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

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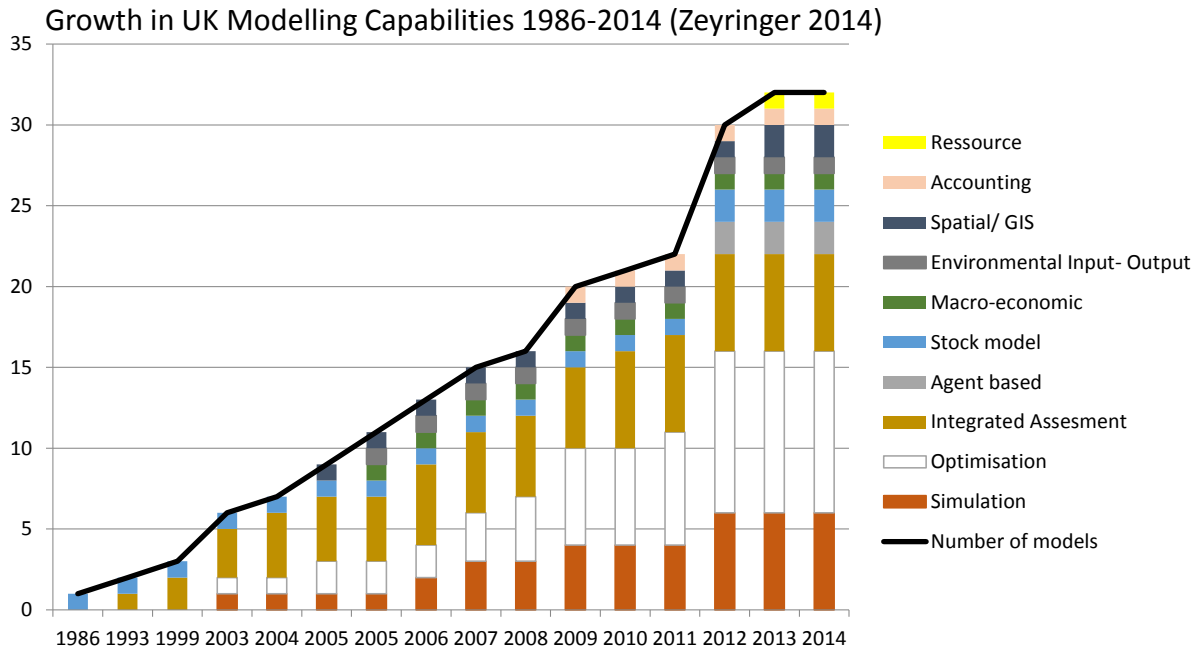
Study context

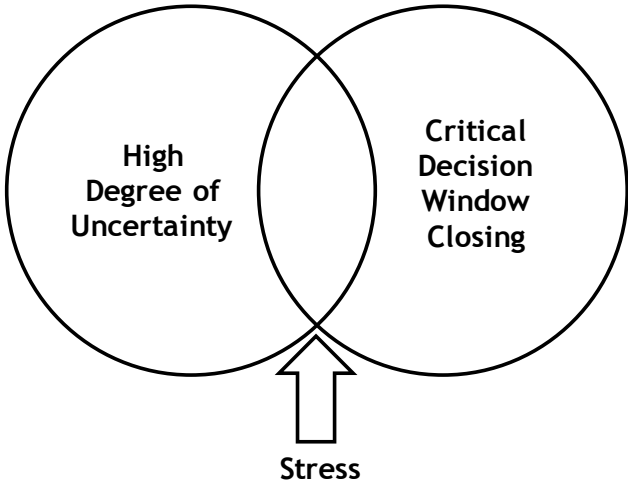
- The last decade has seen a strong and persistent growth in the use of models and institutional capacity for model-based science and policy analysis in the UK (Taylor et al. 2014, Strachan et al. 2016)

