Nutwood

Governance challenges emerging from energy digitalisation

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The UK energy sector is experiencing a rapid shift towards the use of digital and data-based technologies, referred to as *energy digitalisation*. Energy digitalisation could significantly change the ways in which energy is generated, managed and consumed. It also opens a door for new actors, roles and responsibilities to evolve. Emily Judson, Doctoral Researcher at the University of Exeter, explores how these changes present new governance challenges for the sector in her recent *report*.

Energy digitalisation is fundamentally driven by the need to decarbonise. To achieve this, the energy system must become more responsive and flexible – able to incorporate high levels of intermittent renewable generation and new patterns of demand from electrified heat and transport systems. At the core, digital and data-based technologies can support this transformation by enhancing system transparency and enabling supply/demand balancing under much less predictable circumstances. More broadly, digitalisation brings new business models to the sector that can offer new products, services and approaches to customer engagement. Digitalisation also ties into a trend towards energy sector decentralisation by enabling new actors and devices to participate in energy system services.

While this paints a rosy picture of technological potential, the outcomes of energy digitalisation are not guaranteed to align with environmental or socio-economic policy goals. Appropriate governance is therefore required to ensure that the aims of system digitalisation are met and any negative consequences are addressed.

Six key challenges

The report articulates six key governance challenges emerging from energy digitalisation. These were identified from 18 expert interviews with policy, regulatory and private sector representatives, supplemented by a literature and policy review. The challenges cover data, distributional effects, organisational culture, politics, regulation and automation (Figure 1).

Figure 1: Governance challenges
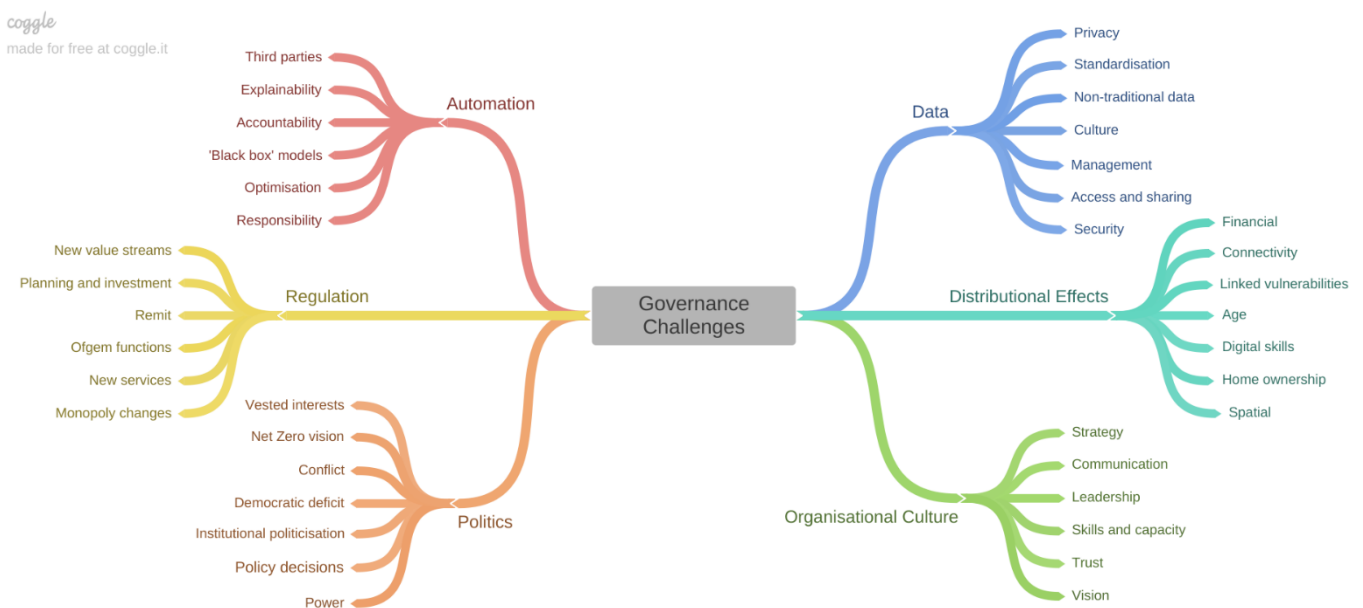
Data: Data governance has been the focus of increased recent policy attention, particularly focusing on data openness. Participants indicated that further development of work streams, such as BEIS and Ofgem's joint Modernising Energy Data initiative, would be broadly supported in the sector. Data standards and interoperability represent two areas recommended for further policy focus. Separately, participants differentiated between data governance and the broader concept of digital governance in the energy system. More explicit attention to wider digital governance in future policy making could enable a more holistic response to challenges that incorporate, but extend beyond, data concerns alone.

Distributional Effects: Digitalisation can change the nature, spread and scale of existing distributional challenges in energy, as well as introduce new ones. Participants highlighted that digitalisation is being shaped by financial and capital inequalities, variation in digital capabilities by age group and geography, and 'linked vulnerabilities' such as ill health. Further research is needed to attend to such developments, which will require sensitivity to different patterns of inequality across electricity, heat and transport vectors.

Organisational culture: Cultural and managerial factors can sometimes be viewed as secondary to the technical aspects of energy digitalisation. However, they have lasting power to shape - or even undermine - the intended uses and efficacy of digital technologies. Cultural challenges identified include outdated software development practices, 'patchwork' systems caused by over-reliance on subcontracting, and direction-setting vacuums.

Regulation: The sheer pace of digital change - alongside tendencies for digital and data innovations to cross traditional sector boundaries - challenges the functions, remits and planning cycles of existing regulators. Balancing system reliability with innovation freedom represents a key tension in this evolving space. Ofgem must also respond to changes in energy sector monopolies brought by digitalisation. Here, digitalisation is both changing the operation of existing physical energy monopolies (networks) and creating entirely new digital and data monopolies such as data 'walled gardens', metering infrastructure, and platforms.

Politics: Participants identified four key political challenges influencing the development of energy digitalisation. The capture of institutions and decision-making processes by vested interests represents a particular barrier to ensuring digital outcomes align to policy goals. Institutional 'creep' beyond contractual remits, pressure to change political structures to reflect decentralising trends, and uncertainty around the government's net zero vision, could also influence the sector's digital direction.

Automation: Digital automation - particularly of 'cognitive' or decision-making functions - could transform the energy system into a primarily machine-operated environment. Automation governance challenges were identified regarding opacity of decisions made using 'black box' models and inadequate scrutiny of the outcomes of optimisation software. A lack of clarity surrounding responsibility and accountability within complex systems was also discussed, particularly where systems include self-learning components, third parties, or complicated product supply chains.

Further Research

Building from challenges identified in the report, a series of online workshops are now taking place to explore the question: is the existing institutional landscape fit for purpose to address governance challenges emerging from energy sector digitalisation?

Readers interested in participating can sign up via this link *or contact Emily at* e.judson@exeter.ac.uk *for more information.*