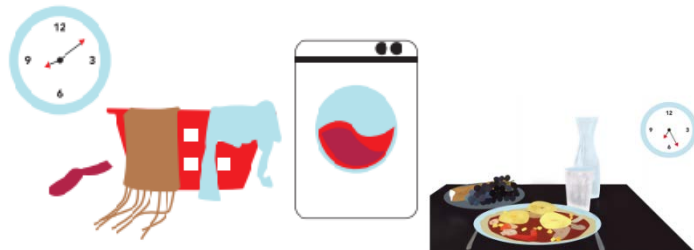
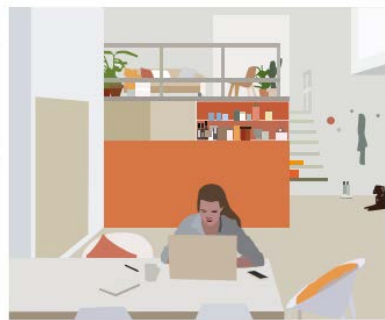


# Changing energy demand

## Concepts, metaphors and implications for policy

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## Introduction: How can energy demand be reduced?

Meeting the UK's 80% carbon reduction targets (HM Government, 2008) depends on reducing energy demand, of that there is no doubt. There is much less clarity about the types of changes this entails, or how these might come about.

This cross-cutting DEMAND research insight reviews alternative methods of conceptualising and steering changes in energy demand. Each of the five approaches we describe has practical consequences – favouring, or cautioning against specific types of policy intervention. Before outlining these strategies we begin with a few words on the fundamental meaning of ‘energy demand’, that is, on *what* it is that is or ought to be changing.

It is common to equate energy demand with energy consumption, taking recorded energy use to be ‘revealed’ demand. For physicists, economists and many policy makers, estimates of *future* energy demand represent the total units of Joules or Kwh that the UK will “need in the future to keep our homes warm and our workplaces functioning”.<sup>1</sup> For others, ‘demand response’ is about reducing the energy used at peak times (Kannan, 2011). Both are derived from an essentially economic understanding of ‘demand’ as one half of ‘demand and supply’.

In such accounts demand is revealed through prices that reflect the availability and scarcity of goods, and the ‘need’ for them. In the fields of energy policy, generation, distribution and supply, data on consumption is the metric by and through which demand is revealed and known. The focus on *supplying* resources means that most attention has focused on the extent of demand rather than its detailed composition.<sup>2</sup>

By contrast, the DEMAND Centre’s research focuses on how energy is used in society, and how that changes. What ways of life do current patterns of consumption enable, and how might these be reconfigured? Understanding demand in these terms depends on understanding what energy is used *for* and is a first step in understanding how ‘end uses’ develop and change. From this point of view, significant reductions in consumption depend on engaging with the constitution of ‘demand’ in this more fundamental sense.

Methods of understanding demand and how it changes are important for attempts to steer it. In this research insight we highlight differences between those who take changes in energy demand to be outcomes of largely exogenous factors, on the one hand, and those who conceptualise change as a more endogenous and less certain process, on the other. Similarly, whereas some take energy demand to be an outcome of specific ‘drivers’, aspects of which can be adjusted and manipulated using policy ‘levers’ applied from the outside, others contend that energy-demanding practices are continually on the move and that intervention is more like sailing or navigating through an also changing environment of shifting currents, tides, and winds.

As our necessarily simplified review of five ways of conceptualising the dynamics of energy demand reveals, contemporary policies and strategies mostly focus on demand-as-consumption, and mostly work with ‘linear’ and largely exogenous accounts of change and steering. In drawing attention to other ways of conceptualising demand and change we point to new and different opportunities for intervention. In setting out these ideas our aim is to inspire researchers and policy makers to reflect

on the conceptual foundations of the energy-related agendas they are pursuing, and to consider new forms of analysis and action.

The five approaches we review take energy demand to be an outcome of a) economic processes; b) behaviour and choice; c) technological efficiency; d) socio-technical change, and e) changing practices. Whilst some of these positions combine and intersect, others do not.