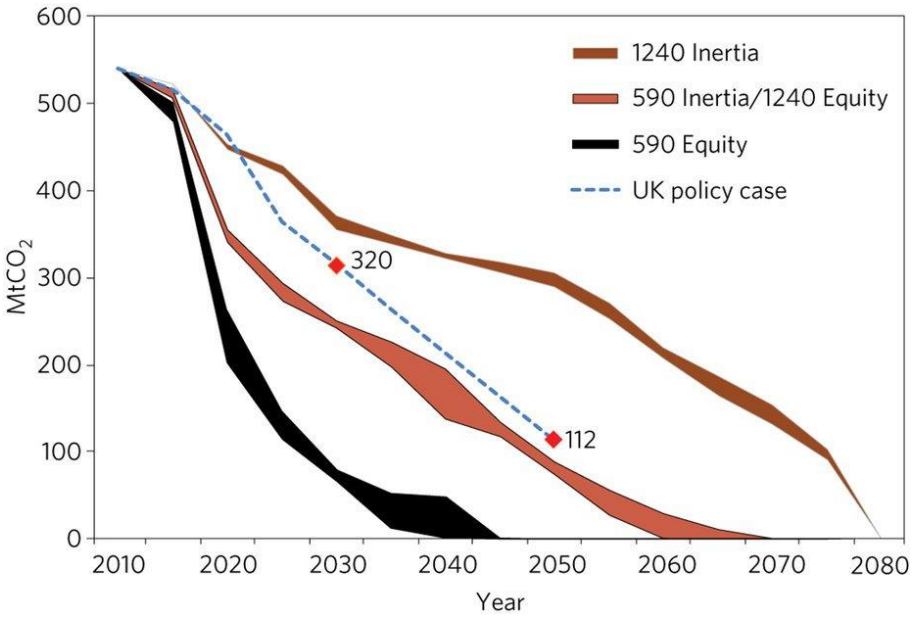


- UKERC have identified greater use of analytical tools that explore UK energy policy uncertainties and their potential impacts as a key strategic priority (Watson et al. 2015)

Study context

- ETI, BEIS, CCC, The Scottish Government etc. have all been advancing development of energy models to explore energy transitions to a low carbon system
- The window for critical decisions is closing and uncertainties are not necessarily reducing through time as better information becomes available
- For example, if you want to hedge against several critical uncertainties we now know it's possible that the UK needs to hit "net zero" emissions by 2045, not 80% by 2050 (Pye et al. 2017)





"Wicked" problem framing

- UK needs to make urgent near term decisions but is faced by what Rittel and West Churchman (1967, 1973) called *"wicked problems"*
- *"Tame problems"* include mathematics, chess, puzzle solving, cost benefit analysis: straightforward planning response, because there is a "right" answer
- With *"Wicked Problems"* there is no obviously "right" answer, and the appropriate response is unclear

"Wicked" problem framing

Requires complex judgement involving strong moral, ethical and professional dimensions

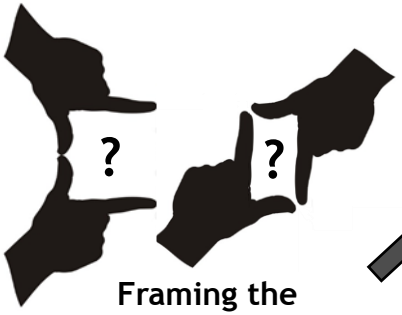
Decision makers and stakeholders hold radically different worldviews

No obviously right or wrong solutions

Iteration

WICKED PROBLEMS

Each Trial Counts



Framing the challenge clearly is not straightforward

While exploring solutions, key factors keep changing

Deep uncertainty

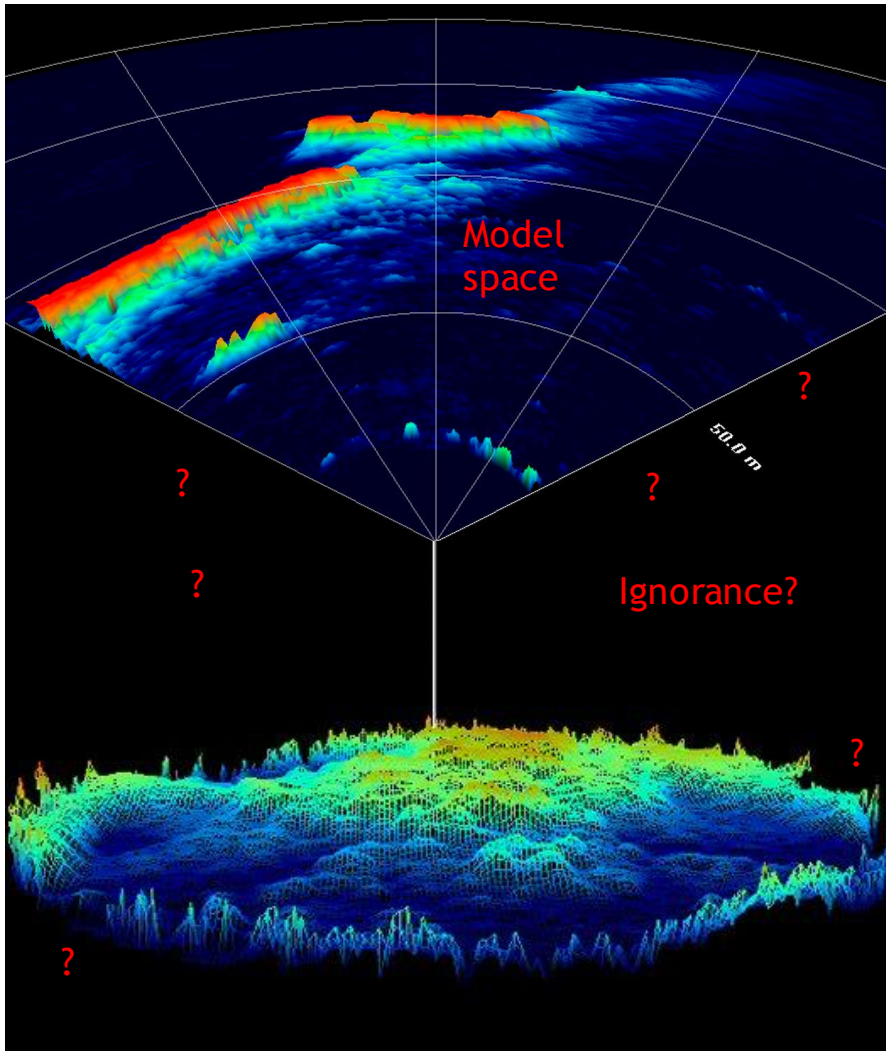
- Scholars define “deep uncertainty” (Lempert et al. 2003, Hallegatte et al. 2012) as problems where decision makers either don’t know or cannot agree on:
    - *The appropriate models to describe the interactions among a system’s variables,*
    - *The probability distributions to represent uncertainty about key variables and parameters in the models, and/or*
    - *How to value the desirability of alternative outcomes*

