

Chapter 5: Services revisited: What is energy for?

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Abstract:

This chapter reviews the markedly different ways in which concepts of 'energy service' are used, despite each ostensibly speaking to 'what energy is for'. Although the importance of energy demand reduction is widely acknowledged, understandings of what demand actually is vary widely. This chapter argues that sociological conceptualisations of energy service, which are commonly overlooked, offer an important perspective to the analysis of energy demand. In particular, sociological concepts emphasise the cultural and historical specificity of 'needs' which tend to be interpreted in more static ways in other literatures. This has consequences for attempts to reorganise and decarbonise energy systems, since policies may work to reproduce current ways of life rather than recognising and harnessing their existing roles in shaping energy services. This is explored in relation to the current policy interest in 'Heat as a Service'.

Key words:

Energy demand, energy services, sufficiency, demand reduction, sociology, heat-as-a-service

Services revisited: What is energy for?

It is broadly accepted that along with the shift towards low-carbon supply, reductions in absolute energy demand are necessary in order to meet climate change targets. It is also broadly accepted that energy efficiency measures, on which current energy policy largely focusses, will not be sufficient to deliver these reductions. Many authors have made the case for absolute energy demand reductions; against which context, other authors highlight the importance of how energy demand is conceptualised (Shove and Walker, 2014; Rinkinen, Shove and Marsden, 2020). The concept of energy services has long been instrumental in these kinds of debates, and it is becoming, once again, increasingly important. In particular, this can be seen in the emerging literature on energy sufficiency, which explores how populations can live well but within environmental limits. Here, in order to reduce energy demand in higher-income countries, researchers emphasise the need for policy to focus on services. There is also discussion in economics literature of the possibilities for service demand reduction policy. Moreover, new service-oriented business models are being explored for domestic energy markets. But the concept of energy services, which is commonly used to denote the benefits that energy provides (i.e. what energy is for) is not straightforward. It is defined and operationalised in various ways.

The term is perhaps most commonly used in economic literatures, especially on rebound effects. Sociologists have conceptualised services in a different way, as contingent, historical and culturally variable. Yet the latter is not widely used in sociologically informed energy research today: it has been superseded by a framing of energy demand in terms of social practices. Indeed, the title of this chapter alludes to an influential article by Shove and Walker (2014) which sought to strengthen this agenda. This chapter builds on my argument elsewhere (Morley, 2018) that a sociological conceptualisation of services still has much to offer the analysis of energy demand and the development of decarbonisation and sufficiency policies. Not least, it highlights why conflation in terminology matter, and challenges narrower usages that could limit the scope, ambition and nature of the demand reduction policies that are urgently needed to achieve climate targets.

The chapter begins by comparing uses of the concept of energy services. It shows how some differences arise, not from a confusion or imprecision in terminology per se, but through varied disciplinary engagements. The following section then considers attempts to define energy services more precisely by distinguishing the physical functions delivered (e.g. heating, cooling, lighting) from the benefits or end-services they help to achieve (e.g. thermal comfort or being able to see at night). Conventional economics literatures work with a narrow, quantifiable definition of the former, and ignore the latter. In contrast, a sociological conceptualisation of services problematises the relationship between functions and benefits, suggesting it is neither exclusive and direct (there are likely to be other, non-energy contributors), nor is it one between independent variables (for instance, new energy services like computing often create and redefine the benefits they provide over time). This suggests that re-organisations in favour of lower-energy provisioning may lead to changes, however subtle, in both types of service (i.e. ongoing co-evolution). The third section explores the implications of this, and the tendency to conflate the different types of energy service, for the development of service-based business models, in particular 'Heat as a Service'. Finally, the chapter concludes with a discussion of how energy services might be reconceptualised in relation to social practices. It also considers how service-focused policies might differ from more conventional efficiency policies and the importance of measures to address service demand alongside service-based innovations.