### **1: Conceptualising energy demand as an outcome of *economic processes***

The first position we consider holds that energy demand, as revealed through consumption, is in essence an outcome of macro-economic drivers, also linked to changes in population. This way of thinking is routinely embedded in methods of modelling and forecasting future energy demand at national scales (Lu, Campbell, Sagisaka, & Ren, 2016; Slini, Giama and Papadopoulos, 2015; Smith, 2013: 14-17), and in claims that the 'the recession ... [and fuel changes] largely explain the fall in industrial direct GHG emissions over 2009-2014' (Committee on Climate Change, 2016: 121). Drops in economic activity, as in 2008, *do* show up in terms of reduced levels of national energy consumption, hence the conclusion that energy demand is an outcome of national industrial policy and that the 'drivers of energy demand – income, GDP, land use planning, many building techniques and most energy-using practices – have strongly national characteristics' (Ekins and Watson, 2014: 17). By implication, demand changes as a result of changes in these major 'drivers' hence the conclusion that measured drops or stabilisation in domestic energy demand *are* evidence of the effect of a basket of government policies; economic, industrial and energy-related (Pearson and Watson, 2012).

This relatively straightforward picture is complicated by the need to define and bound 'UK energy consumption' and to leave out or factor in questions about where goods and services are manufactured and thus where emissions occur (Afionis, Sakai, Scott, Barrett and Gouldson, 2017; Feng, Davis, Sun and Hubacek, 2015; Hunt and Milne, 2013). This is important in that changes in the very structure of the economy and their impact on critical processes such as those of 'offshoring' production are often obscured.

However the boundaries are drawn, viewing energy demand as an outcome of macro-economic variables depends on further cause-effect assumptions about consumption. Principally, it supposes that as incomes rise or prices fall, people will engage in activities that result in an increase in energy demand. Because there is an association between income and energy expenditure at an aggregate level (by nation or by household) (DECC, 2013: 30-31), interventions based on this approach assume that prices work as 'levers' with which to modulate demand.

The policy implications of this view are clear: engendering change depends on modifying the financial landscapes in which rational economic decisions are made. Such strategies work with concepts of economic incentives and rational action played out not only in terms of individual choices (to take the bus or car etc.: Cass and Faulconbridge, 2016), but also in terms of altering sectoral economic activity, often through fiscal or pricing measures. Forms of policy evaluation rest on the same ideas, hence social, cultural and historical variation is set aside in order to 'see' the impact of specific policy measures (DECC, 2012). The terms of evaluation, along with the levers and instruments of intervention consequently suppose that policies of demand reduction have effect in a fairly stable social world.

## **2: Conceptualising energy demand as an outcome of *behaviour***

A second also dominant approach supposes that the demand for energy in society is an outcome of the choices that people make having weighed up the costs and benefits of different options, given certain levels of information, time and money. More subtle variants recognise that rationality is 'bounded' and insert 'non-rational' (e.g. sub-conscious) influences into the same decision-making model (Gsottbauer and van den Bergh 2011). Either way, the point is that chosen behaviours have variously energy-demanding outcomes, and that energy demand is usefully understood as an outcome of such behaviours, added together.

If this is how demand is constituted, how might it be changed and steered? If energy demand is seen as a consequence of behaviour, the obvious policy response is to 'help people make better choices' (Sloman et al., 2010): for example, by providing and promoting more efficient ways of meeting their needs. These ideas underpin behaviour change policy in areas including transport, work and the home (Ben-Elia and Shiftan, 2013; Mulville, Jones, Huebner and Powell-Greig, 2016; Pothitou, Kolios, Varga and Gu, 2014; Swaffield, 2016). From this point of view, the role of the state and other policy actors is to influence consumer choices through policy instruments including information, marketing, and incentives (Leonard, 2008). The effect of measures like these is usually evaluated by comparing before-and-after levels of energy consumption, as if in a controlled experiment. As above, such approaches suppose that the extent of demand/consumption can be manipulated from 'outside' by policy actors pulling levers or nudging consumers.