Stakeholder involvement in decisions

- Stakeholders need to be consulted for effective decision support under uncertainty (e.g. Funtowicz and Ravetz 1993), because:
    - *Expertise is resident in the community regarding the key questions and issues*
    - *Different stakeholders bring with them different perspectives and priorities*
    - *Engagement is key for stakeholders to buy-in to the analysis*
- The credibility, salience and legitimacy (Cash et al., 2002, 2003) of scientific evidence depends on the decision maker community trusting the analyst community

Challenges with current problem framing

- But often in energy policy and energy research this engagement is limited to analysts talking to each other e.g. analyst-providers talking to analyst-users
- Analytical frameworks used (typically techno-economic models) often have the effect of narrowing the scope of what is discussed to what is tractable (Wynne, 1992)
- This potentially leaves other key uncertainties unresolved or ignored
- The map is not the territory (Robinson, 1992; Korzybski, 1958)



Research objectives and approach

- In recognising the challenge posed by deep uncertainty, interviews with strategy experts sought to broaden engagement, and to determine perspectives on uncertainty and decision support

- Key questions:

    - *What do you perceive as being the critical uncertainties relating to the UK's future transition to a low carbon economy?*

    - *How do you think that these critical uncertainties can be mitigated?*

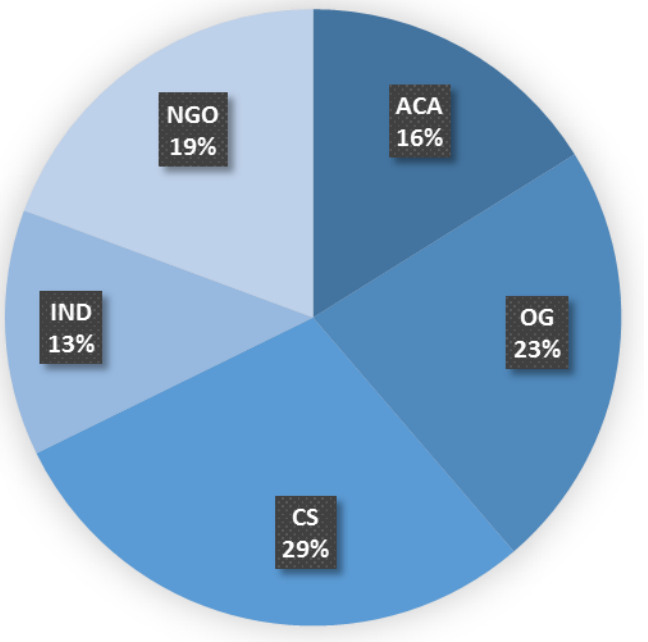
    - *What improvements can be made in the area of decision support for strategic planning and policy design?*

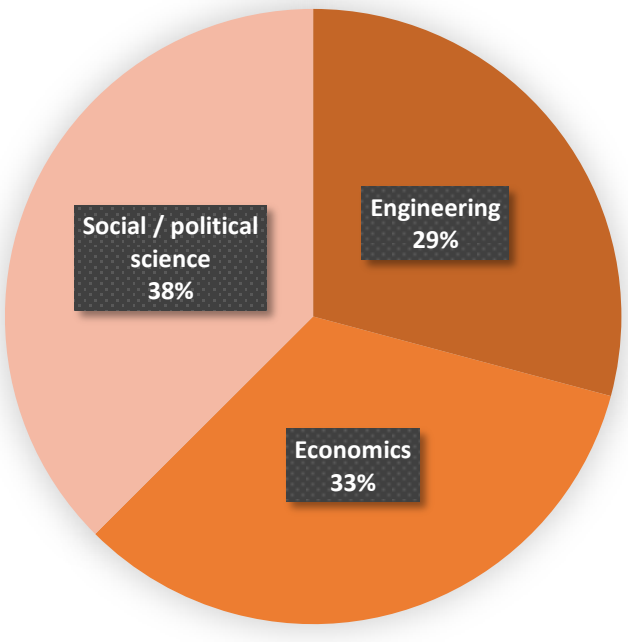
- Open-ended (to avoid bias), semi-structured discussion format, around 60 minutes each (carried out between September 2016 – January 2017)

