networks, and demand?
- To what extent can we make security strategies compatible with those for low carbon, and other objectives – what are the trade-offs, what are the win-wins?

Chair: Prof Jim Watson, UKERC

Rapporteur: Dr William Burns, UKERC

Speakers:

- Prof Keith Bell, UKERC Co-Director & ScottishPower Professor of Smart Grids, University of Strathclyde
- Dr Amelia Hadfield, Jean Monnet Chair in European Foreign Affairs & Head, Energy and Governance Group, Canterbury Christchurch University
- Prof Paul Stevens, Distinguished Fellow, The Royal Institute of International Affairs (Chatham House)

### **Making change happen: consumers, citizens, and practices (Talbot Hall)**

People and communities will be vital to the energy transition. But human responses are complex, hard to predict, and not always amenable to ‘nudges’. Given that we want to engage people with us as we move towards a decarbonised energy system, how can we better understand their roles, and accommodate human factors within our technology, modelling, scenario building, and policymaking? How can energy transitions take into account the different roles people play individually and collectively – as consumers, citizens and practitioners?

The aim of this session is to identify the insights and data that are currently available; to identify what we still don't know; and to determine the kind of research we will need in five years' time, to understand and foster changes in practices and behaviours.

Critical questions include:

- What lessons and evidence exist to inform start-ups developing products that are designed to influence energy use by individuals and communities?
- What publically-available primary data do we have on how practices and behaviours change? Is it possible to connect, say, Oyster (London public transport), walking (phone GPS), driving and taxi use data? How do interventions such as Hive, Zipcar, and Uber impact energy consumption, if at all?
- Is a data-driven approach feasible? Are there 'generalizable' behaviours or practices that can be characterised and influenced? How ought we to segment, and prioritise, particular groups of people for intervention?
- How can citizens be more fully engaged in energy decision-making at national and local levels? What do we know now that could be used for decision-making immediately, and what do we need to know?

Chair: Prof Neil Strachan, Professor of Energy Economics and Modelling, UCL

Rapporteur: Lindsay Wright, UKERC

Speakers:

- Dr Catherine (Frin) Bale, University Academic Fellow, University of Leeds
- Prof Elizabeth Shove, Professor of Sociology, Lancaster University
- Prof Benjamin Sovacool, Professor of Energy Policy, University of Sussex

**14.30 Coffee break (Monson Room)**

**15.00 Parallel sessions continued:**

#### **Energy innovation systems (Old Library)**

To achieve the ambitious goals set out in the CoP21 Paris agreement, improvements in current technologies and practices will be needed. Mid-century we may need to rely on existing technologies or reasonably foreseeable improvements and enhancements. In the second half of the century, the Paris agreement implies the development of negative emission technologies which are not yet available and which could imply new sustainability challenges.

Systems of innovation can be characterised by technologies, sectors or countries. In the last decade, there have been a number of initiatives designed to re-invigorate innovation processes in the energy sector and accelerate progress from basic science

through to concept and market deployment. Examples include ARPA-E in the US, the absorption of the Risoe labs into the Technical University of Denmark and the Energy Technologies Institute and Low Carbon Network Fund initiatives in the UK. CoP21 has inspired the Mission Innovation initiative engaging 20 countries as well as the private sector Breakthrough Energy Coalition.

This session will explore energy innovation needs from a system perspective and review the effectiveness of recent and planned initiatives.

The following questions will be addressed:

- Do we need to expend more resources on energy R&D? Is Mission Innovation, for example, following the right approach? How do we not only spend more money, but spend it more wisely?
- What is the right balance between deployment support for near-market technologies and research support for more novel and potentially game-changing technologies? At what point should near-market technologies stand on their own two feet?
- What institutional arrangements and practices can best accelerate the path from the laboratory to market deployment? Have initiatives like ARPA-E fulfilled their purpose?
- How can public sector interventions be designed to leverage private sector support? Can business-led initiatives such as the Breakthrough Energy Coalition act as game-changers?

Chair: Prof Jim Skea, Imperial College London

Rapporteur: Richard Hoggett, University of Exeter

Speakers:

- Dr Jeff Hardy, Head of Future Consumers and Sustainability, Ofgem
- Dr Jonathan Radcliffe, Senior Research Fellow, Energy Storage, University of Birmingham
- Dr Charlie Wilson, Lecturer in Energy & Climate Change, UEA

### **Resources for energy systems (Talbot Hall)**

Currently, the UK's energy resources are adequately met by fossil fuels. However, we will need to transition to low or zero carbon in the future. Energy demand is likely to remain around the current level, but the transition will require some switching towards electricity, particularly for heat and transport. These changes will impact on our resource needs.

The main low carbon technologies available to the UK appear to be nuclear, wind, bioenergy, and photovoltaic. Each of these have unwanted side-effects. For example, in the case of renewables, some may be constrained by the availability of materials such as rare earth metals.