## **3: Conceptualising energy demand as an outcome of *technological efficiency***

This relative efficiency of appliances, infrastructures and technologies clearly matters for energy consumption, hence efforts to generate and promote more efficient solutions without changing the levels of 'service' provided (Diamond and Shove, 2016). This can be achieved at multiple points in energy systems, and is primarily a matter of technology/innovation policy. Technological research focuses on developing 'better' options, and regulation is sometimes used to remove appliances and systems which are significantly 'worse'. Where there are 'choices' to be made, the aim is to persuade consumers or designers to select the most cost effective and efficient option on offer.

In this context, policy evaluation is based on quantifying 'impact' by imagining how much more energy would have been used in the absence of more efficient technologies. For instance, the recent levelling of UK domestic energy consumption is attributed to the success and impact of increased efficiency, more insulation, or better heating systems (DECC, 2013; Kelly and Tuohy, 2012). Again, this strategy depends on holding certain understandings of 'need' stable in order to assess the efficiency with which those needs are met.<sup>3</sup>

## **4: Conceptualising energy demand as an outcome of *socio-technical change***

From this point of view, energy demand is best understood as an outcome of what people do as that is shaped and formed by established and novel *socio-technical* systems of transport, leisure, consumption etc. For example, in an 'ecosystem' of socio-technical systems, distinctly energy demanding regimes including those featuring automobility (Urry, 2004), electric fridge-freezers, or gas central heating emerge, become stabilised and change as networks of actors (government, business, consumers) form and evolve. In essence change occurs as nascent systems involving

different technologies and networks of actors appear, become embedded and eventually supplant previously dominant arrangements. Energy demand is seen as a complex emergent property of people's involvement with multiple socio-technical regimes across different areas of everyday life: as such, energy demand is constantly changing in ways that are hard-to-predict.

Where do opportunities for steering and intervention lie in this scenario? In essence new regimes are thought to arise as a result of changing relations between innovations and their surrounding (socio-political-cultural) environments. This account has much in common with a co-evolutionary model of species/eco-system relations. By implication, deliberate 'steering' takes place and has effect within and not outside socio-technical systems. Policy-making and innovation are therefore viewed as actions *within and as part of* incumbent or changing regimes. Steering innovation is likened to rowing a boat: policy levers act as oars pushing against the changing currents of surrounding socio-technical change. Other metaphors include those of nurturing and growing: business and policy actors seek to 'cultivate' new socio-technical configurations, for example, cossetting them in protected niches (e.g. subsidising novel technologies). The subsequent fate of such arrangements depends on their ability to survive and thrive in the wider landscape and under various conditions, including conditions deliberately shaped by their promoters.

These methods depend on constant monitoring and reflexive evaluation, sometimes described as 'transition management' (Geels, 2005, 2011, 2012). When, how and whether lower energy regimes become embedded in society is not something that can be predicted in advance. Instead, moving in this direction depends on modulating and re-calibrating strategies as the total socio-technical system evolves. Rather than assuming that technological development, behaviour changes, or economic factors will of themselves engender a systemic transition towards lower energy demand the strategy is to foster joined-up innovation simultaneously, and *across* the various regimes in which demand is constituted.

### **5: Conceptualising demand as an outcome of *social practices*.**

A fifth possibility is to conceptualise energy demand as an outcome of social practices. By this we mean that energy demand follows from and is part of 'doing' things like office work,<sup>4</sup> preparing and eating evening meals, or commuting (Shove and Walker, 2014). From this point of view, practices are inherently social: they exist across space and time and constitute recognised patterns of activity that people join with, or depart from (Reckwitz, 2002; Schatzki, 1996). A key feature of this approach, and one that sharply distinguishes it from a focus on individual 'behaviour', is the method of taking (combinations of) practices as the central unit of conceptualisation (Shove et al., 2012). Whilst technologies and 'socio-technical arrangements' are integral to practices, it is the practice – and not the technology – that is the focus of attention and investigation. Accordingly, practices or connections between them figure as the primary sites of intervention and change.