- 30+ hours of discussion, covering a wide range of topics and themes, challenging to code and distil key messages

Interviews

- 31 interviewees from a range of (self-reported) professional and disciplinary backgrounds

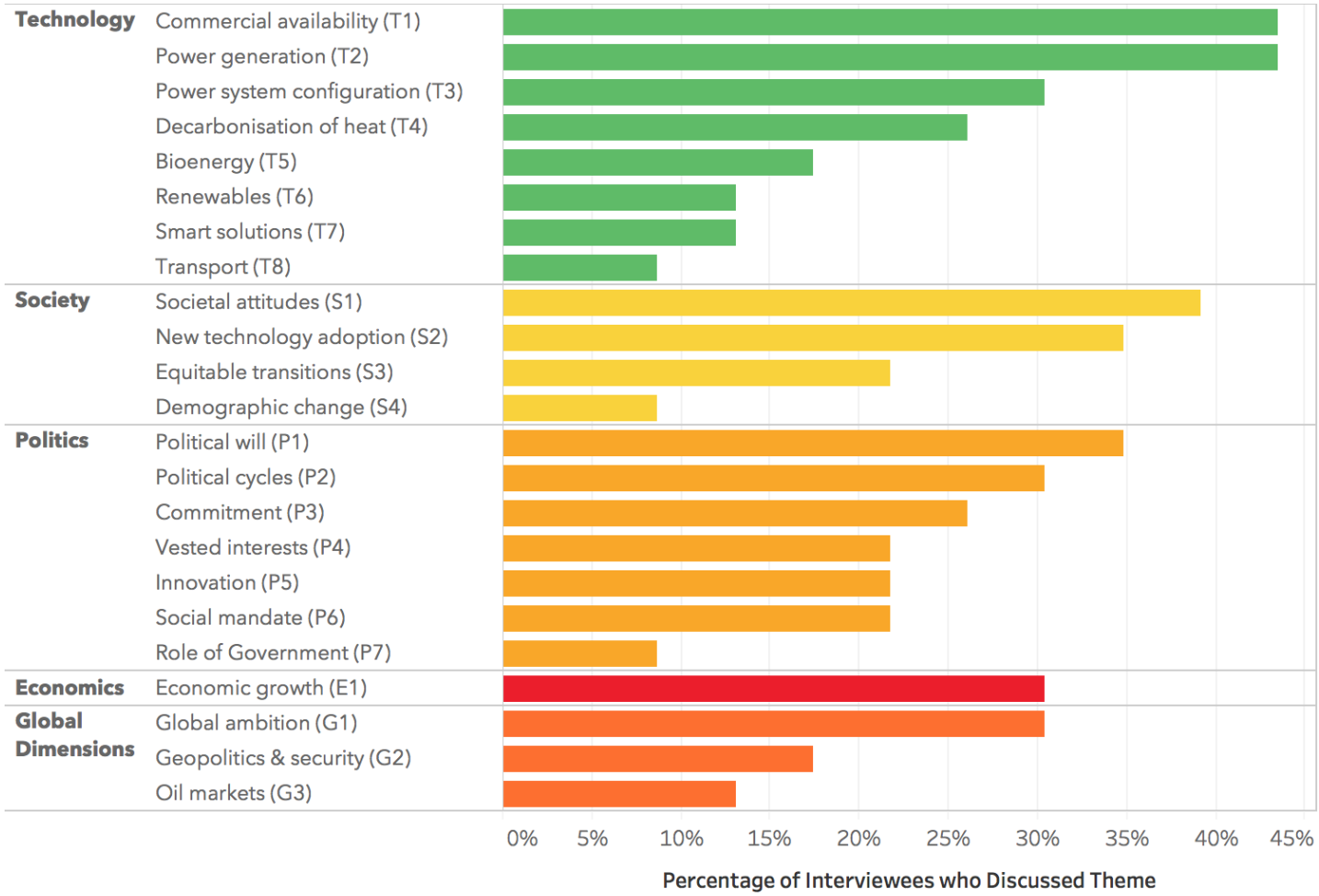




Interview group	Interview group description
Civil service (CS)	Officials involved the development of energy and climate change strategy
Other government (OG)	Officials from UK Government agencies, and senior advisors, either scientific or political, on climate and energy issues
NGO research (NGO)	Senior advisers and knowledge brokers involved in climate change and energy campaigning and research
Industry (IND)	Senior staff from advisory consultancies and industry focused on energy issues
Academia (ACA)	Senior academics (professors) engaged in climate and energy research

