

## **DEMAND Centre conference 2016 Workshop 3: Conceptualising Change and Steering the Dynamics of Demand**

### **Path dependency in energy governance – how does this affect our ability to steer energy demand?**

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#### **Abstract**

The centralisation and top down control which characterises energy system governance in the UK stems from historic events which favoured a focus on generation and this ‘path dependency’ has influenced energy policy and regulation ever since. This paper considers the cases of energy supply regulation and energy efficiency policy to explore the implications of path dependency in governance on current attempts to steer energy demand. It finds that the focus of current supply regulation on citizens as end users, the narrow conceptualisation of energy as a commodity and the complexity of regulation limit the potential of the supplier: citizen relationship to address the complex drivers of demand. Furthermore, energy efficiency policy currently overlooks the wider drivers of energy demand and rebound effects, which constrain its potential to change demand. Alternative approaches are needed that address the wider drivers of demand, use interventions that don’t solely rely on orthodox economic assumptions and enable alternative actors to engage in energy provision. However, these approaches are poorly aligned with the path dependent governance system and the lock-in to this system must be broken to increase their effectiveness. The challenge of breaking this lock in should not be underestimated and is unlikely to be driven by national policy actors. It is more likely to come from non-traditional actors who are defining their own systems of governance, which must be integrated with national systems in a way that allows independence and collaboration. A more polycentric, plural system of governance is needed, which allows multiple centres of decision making that are independent and make rules within their specific domain, but which interact productively.

#### **1 Introduction**

The UK energy system is based on ‘top down’ control that directs energy from highly centralised generation to meet unmanaged demand at any point on the system. This paper aims to expose the inherent conflict between this approach to governance and the widely acknowledged need to change the nature and scale of energy demand to address the energy trilemma. It does this in order to identify why recent attempts to steer demand have had such limited impact and how steering of demand might become more effective.

This generation-driven conceptualisation stems in part from the fact that, when privatised in the 1980s, Information and Communication Technology (ICT) was very expensive and could only be operated cost effectively in a limited number of locations. This led to a system of national control that focussed on the small number of sites of generation, which contributed to the conceptualisation of energy as a challenge of generation at the exclusion of the role and drivers of demand. Systems of regulation and trading followed this conceptualisation and have continued to focus on centralisation and generation ever since. The evolution of the physical energy system, and the systems of governance which control it, have been strongly influenced by the historical coincidence of high ICT costs at the time of privatisation, a phenomenon known as path dependency.

This paper explores the significant role that this path dependency plays in locking us in to current practices and limiting the potential of governments to steer change in energy demand. It focuses on

the constraints created by systems of governance and will consider an empirical case study in UK energy governance. This examines how the conceptualisation of energy as a problem of generation in UK policy and regulation affects two key areas of interface with energy demand – the regulation of the relationship between suppliers and energy ‘users’ and recent attempts to change patterns of demand through energy efficiency policy.

This case study is used to argue that current UK government policy is reinforcing the lock-in stemming from historical path dependency and that new approaches are needed to reduce constraints and accelerate change in energy demand. The paper also reflects on how insights from the case study could be used in other contexts.

## **2 Historical evolution of the UK Energy system**

In the early 20<sup>th</sup> century, energy was provided in the UK at a municipal level by a range of public and private actors, including municipalities (Fouquet & Pearson 1999). Energy systems were small and localised, and evolved to serve specific users and locations (Hughes 1983). The 1920s saw the start of a phase of standardisation and centralisation to improve economies of scale, including development of the national grid, and the UK energy system was nationalised in the late 1940s (National Grid 2005). Energy remained within state hands until the late 1980s when the government of the time started a process of privatisation, motivated by the belief that state operation of infrastructure was inefficient. During the 1990s, generation and supply were separated and the retail markets were liberalised to enable competition for both electricity and gas. Crucially, privatisation and liberalisation happened after centralisation so the newly formed suppliers were large, complex organisations. The post-privatisation policy and regulatory system has evolved around, and favours, these large suppliers, which are profit-oriented and throughput-based (Mitchell 2010).