To elaborate, the amount of energy associated with practices like those of preparing dinner (and the detail of when this occurs) depends on socially shared understandings of 'evening meal' (Warde, 2013) bound up with societal rhythms (Southerton, 2012; Zerubavel, 1985), histories of food and cooking technologies, and ideals of family life (Rönkä and Korvela, 2009). The practices involved are not stable: they change and differ, significantly, between one country, class or social group, and another, but not simply as a consequence of individual choice. Other forms of energy demand, for

example for travel,<sup>5</sup> heating,<sup>6</sup> use of appliances,<sup>7</sup> etc., can be understood in much the same terms. From this point of view, understanding and changing energy demand is *primarily* a matter of understanding and intervening in the dynamics of energy demanding social practices. Technologies, innovations and policy measures are all part of this process. For example, infrastructural investments and urban planning matter directly for where specific practices go on; laws and regulations define which practices are ‘acceptable’, where and when, and systems of provision, for instance of electric power, matter for how practices develop and how they are enacted.

Current policies also shape future practices. For instance, the long tradition of ‘predict and provide’ – used to justify investment in road and electricity infrastructures – depends on projecting future energy demand and providing systems of provision capable of meeting it. Since infrastructures, practices and energy demands develop in tandem, such strategies establish conditions that foster certain trajectories of practice and that limit others. Policy is thus *part of* changing practice relations: it is not situated ‘outside’ these processes.

Similarly, many policies – not only those that deal with energy – matter for the trajectories of energy-demanding practices (Cox, Royston and Selby, 2016; Royston, 2016). Whether intentionally or not, changes-that-matter-for-energy-demand are influenced by multiple forms of (non-) energy policy intervention: overlapping from the past and present, and with consequences that are likely to vary from one practice to another. Identifying relevant forms of policy intervention depends on thinking about how proposed measures might have a bearing on those practices through which energy demand is constituted: for example, which energy-using practices are changing, in what directions and with what consequences for demand? Are certain practices expanding because others are disappearing, or merging, morphing or hybridising in some way? And which areas of policy have (or have had) a part in shaping these trajectories?

In this context, evaluating policy impact is at heart a matter of understanding how policy objectives and policy processes have a bearing on one or more areas of practice, and on the energy demands that follow.

### **Reducing energy demand: Implications and opportunities for policy**

Different ways of conceptualising energy matter for the steps that could or should be taken to reduce it. As Table 1 shows, there are hugely significant points of difference, as well as aspects of commonality and overlap between the five positions outlined. These are important in that some of these approaches are currently much more influential than others.

	Ways of thinking about energy demand, how it changes and how it might be steered				
	Dominant approaches			Marginal approaches	
	Economic	Behavioural	Technological	Socio-technical	Social Practice
How is energy demand conceptualised?	Revealed in and through consumption: short term	Revealed in and through consumption: short term	Revealed in and through consumption: short term	Revealed in and through consumption: short and long term	An outcome of social practices: short and long term
How does energy demand change?	Energy demand reflects 'drivers' of income, cost and population	Energy demand changes as people choose to save or consume more	Energy demand reflects the use of more or less energy efficient technologies	Energy demand depends on socio-technical regimes – change depends on innovation shaped by landscapes	Energy demand is an outcome of practice dynamics and changing relations between practices
Origins of change/steering	Exogenous	Exogenous	Exogenous	Exogenous / endogenous	Endogenous / exogenous
Instruments of demand reduction	Pricing Regulation Infrastructure	Information and incentives	Research and development	Multi-sited governance, the ambitions and actions of technical and regime actors	Any intervention that has a bearing on practice, including non-energy policy <sup>8</sup>
Terms of policy evaluation	National, sectoral energy use	Before-after, attitudes and choices	Efficiency per unit of service	Regime change, system transition	Less energy demanding practices and complexes of practice

**Table 1: Ways of thinking about energy demand and how it changes.**

To date, most energy policy and most energy related agendas reflect what we have characterised as economic, behavioural or technological ideas about demand and how it changes. This is not the only way to go. DEMAND research gives a sense of the new opportunities for intervention that arise if we take a more systemic, and also longer term view of energy demand and of how it changes.