<a> Many 'energy service' concepts

The idea that energy is not consumed for its own sake but for the services it provides seems to have become an accepted, and well-rehearsed, wisdom in many strands of energy research. It indicates that unlike eating food or drinking water, people do not consume energy itself, nor do they use it in the way they use a kettle, a car or a TV set: that is, by directly handling, controlling or interacting with it. Instead, energy works in the background: to power appliances and vehicles, or to provide lighting, heating, ventilation and so on. This means that people do not demand, want or benefit from energy as a resource in its own right, but rather the things that energy makes possible. As such, economists sometimes describe energy demand as a 'derived demand': a form of consumption incurred in order to engage in another form of consumption (that of services) (Sorrell, 2015). In principle, this distinction should help to shift attention away from issues of fuel and technology that dominate the energy policy agenda, as well as much energy research, and towards analysis of services themselves: how they are achieved, interpreted and might be re-organised in less energy-intensive ways (Sovacool, 2011; Shove, 1997). In practice, however, making a distinction between energy carriers, such as electricity, gas or petrol, and the services they provide has several different purposes across different literatures. This section outlines a brief history of the term and its various uses.

The concept of energy services dates back at least to the 1970s when, in arguing for a more strategic approach to planning electricity infrastructure, Amory Lovins (1976) noted that alternative energy carriers might be just as suitable as grid-supplied electricity for meeting 'end-use needs' like 'comfortable rooms, light, vehicular motion, food, tables, and other real things' (Lovins, 1976, p. 78). He argued that substituting between alternative means would not matter to consumers so long as equivalent ends (or 'real things') are achieved.

Another early and more direct reference to 'energy services' is found in Reister and Devine's (1981) economic analysis of the impact of technological development on the cost of energy services. Services are relevant both as the economic outcome most salient to consumers and because their cost is not equivalent to the price of supplied energy itself, but also the cost of buying and maintaining end-use equipment, such as refrigerators, boilers and washing machines. Fouquet (2010; 2014) is similarly interested in the cost of energy services and the economics of long-term changes in their supply and consumption. But he delineates just 'four main energy services' of 'heat, power, transport and light' (Fouquet, 2010, p. 6587), whereas Reister and Devine (1981) identify 15 categories of energy services. This indicates an ambiguity of usage that can result in substantially varying characterisations of energy services, meaning it is possible for analysts to be working with quite different types of energy service even in relatively similar domains.

The distinction between energy and energy services is perhaps most prominent in the extensive economics literature on rebound effects, otherwise known as Jevon's Paradox (Berkhout, Muskens and Velthuis, 2000; Schipper and Grubb, 2000; Sorrell, 2007). A rebound effect is identified where energy efficiency improvements unintentionally result in increased energy consumption or at least a lower reduction than would have been expected. Various mechanisms have been elaborated but most depend on the distinction of energy use per se, the cost of which remains the same, from energy services, which become less expensive when end-use appliances are more efficient. Because they are cheaper, it is assumed that demand for services increases, counter-acting or reducing any reductions in consumption from the efficiency measures. But it matters little to the economics of rebound effects exactly how energy services are defined, or indeed why they are 'useful' in the first

place. As Fouquet, an economist, acknowledges ‘energy service demand has evolved over time, at different stages of economic development, *or as a result of other economic, technological, political, social, or cultural factors*. Economists must begin by addressing a *narrower issue*’ (Fouquet, 2014, p. 2011 emphasis added): that of changes in income and price elasticities. One result of this usually unacknowledged narrow treatment of the demand for energy services is a lack of conceptualisation and consistency within economics literatures.

The concept of services is also central to the literature on eco-efficient services and Sustainable Product Service Systems that grew to prominence in the 1990s and has continued to be influential, particularly in more recent discussions of circular economies. Here, as with Lovins (1976), services are seen as ends that can be achieved through interchangeable means, particularly those which use materials and energy more efficiently. There is also interest in a shift towards provision of services rather than goods per se (Stahel, 1997; Mont, 2002; Tukker and Tischner, 2006). Commonly identified final, or end, services include communication, illumination, hygiene, sustenance or nourishment, mobility or transport, shelter or structure, and thermal comfort. These are clearly different from the kind of services that a producer might provide directly, such as advice, lease-hire or a haircut. Although such final/end services are characterised in various ways: as representing or satisfying basic human needs and activities (Baccini and Brunner, 1991; Cullen and Allwood, 2010), standards of living or ‘desires arising from cultural values’ (Nørgård, 2000, p. 109), there is a tendency in these literatures to interpret such categories of consumption as enduring and universal hierarchies of fundamental ‘need’ that are always present in some form or must be satisfied in some way. As Heiskanen and Pantzar (1997, p. 424) argue researchers working in these areas tend to possess ‘an excessively functional view’ of end services that fails to address their ‘socio-historical dimensions’.