The UK energy system is based on ‘top down’ control that directs energy from centralised generation to meet demand at any point (Lockwood 2013). When this approach was conceived following privatisation in the 1980s, ICT was expensive and could only be operated economically when concentrated in one place, therefore, this national system of control made a lot of sense (Rhodes 2014). Regulation and trading systems followed this national centralised model and continue to prioritise generation and centralisation. Supply and demand are matched through national systems of energy trading and system balancing (Elexon 2014). These systems are necessarily complex to ensure the physical system is balanced but as a result favour large organisations with capacity and resource to operate complicated IT systems and forecast future market positions.

The historical evolution of the UK energy system is a very good example of the phenomenon of path dependency, where small historic events can favour the initial adoption of a particular, often inferior, technology or mode of operation. Once established, systemic interactions between technologies, infrastructures, institutions and users can increase the returns to adoption of that technology or mode of operation and constrain the development and adoption of a superior one (Unruh 2000; Arthur 1989). Path dependency can lock in inefficient technologies and behaviours and limit the potential of intervention to create disruptive change (Unruh 2002). One of the reasons for the highly centralized system of control and supply-side focus of regulation was the high cost of ICT at the time of privatisation, which favoured control at a small number of assets. This was an historical coincidence but aligned well with the political ideology of the time that standardisation and centralisation was more efficient and desirable. A centralised oligopoly also represented a less

dramatic change from monopoly government ownership than the alternative of a fully decentralised system, which may have further supported this system.

The emergence of smart technologies and distributed generation call into question the wisdom of relying on a national system of control. The diversity and variety of local demand and generation suggests that some forms of local balancing could be a more effective and efficient to optimise supply and demand (Rhodes 2014), and may be able to complement and run in parallel to national balancing (Gillie et al. 2009). However, the dominance of the centralised system remains despite the potential for system efficiency and increasing democracy.

Path dependency is most often thought about in relation to technology, with little consideration of the role of governance in locking-in energy systems and constraining systemic change. However, the case of energy regulation and policy in the UK provides an interesting example of where governance itself (which has coevolved with the technology system) is constraining changes in demand, demonstrating that path dependency in energy governance can be as important as technology. In the next two sections I describe two aspects of energy governance in the UK and how they limit the ability of the government to steer energy demand to demonstrate why it is so important to consider this aspect of path dependency.

### **3 Implications for the relationship between suppliers and energy ‘users’**

A key relationship in the energy supply chain, which is often overlooked when considering energy demand is that between suppliers (who buy energy from generators or the wholesale market) and energy ‘users’ (who buy energy from suppliers) (Hall & Roelich 2015). It is useful to understand how this relationship is affected by regulation and what implications this might have for changing energy demand.

Privatisation and liberalisation of energy supply was driven by the ideology of then the Conservative government, that state control of infrastructure was inefficient and undesirable (Roelich et al. 2015). It was considered that a ‘market’ context would be best suited to establish priorities for infrastructure investment and operation; however it was recognised that some regulation would be required to disband monopolies and create a ‘free’ infrastructure market (Hall et al. 2012). This market-led ideology has been variously described as the Regulatory State Paradigm (Mitchell 2010) and the Pro-Market Policy Paradigm (Kern et al. 2014). The primary purpose of post-privatisation infrastructure government intervention was to introduce competition into the infrastructure system, to deliver greater economic efficiency and to protect consumer rights (Mitchell 2010).

In the pro-market paradigm, energy is treated as a commodity and the market is incentivised to deliver a unit of commodity (kWh of gas or electricity) as cheaply as possible (Patterson 2008). However, this treatment of energy as a commodity encourages business models of energy supply which rely on increasing kWh units sold (relative to costs) to remain profitable (Blyth et al. 2014; Hannon et al. 2013). This unit-sales business model drives the whole energy value chain to increase throughput, defining citizens as ‘end users’ of the energy commodity and locking them into unsustainable practices (Unruh 2002; Apajalahti et al. 2015). Furthermore, it focuses the attention of both regulators and suppliers on units of energy, rather than the service (such as thermal comfort or cleanliness) that citizens actually want (Patterson 2008; Roelich et al. 2015).