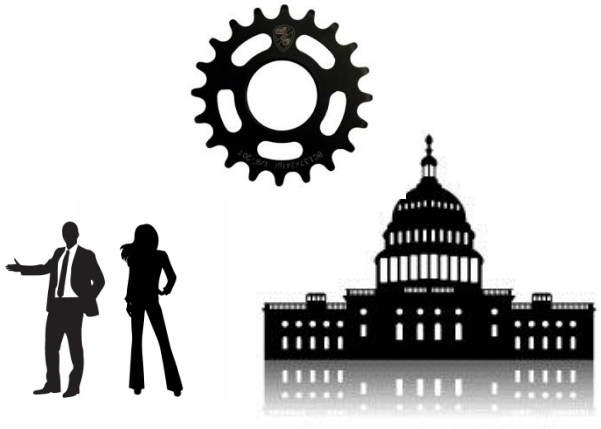
Critical Uncertainties: Overview

- Uncertainties around political & societal factors discussed almost as frequently as technological ones
- Recognition that each domain is contingent on and linked to each of the other domains
- Different emphasis on issues within domains by different groups



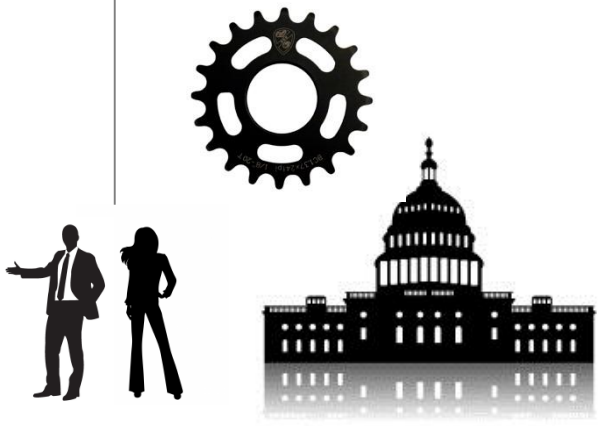
Critical Uncertainties: Most Discussed Themes

- Technological
  - Will low carbon technologies become *commercially available* over timescales that matter? Global development ('wait and see') vs. domestic action (CS) e.g. solar
  - Will critical *large-scale generation plant* (CCS, nuclear) ever be built to scale?
  - What will the *power system configuration* of the future be like (community-led, distributed, prosumers?) And impact of ICT?
  - How will *heat decarbonisation* be resolved? Tension between giving consumers choice versus large scale intervention
  - Less discussed: RE integration, transport, bioenergy



Critical Uncertainties: Most Discussed Themes

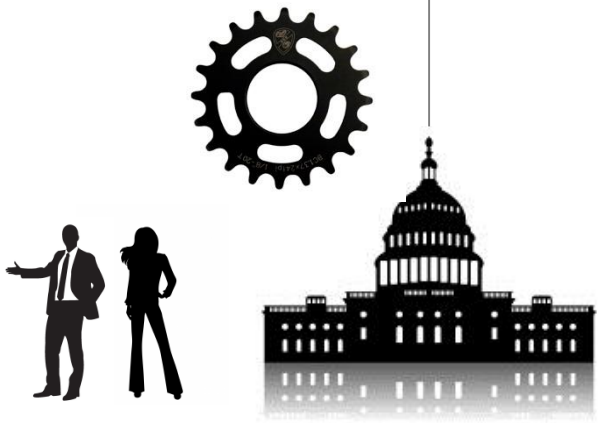
- Societal
  - How will *societal attitudes* evolve*, in* regard to ownership of the energy and climate challenge, and acceptance of increasing costs?
  - Will the role of government be to influence societal attitudes, and to what extent can they affect this e.g. national dialogue?
  - Will transitions be *equitable*, and help to engender buy-in? (ACA/NGO)
  - Will consumers *adopt new technologies* and what will be their motivations to purchase them? (CS/OG)



