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Uncertainty, politics, and technology: Expert perceptions on energy transitions in the United Kingdom

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ABSTRACT

Energy policy is beset by deep uncertainties, owing to the scale of future transitions, the long-term timescales for action, and numerous stakeholders. This paper provides insights from semi-structured interviews with 31 UK experts from government, industry, academia, and civil society. Participants were asked for their views on the major uncertainties surrounding the ability of the UK to meet its 2050 climate targets. The research reveals a range of views on the most critical uncertainties, how they can be mitigated, and how the research community can develop approaches to better support strategic decision-making. The study finds that the socio-political dimensions of uncertainty are discussed by experts almost as frequently as technological ones, but that there exist divergent perspectives on the role of government in the transition and whether or not there is a requirement for increased societal engagement. Finally, the study finds that decision-makers require a new approach to uncertainty assessment that overcomes analytical limits to existing practice, is more flexible and adaptable, and which better integrates qualitative narratives with quantitative analysis. Policy design must escape from 'caged' thinking concerning what can or cannot be included in models, and therefore what types of uncertainties can or cannot be explored.

1. Introduction

1.1. Energy and climate policy in the UK

The landmark climate agreement achieved in Paris in December 2015 sets a course towards global carbon neutrality by the end of the 21st century [1]. But while the target destination is known, the trajectories of individual countries across the century and the scale and speed of the transitions that can be achieved remain uncertain (e.g. [2,3]). Within this global context the UK is currently one of the few advanced economies to have a legally binding emissions reduction target under domestic legislation that extends to mid-century [4], with carbon budgets providing mid-term milestones to ensure progress [5–7]. This level of ambition, combined with the path dependent nature of long term technological change, makes the UK an interesting case study of a developed country seeking to trigger an energy transition by making decisions today under future conditions of uncertainty.

The energy system landscape in the UK has experienced a radical transition since the late 1970s, transforming from a state-directed, coal-dominated and export-focused energy system, to one that is market-led, gas-heavy and import-dependent [8]. The modern energy system has evolved since that period in significant ways, but still shares several legacy components from the old regime. For example, energy production remains heavily centralised and carbon-intensive. Despite major changes over the past 40 years, the stage is set for an even more fundamental transition in the coming decades. While the emerging contours of this new energy system paradigm remain difficult to define, it is clear that the need to eliminate carbon pollution could imply a total reimagining of the way that energy is produced, distributed and used. As well as the engineering systems themselves, energy system institutions and their governance could also be radically transformed, and indeed this might even be an essential prerequisite for such rapid technological change to occur [9].

1.2. Decision-making under deep uncertainty

Climate policy is often grouped into the category of "wicked" [10,11] or "post-normal" [12] challenges. That is to say, high complexity problems with no obviously "right" solutions. The literature on uncertainty analysis provides several useful definitions that can provide a platform for discussion, distinguishing between varying degrees of ignorance about the future. For example, seminal work by Knight [13]

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makes the classic distinction between ignorance that can be reliably quantified (Knightian risk) and ignorance that is unquantifiable (Knightian uncertainty). The writings of Wynne [14], Stirling [15,16], Funtowicz and Ravetz [12], and Taleb [17,18], are all examples which elaborate further on the basic distinctions made by Knight between calculable and incalculable unknowns. Other work distinguishes between epistemic uncertainties that can be reduced through improved knowledge and aleatoric uncertainties that can effectively never be eliminated due to the intrinsic randomness of a phenomenon [19].

Lempert et al. [20] define "deep uncertainty" as a condition where there is a lack of knowledge or agreement between parties on:

i conceptual models that describe relationships between driving forces
ii the probability distributions of uncertainty across variables or parameters, and
iii the value or desirability of different outcomes.

Deep uncertainty in complex systems can exert a particularly powerful paralysing effect on decision-making within institutions that are accustomed to dealing with challenges under a "predict-then-act" paradigm [21], because the prediction stage of the process is impossible or only possible by making value-laden assumptions that are violently contested by key stakeholders [22]. Effective decision-making under such conditions requires extensive peer engagement in addition to the use of quantitative analysis methods.