Following privatisation and liberalisation, the supply market has remained highly concentrated with six companies controlling over 95% of the domestic supply market (Helm and Tindale 2009; Cornwall

Energy 2014). This has made it difficult to have a fully competitive market, which the government of the time considered would leave customers open to exploitation. Therefore, a system of licensing was brought in to regulate the relationship between suppliers and customers to protect them from exploitation. This regulation was highly complex, to prevent monopoly control, protect customers and enable balancing between generation and (uncontrolled) demand. This complexity further marginalised the role of citizens in the energy supply chain – framing them as passive consumers of energy, to be protected from monopolies by competition and to be supplied with a reliable source of uninterrupted energy. This approach has evolved to complement the rather monolithic and highly centralised mode of infrastructure operation and the interests of larger, powerful companies (Mitchell & Woodman 2010).

The focus of current supply governance on citizens as energy ‘users’, the narrow conceptualisation of energy as a commodity and the complexity of regulation limit the potential of the supplier: citizen relationship to address the complex drivers of demand. A key outcome is the lack of trust citizens have in the ‘big six’ suppliers which currently dominate the supply market. This could limit the effect of even some of the more basic opportunities to better integrate citizens into the energy system and change demand, for example through smart technologies (Spence et al. 2015).

#### **4 Implications for energy efficiency policy**

It is widely accepted that changing how much and when energy is consumed is critical in achieving emissions reductions targets, energy security and affordability and has many benefits outside the energy system (Pye et al. 2014; IEA 2014). Despite this importance, policy to support demand reduction is marginalised in comparison to support for generation technologies (Wilson et al. 2012). Globally, this marginalisation could be explained by the smaller scale but more dispersed and heterogeneous nature of demand reduction technologies, which poses problems for analysts and policy makers (Wilson et al. 2012). In the UK, this is exacerbated by the path dependency described in section 2, whereby high ICT costs meant it was easier to control centralised generation rather than distributed demand – which created the focus on generation that still persists today.

What demand-related policy there is in Europe, and in the UK in particular, has evolved to focus on technologies that use energy, such as buildings and energy-using products, rather than on the practices that shape energy use, and on efficiency, not absolute reduction (Mallaburn & Eyre 2014). The historic marginalisation of citizens from the energy supply chain and the focus on engineering over social influences on the energy system has had a significant influence on this approach to steering demand (Wilson et al. 2012). Furthermore, many countries, like the UK, increasingly rely on market forces to deliver energy efficiency programmes, prioritising market-based instruments to drive behaviour change by reducing perceived market barriers. This technology-centric, market-based approach can be traced back to the pro-market paradigm that still dominates energy regulation and policy (Kern et al. 2014) and has a series of limitations in steering changes in energy demand.

*Wider drivers of demand:* Framing the challenge of changing demand as one of increasing the adoption of energy efficient technologies overlooks the fact that energy demand is driven by a complex range of factors including; infrastructure, economics, habits and social norms. A focus on energy technology and on market forces in isolation will do little to address the wider socio-technical system which holds demand practices in place (Verbong & Geels 2010).

*Rebound effects:* The effects of energy efficiency on demand reduction can be diminished by what are termed rebound effects. Rebound effects can be direct; for example if a car is more fuel efficient the owner may choose to drive further, offsetting any energy savings. They can also be indirect; for example the savings from fuel costs of a more efficient car could be spent on other goods, which require energy to produce. And finally, a reduction in fuel demand could reduce fuel prices and increase fuel consumption in other parts of the economy. There is growing evidence to suggest that rebound effects can offset or eliminate savings from energy efficiency. While they are likely to be less than 100% (which would result in no benefit), they are likely to be significant (in the region of 65-80%) (Saunders 2013).