Critical Uncertainties: Most Discussed Themes

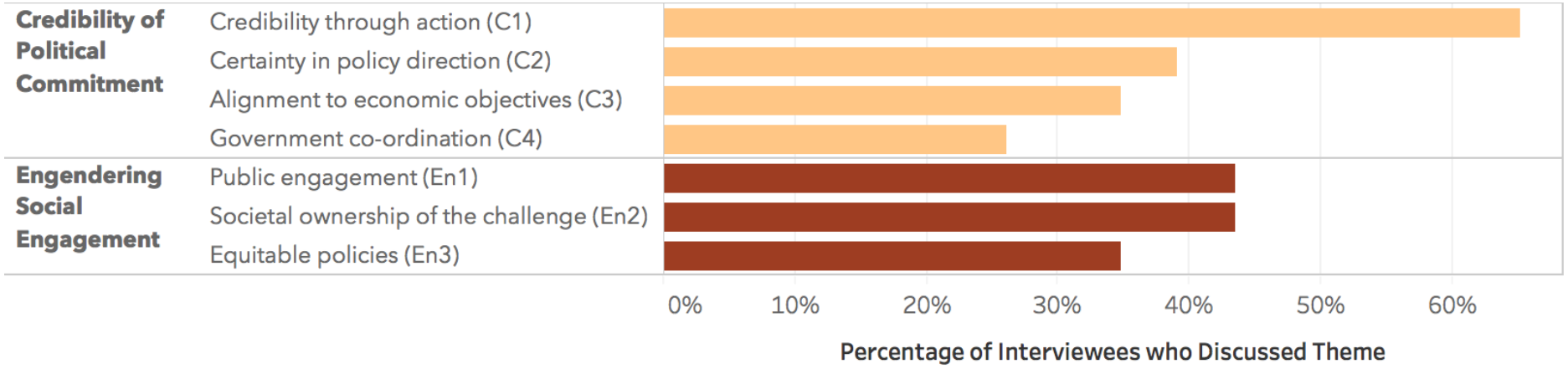
- Political
  - Will necessary *political will* be maintained to seriously drive the transition forward (ACA/NGO)?

    Impacted by -
    - *ST political cycle (*salience*,* strategic decisions*)*?
    - *Vested interests*? (lobbying, incumbents)
    - *Weak social mandate*?
  - Stated *political commitment* to long-term decarbonisation targets not viewed as critical uncertainty



Mitigation of Uncertainty: Overview

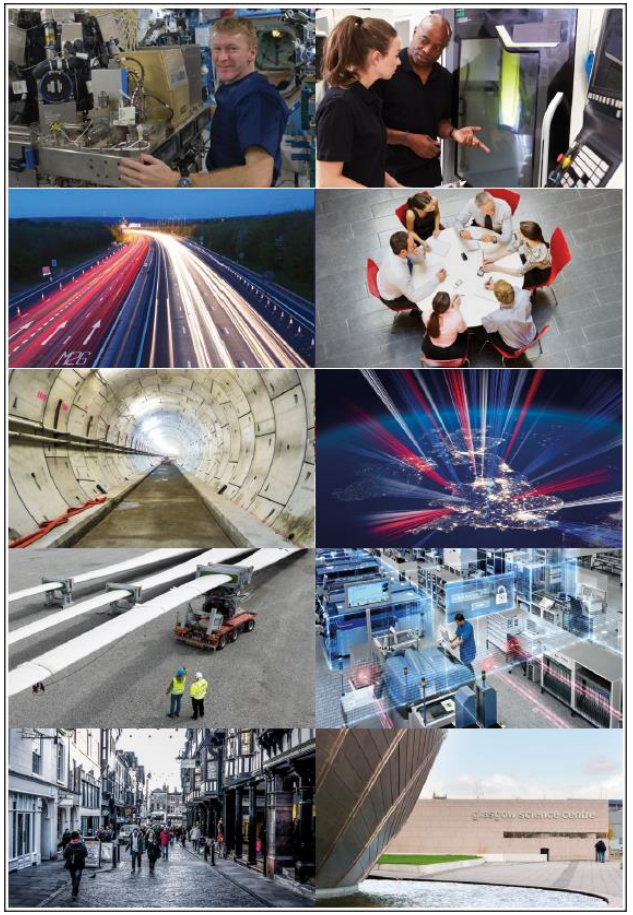
- Interview participant discussions generally focused on two main themes for mitigating the critical social, political and technological uncertainties:
    - *Demonstrating a credible political commitment to the transition*
    - *Social engagement in the transition*



Mitigation of Uncertainty: Most Discussed Themes

- Demonstrate credibility of political commitment
  - *Credibility through action*: Government has strong role in de-risking and facilitating growth of new sectors

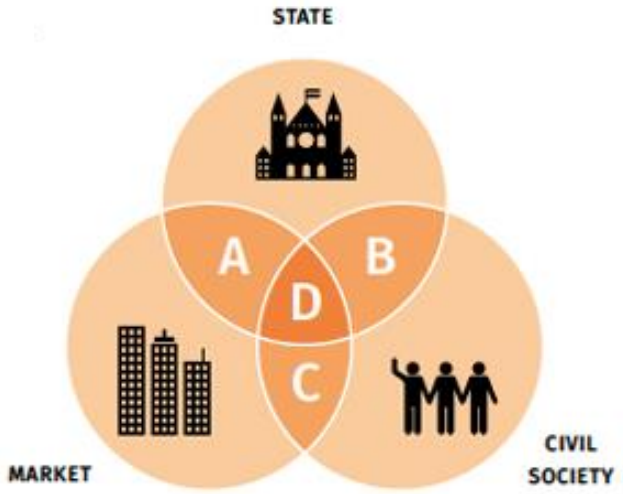
    Recognised issues of political exposure to failure….but nec. part of process (NGO/IND)
  - *Certainty of policy direction and process*, with sufficient flexibility built in
  - *Alignment with economic objectives,* with improved strategic coordination



