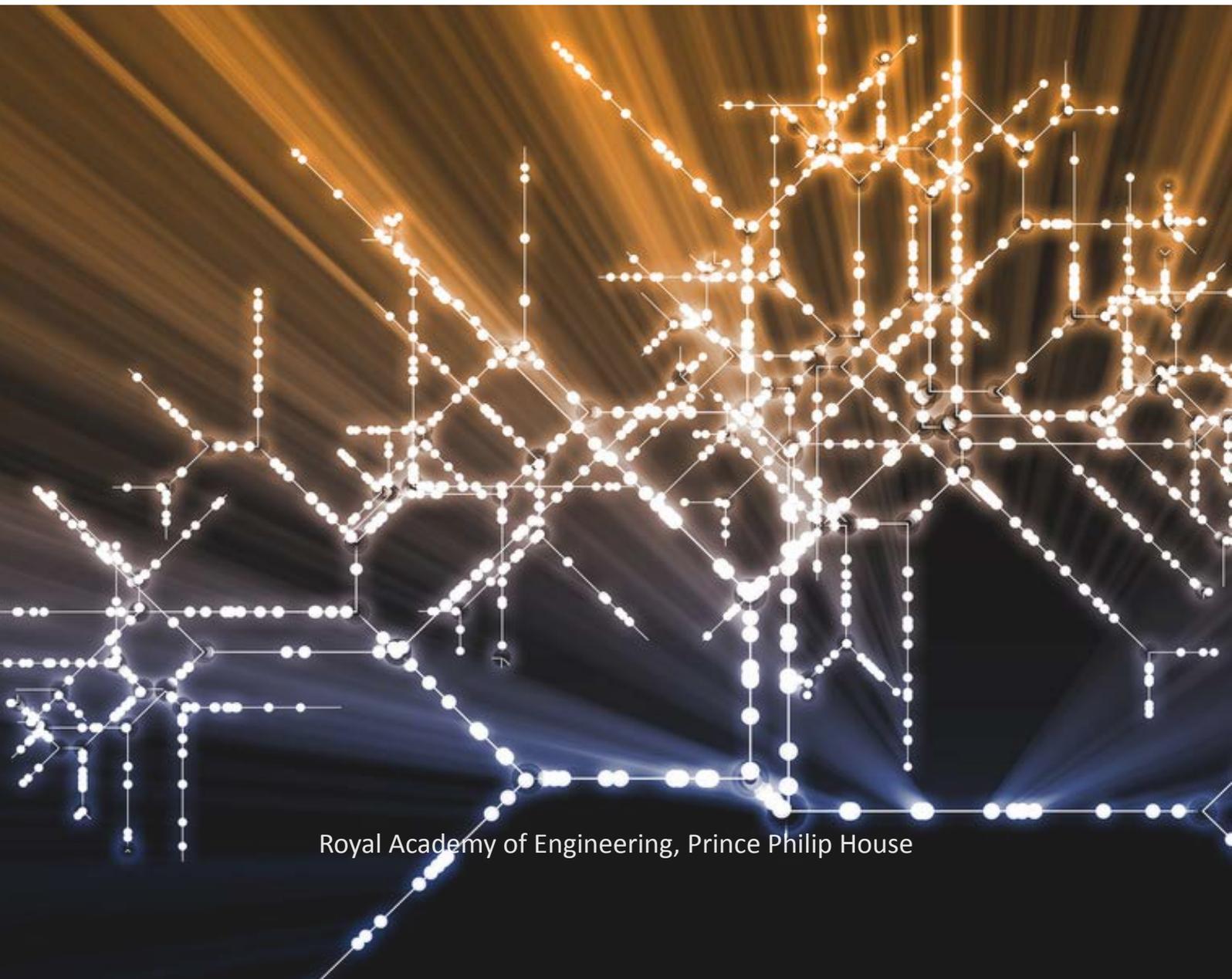![wholeSEM]

wholeSEM Annual Conference 2014

8 & 9 July 2014

Modelling Long-term UK Energy Futures: Challenges and Competing Objectives Conference Report

Royal Academy of Engineering, Prince Philip House

wholeSEM Annual Conference 2014 - Modelling Long-term UK Energy Futures: Challenges and Competing Objectives

Conference Report

Summary

The 1st Annual conference of the wholeSEM consortium (Whole Systems Energy Modelling) was held at the Royal Academy of Engineering in London on 8th & 9th July 2014. This conference focused on modelling insights on long-term UK energy pathways with analysis from alternate modelling perspectives: notably behavioural responses, the dynamics of technological change, the role of key infrastructures, and wider environmental implications.