Taking heating and cooling as an important example, thinking systemically might mean that we stop assuming that demands for uniform and higher temperatures across all spaces will continue. The expectation of temperature variations in summer and winter could be reinforced through programmes like 'Cool Biz' in Japan<sup>9</sup>, that led to a widespread shift in summer office wear, or through personalised heating and cooling devices<sup>10</sup> and practices<sup>11</sup>. It might also involve supporting and encouraging e.g. the acceptance of non-standard comfort levels in different 'workspaces' such as homes, parks, cafés etc. Over time more flexible interpretations of comfort would enable the substitution of air-conditioning and mechanical HVAC systems by heat pumps and other low carbon alternatives.



DEMAND research on home heating,<sup>12</sup> on the energy demands of office buildings<sup>13</sup>, or of domestic IT systems<sup>14</sup> points in the same direction. In all such cases, understanding the scope for effective intervention is a matter of recognising and working with multiple influences including non-energy related policies, past and present. This argues for policy responses that are rooted in distinctive, cross-sectoral analysis of specific practices, of how they are changing and of when and how they might be steered. DEMAND's research repeatedly underlines the conclusion that deliberate efforts to reduce energy demand need to take account of the fact that energy policy may not be the most important policy influence, that the characteristics of energy-demanding practices (making dinner, watching TV, heating the home, etc.) are always in flux, and that policy interventions have effect within and not outside these dynamic processes.

Policy approaches are not exclusive and it is clear that many non-energy policies directly affect energy demand. It is also plain that currently dominant discourses including those of consumer choice, along with the focus on technological efficiency profoundly limit the scope and potential impact of deliberate and concerted effort to reduce energy demand. Moving beyond this very narrow conceptualisation of this problem calls for the systematic development and adoption of metaphors, languages and policy imaginations that are more consistent both with the scale of the challenge and with a more extensive, but also more subtle understanding of how energy demands are constituted and how they change.

## Notes

<sup>1</sup> <http://nationalgridconnecting.com/the-future-of-uk-energy-demand/>

<sup>2</sup> <https://www.theguardian.com/environment/2016/oct/15/energy-storage-vital-to-keep-uk-lights-on-say-mps>, <http://www.demand.ac.uk/14/11/2013/keeping-the-lights-on-the-conversation-13-november-2013/>

<sup>33</sup> Marilyn Brown, on video 'Is energy efficiency a worthwhile investment?':

<http://cied.ac.uk/publications/factandfiction>

<sup>4</sup> <http://www.demand.ac.uk/wp-content/uploads/2015/11/DEMAND-insight-10.pdf>

<sup>5</sup> <http://www.demand.ac.uk/wp-content/uploads/2016/10/DEMAND-insight-3.pdf>

<sup>6</sup> <http://www.demand.ac.uk/wp-content/uploads/2016/10/DEMAND-insight-7.pdf>

<sup>7</sup> <http://www.demand.ac.uk/wp-content/uploads/2016/10/DEMAND-insight-8.pdf>

<sup>8</sup> <http://www.demand.ac.uk/wp-content/uploads/2016/07/The-impacts-of-non-energy-policies-on-the-energy-system-scoping-paper.pdf>

<sup>9</sup> [http://www.demand.ac.uk/wp-content/uploads/2016/03/DEMAND2016\\_Full\\_paper\\_42-Shove.pdf](http://www.demand.ac.uk/wp-content/uploads/2016/03/DEMAND2016_Full_paper_42-Shove.pdf)

<sup>10</sup> <http://www.lowtechmagazine.com/2014/09/circulating-fans-air-conditioning.html>

<sup>11</sup> <http://www.lowtechmagazine.com/2015/02/heating-people-not-spaces.html>

<sup>12</sup> <http://www.demand.ac.uk/wp-content/uploads/2016/10/DEMAND-insight-7.pdf>

<sup>13</sup> <http://www.demand.ac.uk/wp-content/uploads/2016/10/DEMAND-insight-6.pdf>

<sup>14</sup> [http://www.demand.ac.uk/wp-content/uploads/2016/05/DEMAND2016\\_Full\\_paper\\_87-Morley-v2.pdf](http://www.demand.ac.uk/wp-content/uploads/2016/05/DEMAND2016_Full_paper_87-Morley-v2.pdf)

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