Source: BEIS (2017)

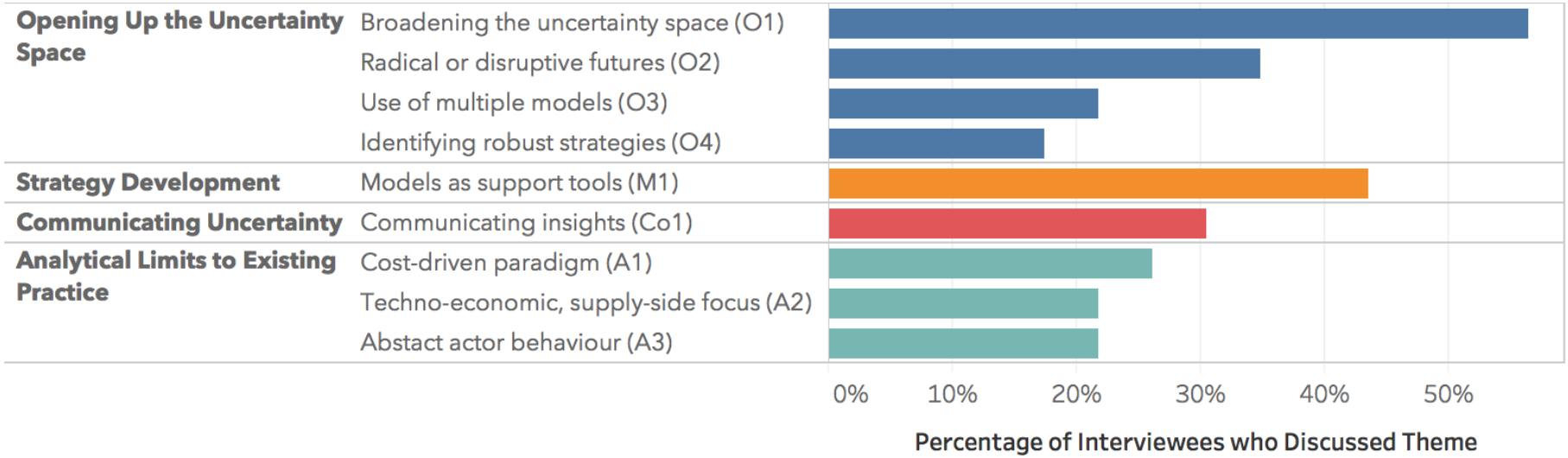
Mitigation of Uncertainty: Most Discussed Themes

- Engendering social engagement
  - Different emphasis by interviewees on the role of actors
  - On increased *'ownership' of the challenge:*
    Government must lead due to scale and complexity (non-CS) vs. limits on government reach in market-based economy (CS)
  - On more *public engagement & participation:*
    Solutions attractive consumer proposition (CS) vs. stronger proactive position through persuasive narrative re. co-benefits, fairness (*equity*) in addressing regional inequalities (NGO)



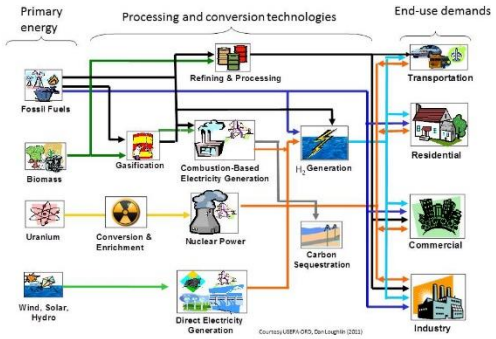
Decision Support: Overview

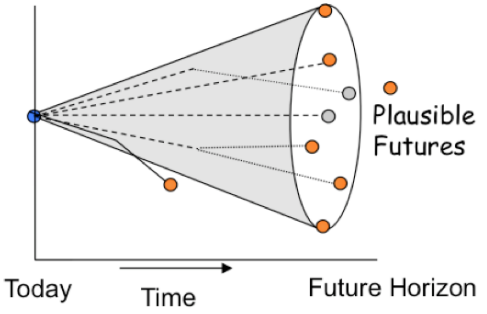
- Interview participants concerned with four main areas:
  - Narrow uncertainty space needs opening up (small range of parameters)
  - Models as a too dominant a part of analytical framework
  - Poor communication of uncertainty
  - Limits to existing analytical tools