An invited audience of 100 UK energy modelling practitioners and expert users explored and critiqued the modelling insights generated from interdisciplinary perspectives in their analysis of the UK policy priorities of decarbonisation, energy security and equity.

The conference communicated in real time with wider stakeholders via the Twitter feed at @wholeSEM using the event hashtag #wholeSEM14.

Key themes emerging from the discussion were:
- Expert user feedback on state-of-the art UK models, their narratives and their insights is critical for understanding by policy and industrial decision makers;
- Models give a framing mechanisms to key energy policy questions, but transparency over model's workings and assumptions is hugely important;
- Modelling the energy systems is a complex and overlapping task, with soft- and hard-linked combined approaches a critical research direction.

Presentations and Discussions

Professor Neil Strachan of University College London opened the conference with a discussion of the challenges of interdisciplinary energy modelling. Dr Marianne Zeyringer of UCL then presented a mapping exercise of current UK energy modelling expertise in academia, government and industry. The survey was based on analysis of funding streams, publications and an expert elicitation. The conference discussion focused on continuing gaps in UK expertise for which wholeSEM and other current modelling consortium is only a partial solution to. These modelling gaps were tempered by discussion of a possible lack of demand for modelling in a particular area or particular methodology, lack of data to enable modelling or the survey missing industrial expertise.

Dr Steven Fries – DECC's Chief Economist – gave the conference's keynote presentation: Long-term UK energy policy and modelling insights. He stressed the policy imperatives of understanding both cost effectiveness of energy options plus their scalability for mass deployment. The conference discussion focused on the challenges of meeting these policy goals including understanding multiple policy objectives, characterising uncertainty, classifying interactions between electricity heat and other vectors, understanding price and non-price drivers of investment, and understanding wider economic and environmental implications.

Professor Jim Watson – UKERC's Research Director – discussed the range of models used in UKERC and other major UK research centres. He noted the critical role models have played in defining and shaping energy research and policy agendas. Both he and the wider conference discussion counselled caution in the need to understand assumptions and model construction in using the outputs and insights from such large-scale complex analytical tools.

The afternoon sessions of Day 1 revolved around a set of technical presentations on key UK models. Alec Waterhouse – Head of Modelling at DECC – presented an overview of modelling in DECC, focusing on the integrated set of key modelling platform using in evidence based policy making. Birgit Fais of UCL examined technology pathways for a low-carbon energy transition, presenting critical insights from the new energy system model UK TIMES (UKTM). This including a systematic sensitivity analysis of restrictions on key electricity technology, limit on sustainable biomass imports, and lack of progress on end-use energy efficiency. Professor Nigel Gilbert presented work from his research team at the University of Surrey on modelling the co-evolution of domestic energy practices in low carbon scenarios. This focus on energy practices is being developed into an innovative agent-based simulation to explore the interactions between practices and their evolution and to formalise a model of household energy use.

Dr Julian Allwood of the University of Cambridge presented his team's work on the environmental and resource aspects of low carbon scenarios. This has been formalised in an integrated assessment of resource use and an understanding of the connections and trade-offs between the energy, water and land use systems via the development of the UK Foreseer tool that uses Sankey diagrams to trace the connections between energy, water and land use. Preliminary analysis of the land and water system implications of the UK Carbon Plan pathways, focused on the evolution of water demand for energy sector activities and an analysis of the area of land needed to deploy the bioenergy supply chain for the energy sector. Finally two linked presentations by the Imperial College London wholeSEM team by Professor Goran Strbac, Dr Meysam Qadrdan and Dr Sheila Samsatli discussed the set of detailed models of key energy vectors. These include the combined gas and electricity network model (CGEN) to understanding the impacts of large-scale deployment of intermittent generation and the potential demand flexibility from smart metering. Analysis on energy storage in key energy options is being undertaken using the Hydrogen Supply Chain (HSC) model and of the whole energy system using a new model, Spatio-Temporal Model for Energy Systems (STeMES). These approaches all adopt a detailed spatio-temporal optimisation approach to capture the essential space and time considerations in energy system evaluation.