In fact, it was social scientists investigating the social construction of ‘needs’, in counterpoint to such functional, universal and psychologistic accounts of consumer demand, who developed a wider conceptualisation of services. The concept was once instrumental in demarcating the distinctive contribution that anthropologists and sociologists might make to energy research, that is, in developing a ‘social science of energy service consumption’ (Wilhite *et al.*, 2000, p. 115). The most notable work to develop a distinctive concept of services is Elizabeth Shove’s (2003) *Comfort, Cleanliness and Convenience: The Social Organization of Normality*. Informed by the research of Wilhite and colleagues (e.g. Wilhite *et al.*, 1996, p. 803) into cultural variations in meaning and achievement of what they called ‘cultural services’, such as cosiness and cleanliness, that just happen to depend on energy, Shove (2003) explores how energy-intensive ways of life become normal. She defines services as ‘composite accomplishments generating and sustaining certain conditions and experiences’ (Shove, 2003, p. 165); they are significant as ‘working units of sociotechnical change’ that ‘help[s] to define larger packages of habit and convention into which new arrangements and technologies are incorporated’ (Shove, 2003, p. 166). Examples include comfort and cleanliness. For instance, she explores the rising frequency of bathing and showering in the UK, and other western countries, over the last 60 years or so, as well as the specification of narrow comfort parameters that have accompanied the development and marketing of heating and cooling technologies. In other words, Shove uses the concept of services to articulate how needs, even those as apparently basic as hygiene and thermal comfort, come to be defined, experienced and change within contingent social circumstances and histories. It also highlights how needs are constructed and constituted through the very systems of provision that purport to meet them. As others have emphasised, energy providers are implicated in specifying and manufacturing demand for the services they support (Shove, Chappells and Van Vliet, 2012). Recognition of these co-

constituting relationships challenges the clear-cut distinction between energy carriers, as means, and final services, as ends, on which other literatures depend. We shall return to this point in the following section.

The concept of energy services is also central to the emerging literature on energy sufficiency. Since energy demand reduction beyond efficiency measures may increasingly be framed in terms of energy sufficiency (Sorrell, Gatersleben and Druckman, 2020), this is a significant development. Darby and Fawcett (2018, p. 8) define energy sufficiency as ‘a state in which people’s basic needs for energy services are met equitably and ecological limits are respected’. In contrast to discussions of demand reduction or energy conservation per se, sufficiency includes reference to absolute limits and equity and wellbeing, that is, how to ‘live well, within the limits’. Whilst they define energy services as the benefits provided by energy and give examples of cooking, lighting, cooling and automotive transport, they recognise that a) services have a subjective dimension and are culturally, contextually specific, b) other things than supplied energy contribute to their delivery and c) access to them depends on a range of non-energy policies, initiatives and changes. They argue that a focus on energy services is important as it helps policy makers to accept more ‘flexible’ definitions, for instance, allowing consideration of alternative means of promoting cooling than air-conditioning, rather than just focusing on the efficiency of such systems. However, they refer equally to thermal comfort, cooling, air-conditioning as services, as well as automotive transport and mobility. This matters because, as Sorrell, Gatersleben and Druckman (2020, p. 4) note “‘reducing” energy service consumption can mean different things and can have different outcomes depending upon how those services are understood, measured, provided and valued.’

In sum, the concept of (energy) services has proved analytically useful across a number of different issues, as framed by different disciplines. The point thus far has not been to clarify or reconcile these differences. Indeed, they are instructive of the varied insights that service concepts can facilitate. In this light, the ongoing confusion around the term ‘energy services’ that recent contributions have sought to address (Fell, 2017; Kalt *et al.*, 2019) is hardly surprising. However, when it comes to informing demand reduction policy and to the practical implementation of service-centred business models, the potential for confusion and misunderstanding can be of real consequence. I explore each in turn in the following two sections.