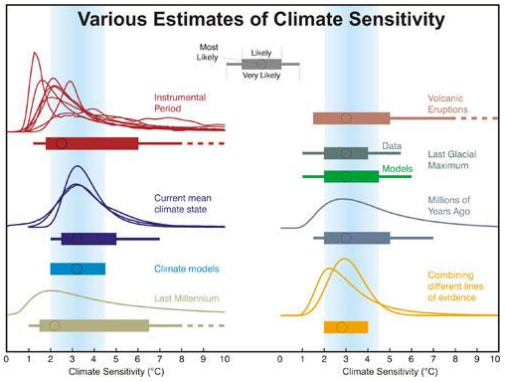


Decision Support: Most Discussed Themes

- **Existing analytical tools** *[whilst recognising the important role they play]*
  - Move away from sole focus on techno-economic, supply-side framing
  - Stronger understanding of actor behaviour – and limits of cost-driven paradigm
- **Assessment of uncertainty**
  - Broadening out, including radical & disruptive futures – but challenge of political acceptability
  - Multiple models generating distinctive scenarios
  - Meeting the policy need to understand robustness (against multiple criteria)
- **Role of models**
  - Modelling as part of broader framework (model-informed, not necessarily model-led)
  - More space for strong narratives and "visions" for communicating
- **Communication**
  - Where uncertainty incorporated, stronger efforts to communicate complexity…….but underlying tension here in policy process







Critical Reflection

- The open ended nature of the interviews provided challenging to digest
- Some themes could fit equally well in politics/society/technology, we have used our best judgement
- Capturing a broader range of disciplinary expertise (e.g. investors, financiers, manufacturers etc.) would have provided additional valuable perspectives
- Many noted a requirement to explore innovation and disruption, but few articulated visions of radically different futures to the status quo
- Responses may be framed by the issues of the day

Final thoughts on modelling and decision support

Transition to a low carbon society 'will prove to be a messy, conflictual, and highly disjointed process' (Meadowcroft, 2009)

- Explicit characterisation of the socio-political dimension sits outside of the decision analysis process …… but at the same time is viewed as critical
- Suggests a greater role for alternative framings e.g. socio-technical perspectives to compliment techno-economic assessments (Rosenbloom, 2017)
- Expertise and input from social & political domains required; improve representation of behaviour in models (Li et al., 2015), bridging qualitative narratives and quantitative modelling (Geels et al., 2016), and participatory modelling (Holtz et al., 2015)
- But how to feed into the policy process? There is an obvious tension between increasing the complexity of analysis, bringing together different disciplines, and broadening engagement – and the process of policy making

Next Steps

- A paper on the expert interviews has been submitted to the journal Energy Research and Social Science (ERSS)

- Next part of the research is to focus on modelling approaches that allow for an assessment of both quantitative and qualitative uncertainties in modelling energy futures e.g. NUSAP (Numeral-Unit-Spread-Assessment-Pedigree) (Van Der Sluijs et al. 2005)

- Move towards stronger stakeholder involvement in modelling process, and an explicit recognition of why assumptions made (value-ladenness, consensus, expert judgment etc.)

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Thank you for listening.

Approaches for dealing with deep uncertainty

- Stirling (1999, 2007) has a different four quadrant taxonomy for incomplete knowledge, based on whether we have a complete understanding what might happen (*outcomes*) vs. a complete understanding of their likelihood of occurring (*probabilities*)
- Identifies regions where quantitative analysis of uncertainty may prove intractable
- Stirling (2010) argues that experts should avoid pressures to simplify uncertainty to a simple number

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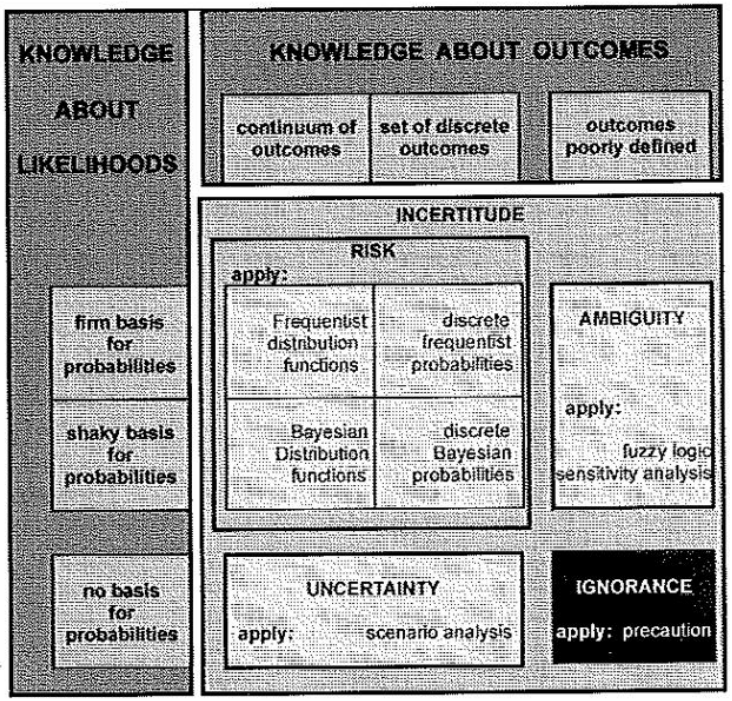

2007 Update