Panel Sessions and Breakout Groups

Day 2 revolved around broader discussions of low carbon energy pathways.

Panel Session 1 revisiting the critical issues in long-term low carbon energy scenarios. Jo Coleman of the ETI focused on technology and stressed the consistency between UKTM and other energy systems optimisation models such as ESME. She highlighted the inertia in the energy systems of scale up technology deployment, infrastructure deployment and new business models. Dr Jason Chilvers of UEA focused on behaviour and highlighted the need to integrate quantitative and qualitative approaches. He discussed the opportunities and difficulties in the predictive capacity of agent based models of social practices. Professor Andrew Lovett of UEA focused on environmental issues and stressed the need to consider global trade, the full life cycle of technologies and the need for fine spatial scales of many energy vectors. Finally Lewis Dale, the Head of Modelling at National Grid, revisited infrastructures stressing the role of market design on long-term operation of the electricity and gas networks

Panel Session 2 discussed broader considerations on long-term low carbon energy scenarios. Martin Haigh of Shell International focused on resources and discussed both the need to model geopolitics as well as low political and public constraints for individual energy technologies. Professor John Barrett of the University of Leeds focused on macro-economics, highlighting the need to understand non-marginal changes as the UK and the world tries to implement a step change towards low carbon energy systems. This includes wider impacts on jobs and trade as well as wider policy levers to enable and mange such changes. Finally Professor Richard Green of Imperial College London focused on energy markets. He cautioned against over complexity in models and the need to capture uncertainties including via multiple model runs. In any market arrangement consumers and supplier need to be represented in adequate detail.

Breakout sessions were then held on three key topics, listed below with key points from the discussion:

Model Linkages
- The importance of a clear model taxonomy (including methodologies)
- The usefulness of visual linkages as well as commonality in language
- The need for model verification, testing and calibration
- Clarity and prioritisation of parameters to both link and iteratively exchange

Data Gaps
- Common themes were uncertainty in data, the commercial nature of some data sets, and historical gaps in data when calibrating models
- Key data gaps areas included demand drivers, rates of change in technology or infrastructure deployment, characterisation of "real world" costs, and the efficacy of policy mechanisms

Future Modelling Workshops
- Broader reach out to other government departments, NGOs, SMEs and representatives of civil society
- Combine UK and international expertise
- Focus conferences on key research questions (as opposed to topics)
- Focus on model validation and model uncertainty

A final session was held on Energy Modelling and Improved Policy Insights, led by Dr Jon Saltmarsh from DECC and Dr David Joffe from the Committee on Climate Change. The general conference discussion focused on the appropriate choice of models for specific questions, their integration with other analytical techniques and iteration with policy makers. Ultimately however models can help to make the hard decisions, bridge the gaps between optimality and policy reality and communicate uncertainty. A broader output of modelling is an understanding of the complexity of the energy policy question, and that the energy analysts and the energy policy makers evolve their understanding and sophistication in tandem to the actual model development.

About the Whole Systems Energy Modelling Consortium (wholeSEM)

The whole systems energy modelling consortium (wholeSEM) is a ground breaking, multi-institution initiative to develop, integrate and apply state-of-the-art energy models.
Our aim is to employ extensive integration mechanisms to link and apply interdisciplinary models to key energy policy problems, with substantive bilateral engagement with stakeholders in academia, government and industry. Funded by EPSRC, the consortium is led by University College London and consists of Imperial College London, the University of Cambridge and the University of Surrey.

Energy models provide essential quantitative insights into the 21st Century challenges of decarbonisation, energy security, energy equity, and cost-effectiveness. Models provide the integrating language and framework that assists energy policy makers – focusing at different scales and time periods – to make improved decisions and trade-offs in conditions of pervasive uncertainty. Whole systems energy modelling also has a central role in helping energy supply companies to make technical and economic decisions with regard to future energy technologies and infrastructure, as well as in the assessment of the potential role of societal and behavioural change.

Follow us on Twitter at @wholeSEM.

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EPSRC is the main UK government agency for funding research and training in engineering and the physical sciences, investing more than £800 million a year in a broad range of subjects - from mathematics to materials science, and from information technology to structural engineering.