Energy Pathways under Deep Uncertainty: What do Decision Makers Really Think is Important?

Report of wholeSEM – ETI workshop, 30th March 2017

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The purpose of this workshop was to explore several critical questions for the UK energy system, namely: what are the critical uncertainties decision makers are facing as they develop a strategy to transition the UK to a low carbon future, and what are the implications that these uncertainties have for the decision support community? The event marked the completion of the first phase of an Energy Technologies Institute-funded UCL initiative to elicit the perspectives of decision makers and to consider how the modelling community should respond to the issues raised.

Overview of presentations and discussant perspectives

Following a welcome from Neil Strachan, **George Day** (ETI) set out briefly why the Energy technologies Institute (ETI) see this an important area of research. He reflected that robust approaches and tools are required for decision making, and this is an area that the ETI have strongly focused on in their past work. However, the challenge going forward is to improve the associated methodological approaches and tools, so that they can account for deep uncertainty, while still feeding insights into the policy making process.

Jim Watson (UKERC) followed, with a keynote presentation on the uncertainties facing policy makers[1], particularly reflecting on the work carried out under the UK Energy Research Centre (UKERC) on the uncertainties associated with meeting the 4th carbon budget[2]. He first used recent events to illustrate the types of uncertainties faced by the community, including recent political changes (the Brexit Referendum in the UK, the new Trump administration in the United States), technological challenges (the bankruptcy of Westinghouse and the associated fallout for the global nuclear industry, the cancellation of CCS demonstration projects), and the pervasive discussion in the media of future disruption to socio-economic systems through automation of labour. He then questioned whether the conclusions from the UKERC analysis on key uncertainties still held, following completion of the project in 2014.

Uncertainties that have emerged as key issues since 2014, include the role of "smart" systems in the power sector, the extent to which an interventionist approach to the future electricity market will be taken, and the challenges for decarbonising heat supply. The large scale potential impact of smart systems in the power sector were discussed in the context of recent analysis by the National Infrastructure Commission (NIC). On heat, clear uncertainties still remain on how to decarbonise this critical area, with hybrid solutions (i.e. multi-vector) highlighted as an underexplored area going forward. Additionally, key systematic uncertainties that were highlighted as deserving of a stronger focus included the exploration of winners and losers in the transition, how changes to local decision

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[1] Presentation by Jim Watson, http://www.wholesem.ac.uk/documents/UCL_Deep_Uncertainty_-_Mar_2017_-_Jim_Watson.pdf

[2] UKERC Energy Strategies Under Uncertainty, http://www.ukerc.ac.uk/programmes/flagship-projects/energy-strategies-under-uncertainty.html

making could affect the role of different technologies and actors, and a broader assessment of fossil fuel price changes.

Jim concluded that there are many pervasive uncertainties, clearly impacted by the broader socio-political and economic context. However, policy can help reduce uncertainty for a range of actors taking decisions. Going forward, politics will continue to be a challenge for energy policy. But policy should respond by identifying and acting on 'no regrets' measures, and where there is a lack of clarity, keeping options open. A further challenge will be affecting the transition through more disruptive change in 'the rules of the game', system operation, actors and business models.

Francis Li and Steve Pye (UCL Energy Institute) presented the results of their research eliciting the perspectives of the energy strategy community on critical uncertainties[3]. They first set out the challenge of 'wicked problems' faced by decision makers in the energy and climate space. The research was framed as an exercise in understanding how best the analytical community might best support decision makers given the deep uncertainty in addressing the challenge. A key aspect identified in the literature for addressing these issues is to first understand the perspectives of the decision makers, given their expertise on the challenge and solutions, to understand the analytical support required, and to establish a degree of buy-in for the analytical approaches used. The results of interviews with 31 experts was presented.