<a> Different types of energy service: implications for demand reduction

At least some of the variation in the way energy services are defined and operationalised reflects the fact that there are two different kinds of service, which are often conflated (Fell, 2017). On the one hand, there is the ‘work’ done when energy carriers are converted by end-use devices into forms of ‘useful’ energy (e.g. light, sound, heat, motion). On the other hand, there are the ‘benefits’ or ‘satisfactions’ that this provides. Accordingly, Fell suggests that ‘any definition and examples of energy services must make explicit distinction between the energy service itself, and *any end service* or *state* that it is employed to achieve’ (2017: p. 136, emphasis in the original). He proposes that energy services are ‘those functions performed using energy which are means to obtain or facilitate desired end services or states’ (2017: p. 137). Thus, heating (as an energy service) is undertaken for the purpose of thermal comfort (the end-state), and lighting (energy service) for the purpose of seeing at night (end service). Kalt *et al.* (2019) make a similar distinction but in different terms: drawing on the ecosystem services literature they distinguish ‘functions’ (the physical actions performed by the energy chain, equivalent to Fell’s (2017) energy services) from ‘services’ (that which is actually demanded, such as thermal comfort or illuminated living space). In turn, such services generate ‘benefits’, which are contributions to wellbeing, for example ‘not having to freeze in winter’ (Kalt *et al.*; 2019; p. 49). The difference between these attempts to clarify the terminology

suggests that a precise definition of energy services may remain unsettled. Importantly, however, both recognise that ‘benefits’, that is the very usefulness of energy, are an essential element in the broader conceptualisation of energy services.

This is significant because end services or benefits, and the usefulness they articulate, are often taken out of the equation when energy services are analysed, especially when done so quantitatively. For example, in a striking footnote, Haas *et al.* (2008, p. 4012) observe that whilst ‘the *actual energy service* is to reach the shop where I can buy a certain product or to reach my office... a common and more technical definition of transport energy services are distances travelled’ (emphasis added). By defining the energy service as distance travelled rather than the movement of people or goods to specific places of significance, the purpose of journeys and the very *usefulness* of travel itself is lost from sight. As Jonsson *et al.* (2011, p. 363) argue ‘the ambition to quantify energy services in the same fashion as other flows in the energy system... has contributed to a one-dimensional view on energy services’.

Yet differences in how concepts of energy service are used run deeper than methodological expediencies. When service demand is conceptualised *only* in terms of the affordability of achieving set ends, it effectively excludes such ends from analysis. It does not get at a sense of what energy is for, that is, its usefulness and the core common understanding of the term ‘energy service’. It does not consider how ends themselves come about and change, beyond changes in price and income, such as with the emergence of new end-uses like computing technologies and the decline and (near) disappearance of others, such as the erstwhile regular home deliveries of milk or coal. For instance, Kesicki and Anandarajah (2011, p. 7224) define demand reduction as ‘reduction in energy-service demands due to increased prices for meeting those services’. Whilst they recognise that this excludes non-price related changes, they still conclude that ‘demand reduction can always only make up a limited amount of CO2 emissions reduction... Technological change is essential for a transition to a low-carbon society’ (2011: p. 7232). This is a strong conclusion based on a narrow definition of energy service demand, and shows that, when it comes to policy recommendations such conceptual issues matter. In this case, it ignores the potential of non-price related changes in the demand for energy services.

Another area of practical interpretation and confusion surrounds the status of energy services in relation to wellbeing and human needs. This relationship is often emphasised in the literature on energy poverty and how deficits in access to energy services impact upon wellbeing (Day, Walker and Simcock, 2016). But concepts of wellbeing and fundamental need also pervade some literatures on energy services, to the extent that benefits or end services are interpreted as direct expressions and satisfactions of basic human needs. For instance, some studies assume that reductions in the quantity or volume of energy-service ‘come[s] as an expense to society in terms of welfare losses due to un-served energy-service demand’ (Kesicki and Anandarajah, 2011: p. 7232). As this example illustrates, how energy services and the demand for them are understood clearly matters to strategies to reduce energy service demand. Policymakers might be justifiably cautious of interventions aimed at service demand reduction if that is understood to reduce wellbeing inherently. No wonder then that within ecological economics more subtle and sophisticated frameworks are being proposed that position energy services as satisfiers of basic categories of human needs, but in relationships that are culturally specific and historically variable (Brand-Correa and Steinberger, 2017). Arguably however this still naturalises energy services by assuming that they satisfy basic, universal needs thereby enhancing wellbeing. This is not necessarily the case. Even putting aside questions of *who* benefits, it can be readily appreciated that some energy services do

not exist in tidy relationships that promote wellbeing. For instance, buildings can be overheated, causing discomfort. Long commutes may enable people to find employment but when such journeys are time-consuming, sedentary and largely unavoidable, they might impinge on wellbeing.