This session seeks to elucidate the key issues going forward on energy resources, their availability, and impacts for the UK. The following questions are intended to seed the discussion:

- To what extent are energy resources limited both in the UK, and internationally? In the case of bioenergy, resource is uncertain, with estimated potential varying widely from 10–45% of total UK energy demand. Likewise, shale gas development is at a very early stage. Although the UK is one of the few countries in Europe where government wants to support shale gas, without a major programme of exploratory drilling, it is difficult to say what the UK resource will deliver. The fracking situation in the US is quite different from the UK, and is unlikely to serve as a model for a variety of technical, geological, and legislative reasons.
- Nationally, energy policy has moved from an emphasis on climate change towards affordability and energy security. What do we see as the most significant resource issues within this ‘trilemma’? How should the UK balance the benefits and costs of these options?
- What do we need to say on the wider environmental issues, not just carbon emissions but also other policy issues such as land use and non-carbon emissions? For example, lifecycle assessments of photovoltaic show that the main environmental impacts arise from the aluminium frames, rather than the solar-receiving components.

Chair: Prof Geoff Hammond, University of Bath

Rapporteur: Dr Mike Weston, UKERC

Speakers:

- Prof Mel Austen, UKERC Researcher & Head of Science, Plymouth Marine Laboratory
- Prof Paul Ekins, Deputy Director, UKERC
- Dr Aled Jones, Director, Global Sustainability Institute, Anglia Ruskin University

### **16.30 Plenary: What does good leadership look like across the energy system? (Simpkins Lee Lecture Theatre)**

What does good leadership look like across the whole energy system? How do we move towards a coherent ‘system wide’ market and policy environment to support the transition of the energy system?

Chair: Jo Coleman, Strategy Development Director, ETI

Rapporteur: Dr William Burns, UKERC

Speakers:

- Jonathan Luff, Co-Founder and Partner, Epsilon Advisory Partners
- Amy Mount, Senior Policy Adviser, Green Alliance
- Philip New, CEO, Energy Systems Catapult

**17.30 Break**

**18.00 Poster session and drinks reception (Talbot Hall)**

**19.00 Formal Hall (Deneke Dining Hall)**

An Oxford University tradition including a three course silver service dinner.

After-dinner speaker: Laura Sandys, CEO, Challenging Ideas & Founder, POWERFULwomen.

# Day 2 programme

**8.00 Breakfast (Deneke Dining Hall)**

**9.00 Plenary: How can we fund energy systems research and innovation? (Simpkins Lee Lecture Theatre)**

Shifts are occurring in the way UK Government approaches research and innovation. These include the follow-up to the Nurse Review, the formation of Research UK (RUK), the potential for a strengthened role for the Low Carbon Innovation Co-ordination Group, and the founding of the Energy Systems Catapult.

This session will update delegates on the practical side of recent changes in the way research is funded, and how systems researchers in particular might benefit from them.

Talks will help frame the break-out discussions that follow.

- What impact will the Nurse Review, and the formation of RUK, have on funding for energy systems research?
- What within existing structures is working well – and what could be improved?
- How should academia work with industry and government? What structures and communication channels need to be reinforced?

Chair: Dr Jane Dennett-Thorpe, Deputy Head of Science, DECC & Member, UKERC Advisory Board

Rapporteur: Dr Matthew (Matt) Hannon, Imperial College London

Speakers:

- Dr Paul Durrant, Head of Innovation Policy, DECC
- Dr Kathryn Magnay, Head, RCUK Energy Programme
- Dr Alan Pitt, Deputy Director, Science Capability, Energy & Climate Change, Government Office for Science (GO-Science)

**9.45 Break-out groups**

Break-out groups to discuss and prioritise key points and develop recommendations for researchers, funders, and decision-makers. What are the new agendas for research, policy and decision-making? Each delegate should join a breakout group, aiming for around 15-20 people in each group.

- Breakout group 1 (Committee Room): Chair: Jo Coleman; Rapporteur: Dr Mike Weston
- Breakout group 2 (Jerwood Room): Chair: Dr Jane Dennett-Thorpe; Rapporteur: Dr William Burns

- Breakout group 3 (Lodge Coaching): Chair: Prof Geoff Hammond; Rapporteur: Richard Hoggett
- Breakout group 4 (Mary O'Brian Room): Chair: Nigel Fox. Rapporteur: Lindsay Wright
- Breakout group 5 (Old Library): Chair: Prof Catherine Mitchell. Rapporteur: Dr Matthew (Matt) Hannon
- Breakout group 6 (Talbot Seminar Room 2): Chair: Prof Neil Strachan; Rapporteur: Dr Catherine (Frin) Bale

#### **10.45 Coffee (Monson Room)**

#### **11.00 Plenary: Synthesis of discussions (Simpkins Lee Lecture Theatre)**

Break-out group chairs will highlight key challenges, based on what they have heard.

Chair: Dr Keith MacLean, Chair, UKERC Advisory Board

Rapporteurs: Dr Mike Weston & Dr William Burns

#### **12.00 Lunch (Deneke Dining Hall)**

#### **13.00 Close of meeting**

The Amanda Foreman Room is available for ad-hoc meetings throughout the conference.

Delegates should be aware the programme is subject to minor change.