

Governing Energy Networks For a Low Carbon Economy

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This project focuses on the challenge of governing energy infrastructure networks for the transition to a low carbon economy. Using qualitative, interview based research methods, I am analysing the institutions which coordinate activity in energy network sectors and exploring how they influence/enable/constrain innovation

1. Transition Pathways to a Low Carbon Economy

This research is part of the Transition Pathways consortium; an interdisciplinary project exploring alternative pathways to a low carbon energy system in the UK. As part of the project we are analysing the technical and social feasibility of alternative transition paths to achieving carbon reductions targets. Taking a governance approach, we are exploring three alternative pathways which involve different mixes of supply and demand side technologies (Foxon et al. 2010):

- **Market Rules:** The broad continuation of the current governance pattern.
- **Central Co-ordination:** More direct state intervention in the governance of energy systems.
- **Thousand Flowers:** A focus on more local, bottom-up diversity of solutions, driven by innovative local authorities and citizens groups.

The Networks Challenge

My research focuses on the implications for the governance of energy networks in the UK. Using qualitative research methods and a case study approach, I am exploring the governance of electricity and heat distribution networks in the context of two key challenges:

1. The *dynamic institutional environment* which has introduced privatisation and market liberalisation to the sector.
2. The need to develop *low Carbon network Innovations* for flexible and sustainable infrastructures.

My aim is to explore the relationships, conflicts and synergies between institutional and technical change in the UK energy networks sector - with the research question: In the context of sector reform, how can low carbon innovation be promoted in the UK energy networks ?

2. Understanding Institutions and energy networks

Networks require strong institutional frameworks in order to promote efficiency and effective collective action. Over the years, the networks in the UK have undergone a number of significant institutional changes. The 1882 Electric Lighting Act began the process of sector regulation and state intervention in the industry. Later the industry came to be dominated by powerful municipal authorities, and was eventually nationalised by the post WWII Labour government. During the 1980s, the Thatcher government set about privatising the industry and introducing market incentives. A central aspect of this research is to carry out an institutional analysis of the UK energy networks and explore how this affects innovation processes. Drawing from institutional theory (Scott, 2001), I analyse both formal and informal institutions at the micro, meso, and macro levels which influence technical change in energy systems; see figure 1

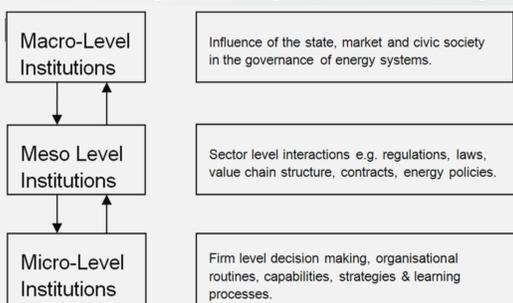


Fig 1: Framework for institutional analysis

3. The 'innovation system' for energy networks

In order to create a favourable institutional environment for the diffusion of low carbon technologies, we must understand the innovation system i.e. the process by which new technologies move from the basic R&D phase towards deployment and commercialisation, see fig 2 below.

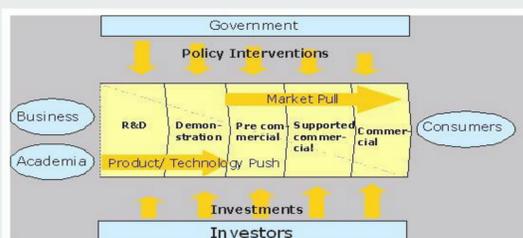


Fig 2: The 'Innovation Chain' (Carbon Trust)

Research has shown that low carbon technologies face significant barriers to their commercialisation and require a range of policy interventions, beyond traditional R&D funding (Foxon and Pearson 2008). A number of characteristics or functions of successful innovation systems have been identified in the literature (Jacobsson and Bergek, 2004):

- *The creation and diffusion of 'new knowledge'*
- *'Guide the direction of the search process among users and suppliers of technology'* i.e. influencing how firms and users make decisions regarding new technologies
- *To 'Supply Resources'* e.g. capital and competencies
- *To 'create positive external economies'* across an industry by creating linkages, exchanging information and knowledge through networks.

4. Developing Low Carbon Networks in the UK:

Two in-depth case studies of network sectors are currently being undertaken in order to explore the relationship between institutions and innovation in energy network sectors. The case studies consist of in-depth interviews with key stakeholders.

Case Study #1: Smart electricity distribution networks

Electricity distribution networks in the UK have traditionally been passive networks which distribute power in a one way flow to the end customer. However, with the diffusion of distributed generation and increasing levels of demand side participation, the networks will have to become more actively managed. Although active network management (ANM) technologies have been trialled and demonstrated in the UK, they face significant barriers as they become commercialised. To date the primary method of stimulating innovation in the sector has been to change the regulatory incentives for DNOs to allow them to spend a proportion of their revenue on technology trials. While this is welcome, creating an effective innovation system for smarter distribution networks will require increased levels of collaboration across the value chain and a build up of knowledge sharing and capabilities in the sector. In many cases this conflicts with the liberalised and highly un-bundled model which promotes short run efficiencies and conservative / least cost procurement policies.



Case Study #2: Developing district energy systems

The second case study focuses on the development of local decentralised energy networks in the UK. Although popular in other European countries, particularly in Scandinavia, the UK has traditionally lacked the supporting institutional framework for the development of local district heating (DH) networks. However, in recent years a small number of local authorities in the UK, e.g. Woking Borough Council, have begun to develop DH networks in response to a range of drivers e.g. reducing emissions, and addressing societal issues such as fuel poverty. Although these projects deploy established technologies, they require innovative commercial and funding models in order to succeed. Currently, many local authorities do not possess the required knowledge capabilities and face significant transaction costs in developing such projects. Also, key uncertainties exist regarding the legal statues of private networks which are currently unregulated. The DH sector in the UK, although innovative, only exists as dispersed niches - a greater degree of institutional coordination is needed at the national level in order to reduce transaction costs at the local level and to disseminate best practice. There is also a lack of private sector involvement in the sector, this reduces the capacity of projects to attract investment and develop a viable commercial proposition.



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For more information on the Transition Pathways Project please visit:

www.lowcarbonpathways.org.uk