

Reframing Energy Demand: Innovation for Sustainable Heat in Northern European Cities

Submission to theme 5. New business models and understandings of human behaviour

Summary

Based on a new research project called *Reframing Energy Demand – innovation for sustainable heat*, this paper sets out the rationale for a comparative interdisciplinary social science analysis of heat decarbonisation in Northern European cities, and outlines an analytical framing based on socio-technical systems thinking for the analysis of sustainable heat pathways. The project aims to compare the institutional, business and organisation structures implicated in heat supply chains and energy efficiency in the urban environments of Denmark, Germany and UK. In the paper we outline a socio-technical approach, drawing on science, technology and innovation studies and economic sociology, to investigate the relative capacity of cities for transformation to low energy, low carbon and sustainable systems. We discuss how our approach might inform key challenges such as the financing of low carbon heat supply and energy efficiency investments, and the scope for knowledge transfer between cities.

Abstract

Introduction

Although almost half of the energy in the UK is used for heating, the area is only now beginning to attract the level of attention amongst energy policy makers and academics which is commensurate with its importance to the low carbon transition. This paper is based on a new research project called *Reframing Energy Demand - innovation for sustainable heat* (RED) which is seeking to understand how sustainable and low carbon heat pathways are being shaped in a Northern European context, focusing on the urban environments of Denmark, Germany and UK¹. A starting point of the project is a meso-level socio-technical analysis (Green et al., 1999) of heat demand in cities. Rather than emphasising aggregate demand patterns or individual behaviour, we focus on the social and material contexts in which demand is embedded, and the institutions, organisational structures and supply chains which calibrate production and consumption linkages, and which mediate between individual behaviours and aggregate demand patterns. In the following section we outline how this approach is informed by the literatures on science, technology and innovation studies (STIS) and economic sociology (ES), and we provide more detail on the research approach.

Theoretical Framework

¹ City cases include Glasgow and Birmingham (UK), Hamburg (Germany) and Aalborg (Denmark)

The paper will outline how the project team aims to deploy insights from the STIS and ES literatures to address the question of how sustainable and low carbon heat pathways are being shaped in diverse settings. Below we summarise how key insights will be deployed to inform the analysis:

Science, technology and innovation studies: Reframing and analysing heat demand as a socio-technical systems issue

Rather than viewing heat as easily divisible into demand and supply side issues socio-technical studies adopts a systemic framing, incorporating the 'upstream' institutions, regulatory frameworks, markets and material infrastructures which structure demand. This approach implies that sustainable heat pathways will not follow an optimal least cost abatement trajectory, rather they will be shaped by historical path dependencies, specific localities and contexts, how interfaces between different systems (gas, electricity and heat) are managed, and the capacities of both incumbent and new entrants to enable or block change. Our perspective is informed by particular strands of innovation studies, including the multi-level perspective (MLP) (Geels, 2002). We draw on the MLP to analyse patterns of radical and incremental innovation for sustainable heat, and interrogate the tensions between niche-led disruptive innovation and continuity based incremental innovation.

Economic sociology: Analysing effects of financial valuation and appraisal techniques on energy efficiency and heat innovation

Economic sociology analyses patterns of supply and demand as embedded in social networks which result in differential evaluation, and pricing, of different technologies, with material consequences for patterns of innovation (Webb, 2014). Continuing societal differences between the UK, Denmark and Germany in regulatory structures and markets for energy efficiency and heating (Hawkey et al., 2013) are likely to mean that very similar socio-technical options (urban retrofit programmes, gas grid decarbonisation, micro-renewables or heat networks) are differentially valued in each country. We will draw on the sociology of markets to investigate innovation in markets for low carbon heat and energy efficiency in relation to the different evaluation and appraisal techniques for assessing sustainable heat investment options.

Research Approach

Here, we outline how the project team plans to deploy the socio-technical approach through a multi-sited comparative approach to analysing low carbon heat pathways in different settings.

For each of the countries and case study cities we will analyse the socio-technical history of heat supply and demand: in the UK, an extensive natural gas network supplies individual buildings heated by gas-fired boilers. Urban retrofit for energy efficiency is uneven, and urban authorities have very limited responsibility, or capacity, for energy provision (Bolton and Foxon, 2013). In contrast urban heating systems in Denmark are structured predominantly around district heating, locally-planned, developed and owned by municipalities, and embedded in national policy and regulatory frameworks. In Germany, heat is

supplied by a variety of gas, electric and district heating systems; liberalisation has resulted in a mix of municipal, regional and large corporate suppliers.

Firstly, from a STIS perspective, these distinct socio-technical legacies imply different starting points for confronting the sustainable heat transition challenge, and they highlight the complex multi-level governance interactions with overlapping institutions and decision making powers at the urban, regional and national scales. As such the project will critically analyse the extent to which heat innovation policies and pathway configurations can be rendered transferrable between these contexts.

Secondly, from an ES perspective, project level analysis will be conducted into specific business models for heat demand and decarbonisation initiatives in the case study cities. Business models for energy efficiency and low carbon heat delivery will be analysed as artefacts onto which different notions of 'value' can be inscribed (Akrich, 1992): for example, the extent to which financial returns are based on increasing or decreasing heat demand over time, how the returns from efficiency savings are recirculated into further investment, and the business model designers' conceptualisations of energy behaviours and everyday practices in different urban settings.

Early Conclusions

Unsustainable patterns of heat demand are strongly embedded in the organisation of our infrastructure systems, market institutions and in everyday social practices. Conceptualising and mapping alternative low carbon and sustainable heat pathways, we argue, will require a broad based interdisciplinary approach which enables a holistic, whole systems analysis of alternative socio-technical configurations. In this paper we aim to develop the building blocks for such an approach. Whilst remaining sensitive to their distinct intellectual histories, we argue that hitherto underexplored synergies between the STIS and ES traditions, such as an emphasis on the materiality of socio-economic activity, can be exploited.

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