*Low price elasticity:* energy price elasticity is low, meaning that broad-brush market-based instruments, like taxes, which aim to drive behaviour change by increasing the cost of energy, have limited success (Eyre 2013). Furthermore, in the face of rising energy prices, politicians are unwilling to tax at the level necessary to drive behaviour change. Therefore, broad economic instruments like taxes and cap and trade, on their own, are unlikely to be the most efficient way to reduce energy demand.

As a result of these limitations, energy efficiency policy has had not been able to address the complex dynamics of energy demand and has had little effect in stimulating change. It could be argued that overlooking wider drivers and rebound effects could actually constrain the potential to change demand.

## **5 Breaking path dependency?**

Many of the opportunities to steer energy demand through either the supplier-citizen relationship or through demand reduction policy are constrained as a result of the centralised, top down nature of energy governance in the UK and the current market-based policy paradigm. It is important to understand how this centralisation has emerged, through a process of historical evolution, and the path dependency that has resulted from that historical evolution. Importantly, the governance system has co-evolved with the physical system, which serves to reinforce path dependency and strengthens the lock-in to current systems of regulation and policy. This means that governance path dependency can be as important as technological path dependency.

### **5.1 New policy approaches to steering demand**

The current regulatory and policy systems limit the framing of energy demand to one of an end-user passively consuming units of energy and frames energy efficiency policy as the adoption of energy efficient technologies. This masks the complex range of drivers of energy demand and is likely to continue to limit the potential for changes in demand unless alternative approaches to policy are implemented. These might include:

**Addressing invisible energy policy:** many of the drivers of energy demand are under the influence of government departments other than the Department of Energy and Climate Change. For example, decisions on road buildings, public transport and spatial planning will affect the demand for energy from transport; planning policy and building codes will affect demand from residential buildings; economic policies on VAT rates, interest rates, banking reserves all affect energy demand from industry and households. Accounting for energy demand when making decisions in these areas will be essential to address the complex drivers of changes in demand.

**Supporting a wider range of interventions:** beyond those that rely on orthodox economic assumptions about economic rationality and autonomous decision making must be developed to address the infrastructural and social factors locking us into current patterns of energy demand. This can include supporting networks and capacity building (Hargreaves et al. 2013), benchmarking against others' performance and ensuring that default options are energy efficient (Sorrell 2014).

**Engaging and enabling alternative actors:** which are more able to support skills development (Hargreaves et al. 2013) and more likely to be trusted (Spence et al. 2015; Walker et al. 2010). There is evidence that local authorities and community groups are keen to engage in energy provision for the specific purpose of changing energy demand but are excluded by the complexity of current governance systems.

## 5.2 The limiting effect of path dependency on new policy approaches

New policy approaches must be implemented within the context of both path dependency in governance and a policy paradigm – a framework of ideas and standards which shape policy goals, instruments and setting of instruments (Hall 1993). If proposals do not align well with the path dependency and a pro-market policy paradigm this could prevent the implementation of the proposals in section 5.1.

*The focus of national policy and regulation on provision of an energy commodity* disregards those influences on energy demand which are not related to the generation or purchase of units of energy and the purchase of energy using technologies. This means that policy instruments for steering demand are conceived and developed by the Department for Energy and Climate Change and regulation is controlled by Ofgem. There is little co-ordination with other government departments, such as transport, and these departments do not have energy demand as one of their priority aims, meaning it is usually marginalised in preference to other aims more directly aligned with their central goal.

*The pro-market paradigm* shapes the goals of policy (to decarbonise at lowest cost and reduce cost per unit of energy) and the policy instruments considered (based on autonomous, economically rational decision making) (Hall 1993). This limits the type and scope of policies considered when attempts are made to steer energy demand. As a result, alternative interventions might not be considered when proposing new policies.