A key finding is that the socio-political domain is viewed as important as any other, alongside technological uncertainties. Such uncertainties include the level of societal engagement and buy-in to the transition, and the political will to build the sustained momentum needed. Experts provided two main groups of mitigation activities for addressing these uncertainties, i) demonstrating a credible political commitment and ii) enhancing social engagement. Interestingly, different stakeholder groups focused on specific approaches to mitigation; for example, on societal engagement, government stakeholders emphasised the need for shared ownership of the challenge and the need to make solutions fit with lifestyle aspirations. NGO and other stakeholders, on the other hand, stressed the need for government leadership, and a much more proactive approach from government in terms of engaging with society to communicate the benefits of a low carbon energy transition.

On modelling approaches to support decision makers, stakeholders stressed the need for assessment of broader uncertainty ranges to better map the uncertainty space, the need for model-informed and not model-led approaches, improved communication of uncertainties and a move away from a sole use of techno-economic framing for problems. Related to this last point, it is clear that it is common for socio-political issues to be located outside of the analytical process. There are a range of prospective approaches in the literature for trying to think about how to recognise this domain in decision support, such as participatory modelling and the use of bridging narratives to connect qualitative analysis with quantitative modelling. However, there is a clear tension between analysis that effectively feeds into decision making processes (which often must be carried out very rapidly) and the increasing complexity, resource needs and interdisciplinarity of new approaches (which are often time consuming).

Three discussants reacted to the presentation. **Karen Mayor** (Ofgem) highlighted the need for adopting a longer term perspective but that there is a challenge of communicating model generated scenarios to decision makers, which may be too few to cover the uncertainty space or too many to

[3] Presentation by Francis Li and Steve Pye, http://www.wholesem.ac.uk/documents/2017-03-30_Uncertainty_Workshop.pdf

easily communicate. She reflected on the numerous areas of uncertainty, and that these are often outside the boundary of the traditional energy system as conceived by analysts. She highlighted how it was important that policy making retained flexibility, despite calls to act now in a specific direction, as this was important to enable learning by doing, and allow for disruptive change.

Amy Mount (Green Alliance) reflected on the importance of understanding and clearly identifying the providers of evidence and their precise relationship to the decision making process. Noting the current primacy of modelling, a requirement was recognised to diversify approaches to providing evidence, being transparent about the strengths and weaknesses of each, and recognising that all evidence providers have agendas (no evidence is "pure" and free of value judgements). This broader diversification activity could be more important than simply looking to improve on or develop models themselves. On the subject of how decision makers use evidence, there is a need to mitigate and adapt. Mitigation can be through setting overarching guidance strategies that offer the direction of travel and support long term decision making in other sectors, and through recognising the importance of including the plurality of different visions in designing more robust strategies that lead to fewer surprises. Adaptation could be achieved by avoiding lock-in and by being responsive to new evidence, while ensuring action is taken despite the uncertainty.

Phil Lawton (Energy Systems Catapult) first noted how when doing scenario studies we tend to turn "wicked" problems into "tame" ones, often through abstraction. He reflected on some of the key uncertainties that we face, from developing a smart grid, to integrating high levels of variable renewables, to electrifying heating and transport, to understanding how consumers will respond to different types of incentives. His final comments related to the uncertainties for policy making, with three key questions posed that need to be thought through – what if we do nothing, what do we want to achieve, and what is the impact of the actions that we take?

Key issues raised in discussion

A vibrant discussion unfolded following the different presentations and interventions by the discussants. Some of the key themes are summarised below –