1.3. Challenges for the status quo

Long term strategic assessment for the UK energy transition has largely been informed to date by quantitative analysis using computational models (e.g. [23–25]). Their success in the policy domain can be explained by two factors; firstly, by being positioned to allow for consideration of new goals and configurations for the energy system as UK energy policy is re-orientated to face the decarbonisation challenge, and secondly, by functioning as a 'boundary object', both connecting and meeting the needs of different science and policy communities, and providing and supporting a shared understanding of the policy problem [24]. Model-based analyses have provided policymakers with a view on the overall affordability of the energy transition [23], sketched out multiple potential transition pathways towards the normative target [26], and demonstrated the path-dependent nature of energy system choices [27].

After a strong paradigm shift towards recognising climate objectives in energy governance between 2000 and 2010 [28], the UK's position became progressively weakened in the period 2010–2015 during the prolonged economic recession. A number of high-profile policy reversals, for example, on domestic energy efficiency [29] and Carbon Capture and Storage development [30], have brought into sharp focus the challenge of moving from merely setting targets towards actual implementation and delivery [31]. At the time of writing, no new policies have been announced for over 12 months since the publication of the Fifth Carbon budget. The government's independent climate advisory body, the Committee on Climate Change, has identified a massive "policy gap" between long term targets and near term policies, and highlighted the current lack of a clear process for "to turn proposals into action" [32]. The mix of political dynamics, consumer expectations, and environmental targets found in energy policy makes for a complex picture, and a future transition fraught with uncertainty [33,34]. The risk remains that progress towards a low carbon future will stall unless successive future governments can continue to overcome socio-political inertia [35]. A critique of the status quo contends that the current policy regime has become complex, entangled, and incoherent, "half-planned, half market-based, but with the disadvantages of each approach" [36]. The scientific community has a crucial role to play in helping to close the current "gap between targets and implementation" [37], through advising policymakers on how to evaluate the complex trade-offs between different options, and on how to make more effective decisions under uncertainty.

1.4. Aims and objectives of the paper

The urgent requirement for decarbonisation of the energy system [3] means that UK policymakers cannot afford to be paralysed in the face of the many uncertainties that pervade the policy landscape. A critical evaluation of existing practices for decision-support is required. This paper seeks to broaden engagement with experts to determine the range of perspectives across the following three questions:

- What do decision-makers perceive as being the critical uncertainties relating to the UK's future transition to a low carbon economy?
- How do decision-makers think that the critical uncertainties can be mitigated? and;
- What improvements can be made in the area of decision support for strategic planning and policy design?

This type and level of explicit engagement with key stakeholders is an underutilised approach in the quantitative analysis community around energy and climate policy in the UK and is envisaged as a first step in reconceptualising the decision support process [38]. Section 2 of the paper sets out the analytical approach, based on exploratory interviews with selected stakeholders. Section 3 presents the key insights from the interviews. Section 4 provides a discussion on the results of the study and Section 5 draws out the key conclusions.

2. Methodology

2.1. Interview approach

Interviews were conducted over a 4-month period between October 2016 and January 2017. To address our research questions, we employed in-depth, face-to-face interviews. These interviews featured a limited number of open-ended questions, intended to elicit views and opinions from the participants [39]. This style of exploratory interview was chosen based on much of the reasoning set out in Aberbach and Rockman [40]. Primarily, it was unclear what range of issues the stakeholder group would cover, with a key objective of the research to reveal them without biasing responses through question framing. A set of tightly focused, pre-determined issues for discussion with relatively closed questions would therefore not have been appropriate. We also judged that the experts we engaged with would be more receptive to a relatively open-ended interview style, within which they could more fully expound their perspectives on the subject in question.

This exploratory approach, using the interview guidelines in Table 1, resulted in interviews that were more conversational compared with those using more structured approaches [40]. Discussions proved to be highly interactive in nature, allowing for further probing on the key issues (via sub-questions), generating new information. As a result, interviews were undertaken face-to-face wherever possible (only 3 out of the 31 experts involved were interviewed remotely via teleconferencing).

2.2. Selection of experts

All interview participants, listed in the acknowledgements section of this paper, have previously held, or currently hold, positions as key stakeholders in the development of UK energy strategy and policy, and can be regarded as subject matter experts. By stakeholder, we mean that they are directly involved in the strategy development process, influence this process via their own organisation's research, or exert influence through being a key consultee to the process. We reflect on the final composition of our interview sample in Section 4.4.