*The complex policy and regulatory systems*, which have evolved around large-scale centralized actors do not specifically exclude alternative actors from engaging with the energy system but put them in a weak position compared to incumbent organisations. The complexity has been introduced to protect customers from monopoly control but is based on the assumption that the only motivation of energy companies is profit. This overlooks the social and environmental motivations of alternative, particularly local, actors and can make it difficult to see how new business models, many of which specifically aim to steer energy demand, comply with regulatory procedures.

There is evidence of relaxation of path dependency to incorporate new perspectives, goals, instruments and institutions which are more supportive of the proposals set out in section 5.1. For example; the introduction of goals for carbon emissions reductions (HM Government 2008), energy security and fuel poverty reduction (HM Government 2007) signals a divergence from a sole focus of policy and regulation on supply and cost efficiency (Hall et al 2012). However, the persistence of the focus on supply and the pro-market perspective alongside emerging perspective of sustainability

limits the coherence of resulting policy and institutions (Kern et al 2014). This allows economic goals to dominate, reinforcing the path dependency in governance described above and limiting the government and regulator's potential to steer energy demand.

### **5.3 Breaking path dependency with polycentric governance?**

Path dependency and lock in are hard to break internally (Unruh 2002) and the tight coupling between physical and governance path dependency makes it hard to see how change will come from national-scale policy makers. Non-traditional actors and business models are becoming increasingly important in driving system change, and particularly in engaging citizens in changing energy demand (Ofgem 2015). These non-traditional actors are defining their own systems of governance as the current, limited support from central government is reduced (Hall & Roelich 2015; Roelich & Knoeri 2014). This niche level of activity and local governance arrangements present perhaps the most promising way to break path dependency.

However, when considering the energy system, demand can never be separated from generation and supply and it is very difficult (and not always desirable) to isolate local arrangements of demand and supply from the national generation, transmission and distribution systems. This means that, to some extent, local governance will always be connected to national policy and regulation. Where these systems of governance interact it is important that they are mutually supportive and one does not constrain change in the other. This requires an element of integration that is missing from the current, top-down approach to energy policy and regulation. Instead we need a more plural system of governance which allows multiple centres of decision making and governing authorities that are independent and make rules within their specific domain, but which interact productively. This is frequently termed polycentric governance. An example of this might be creation of incentives that reward demand reduction at the distribution network scale, which delivers long-term benefits including reduction in the need for grid reinforcement and contribution to decarbonisation and fuel poverty alleviation targets. These values are often central to governance arrangements of local actors but overlooked or excluded by national governance.

In successful polycentric governance actors at different scales *"take each other into account in competitive relationships, enter into various contractual or cooperative undertakings or have recourse to central mechanisms to resolve conflicts..."* (Ostrom et al. 1961 p831). As such, governance operates more effectively and as a system and include mechanisms for mutual monitoring, learning and adaptation of better strategies over time (Ostrom 2010b).

The implementation of polycentric governance is not without challenges but presents a promising avenue to explore how to break path dependency and accelerate change in energy demand without waiting for change in national policy paradigms.

## **6 Conclusions**

Seemingly coincidental historical events have locked the UK's physical energy system into a highly centralised, generation-oriented system. The coevolution of systems of policy and regulation with this physical system has created path dependency in governance, which is often overlooked in when considering how to steer demand. The combination of the supply-orientation which has emerged from this path dependency and the pro-market paradigm limit the effectiveness of attempts to steer demand by marginalising citizens from the energy system and commodifying energy. This means that the complex drivers of energy demand are excluded from policy analysis and where policy exists

to steer demand it focuses on promotion of efficient technologies and price-related signals to change conscious energy consumption behaviour.

Alternative approaches to policy exist, which recognise a broader range of drivers, recognise the low elasticity of energy prices and aim to engage a wider range of actors more able to understand and enable change in energy demand. However, these policy approaches represent a significant departure from the current paradigm and will not be prioritised without breaking path dependency in governance. The challenge of breaking this path dependency should not be underestimated and is unlikely to be driven from the national scale. Instead alternative actors must be enabled to create local systems of governance more able to engage citizens in changing demand. This requires integration between levels of governance which at the same time allows independence and collaboration.

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