- Government as the source of uncertainty rather than a mitigator of uncertainty. Having total certainty about a pathway is difficult, excessive and undesirable because systems change and are dynamic. Instead more certainty is needed about the process used to handle change systematically when it occurs.
- The role of models in influencing policy decisions. There was a view that models are not always chosen for good or even rational reasons – many factors come into play: some may be developed by senior people over many years and be used, retaining influence to date, even though they have exceeded their "shelf life". Also, models will "only go so far" before reaching a point where further analysis does not help and action is required.
- Models are used for different types of decisions, from project level to national policy. How to treat uncertainty in models will be dependent on the complexity and scale of the problem, and some of the model outputs may be used more directly in the decision making process. However, there is always an element of human decision making in supposedly straightforward investment decisions, taking account of other factors outside of the modelling domain.
- The challenge of communication with non-technical users of model outputs, and the wider public. Given recent political events, there is a question about understanding how democracy works and what messages people respond to. For climate change mitigation, there is a need to understand who the advocates that people are willing to believe might be – and within that,

how are academics / energy practitioners supposed to engage. On communicating results to policy makers, there are issues on both sides; modellers need to improve presentation, recognising that not all users have a strong technical background. On the other hand, decision makers need to be open to the idea that there may be irreducible uncertainties that cannot be minimised through additional analysis. On the latter, this includes recognising that many uncertainties lie ahead in delivering Brexit, and that there are risks as well as the opportunities that government retain a focus on.

Closing comments

Phil Lawton remarked that it might be useful for decision makers to ask a) how much do I have to change given parameters before changing my mind about the results? And b) does the question really matter at all when compared with doing nothing? (e.g. is it really impactful to choose nuclear over gas & coal CCS?). The challenge going forward will be, in a world of increasingly selectable news and opinion (echo chambers), gaining consensus and sustaining constructive debate between different stakeholders.

Amy Mount remarked that a robust science-based expertise is not always enough, and we need to be mindful of other factors to get evidence heard. For example, we may need mediators that can provide the conduit to get research insights from academia to decision makers. She also highlighted that 'rationality' and 'choosing to not believe evidence' are two different things. It may be rational not to believe the consensus view from experts e.g. the systemic collapse of the global financial system in 2008 was not widely predicted despite clear warning signals.

Karen Mayor suggested that better and improved modelling was important, but not necessarily all that was required. Multiple approaches to informing decision making are likely to be required moving forward. She also remarked that setting a direction of travel and a set of overarching principles used in policy was important, particularly for different actors to know what directions will be taken under different situations.

Jim Watson highlighted that evidence-based analysis still matters to policy, and that the appetite for evidence is still there. Models have an important role to play but developing a diversity of approaches is important. In combination with other evidence, models can provide mutually reinforcing and distinctive insights, to help make robust decisions and identify "no regret" courses of action. He then reinforced the idea that it is critical to know the audience to whom we are presenting, and communicate the results accordingly.

Workshop attendees

Ravi Baga, EDF
Jean-Marc Bonello, UCL Energy Institute
Oliver Broad, UCL Energy Institute
Pablo Carvajal, UCL Energy Institute
Jen Cronin, UCL Energy Institute
George Day, Energy Technologies Institute
Chris Dent, Edinburgh University
Paul Dodds, UCL Energy Institute
Paul Ekins, UCL Institute for Sustainable Resources
Shih-Che Hsu, UCL Energy Institute
Chris Heaton, Energy Technologies Institute
Ilkka Keppo. UCL Energy Institute
Philip Lawton, Energy Systems Catapult
Francis Li, UCL Energy Institute
Sarah Livermore, Committee on Climate Change
Bob Lowe, UCL Energy Institute
Karen Mayor, Ofgem
Amy Mount, Green Alliance
Michael Priestnall, Innovate UK
Steve Pye, UCL Energy Institute
Tobias Reinauer, UCL Energy Institute
Daniel Scamman, UCL Energy Institute
Michelle Shipworth, UCL Energy Institute
James Spelling, EDF
Neil Strachan, UCL Energy Institute
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Jonathan Tecwyn, Department for Business, Energy & Industrial Strategy
Will Usher, Environmental Change Institute
Jim Watson, UKERC
Daniel Welsby, UCL Institute for Sustainable Resources
Zack Wang, UCL Energy Institute
Goran Strbac, Imperial University
Jonathon Gaventa, E3G
Charalampos Ameloroulos, Loughborough University
Marianne Zeyringer, UCL Energy Institute