In contrast, sociologists argue that the demand for energy services (as functions) is cultural and historical (see Shin and Chappells, Chapter 4 for discussion); it is the outcome of changing and culturally varied practices rather than fundamental, unswerving human ‘needs’ (Shove, 2003; Shove, Walker and Brown, 2014). This is not to argue that wellbeing must be disregarded, but that we do not necessarily possess any automatic knowledge of what people ‘need’ in order to achieve it: it is contingent, relative to prevalent social practices and may also be possible in many different forms than considered ‘likely’ or ‘desirable’ from any particular social-cultural point in time. Take thermal comfort. What we understand, recognise and physically experience as thermal comfort today may have been very different in the past; it might not even have been a distinctive concept in its own right. It is not simply a pre-existing end for which heating and cooling technologies were developed and thereby became immediately useful. Rather, ‘something must have changed in everyday life for these new technologies to *become of use* to large numbers of people’ (Kuijter and Watson, 2017, pp. 78, emphasis in original). The demand for energy services, like comfort or internet connectivity or clean clothes, are not simply pre-given, and necessary in order to preserve wellbeing. To consider only how the same ends, as today, can be achieved in more efficient forms risks reproducing and legitimising them (Shove, 2018).

As interest in the ‘demand-side’ of energy systems grows, it is worth re-emphasising the relevance of these arguments to the concept of energy services. Elsewhere, I have sought to do this by revisiting the concept of services, as originally worked through by Shove (2003), distinguishing it from end services or energy services by the label ‘meta-service’ (Morley, 2018, 2019). Here I continue to use the term ‘services’ in an attempt to keep these observations as broadly relevant as possible. In addition to being relative, rather than absolute, this sociological version of service, entails two further distinctive qualities.

Firstly, services like comfort, cleanliness, entertainment or mobility do not depend on energy alone. Sometimes energy is not required, for instance, during the times of year when space heating or cooling are not used. Often human labour or other control and monitoring inputs are also necessary; for instance, mobility depends on the work of drivers, pilots, walkers and cyclists. In addition, services usually depend on a combination of other products, devices and infrastructures, such as roads, building structures and furniture, which may not consume energy directly, even if energy has been ‘embedded’ indirectly in their production and distribution. The concept of services thereby calls attention to how ‘suites of technologies operate together’ (Shove, 2003: p. 60) in a ‘blend of method, meaning and hardware’ (2003: p. 166) to ‘co-constitute[s] the collective conventions of everyday life’ (2003: p. 60). For instance, the achievement of ‘clean clothing’ depends not only washing machines and the energy to operate them but also detergent, the nature of the fabrics, the practices of laundry itself as well the practices in which clothes are worn. This means that it is not just energy-consumers who are responsible for shaping services and thereby energy demand. Rather, a wide range of parties are involved in provisioning, structuring and defining services. Whilst device manufacturers may already be recognised as ‘tertiary actors’ in delivering services (Steinberger, van Niel and Bourg, 2009) their role in demand reduction is not limited to device efficiency. Instead, it is important to recognise that they help to shape the services to which their products contribute. Most obvious are the attempts of marketers to extend and re-articulate concepts of service for which their products can then become ‘essential’. For instance, Strengers and Nicholls (2017) show how providers of automated home technologies are attempting to tweak

concepts of what home should be, by extending ideas of convenience, and even creating a new concept of ‘pleasance’. Less intentionally, the fashion industry, which supplies clothing and shapes our understanding of what is appropriate to wear, is implicated in how we experience thermal comfort (Morley, 2014).

Secondly, services change when the means of achieving them change (Heiskanen and Pantzar, 1997). Thus, although the distinction between energy functions and services is important, they remain heavily inter-dependent. For instance, concepts of comfort are conditioned by the technologies that provide for them. It is not uncommon today for people to attribute their own experience of comfort when indoors to heating or cooling systems, not recognising that what they are wearing, their levels of activity and health also contribute. The equivalence of comfort to the operation of heating and cooling technologies is an understanding that can only have evolved over time in the context of those technologies. Similarly, new ‘needs’ for communication emerge and co-evolve alongside new ‘means’, as in the way that the internet technologies have incrementally become ‘necessary’ for most households (Walker, Simcock and Day, 2016). This is significant because substitutions between different ‘means’, including more energy-efficient technologies, may actually change the meanings and qualities of the services they support. For instance, one study shows that even though air-to-air heat pumps are more energy-efficient, they tend to be used in different ways compared to central heating or direct heating, including to keep higher room temperatures and, in the summer, for air conditioning, thereby resulting in no overall reduction in average energy use (Gram-Hanssen, Christensen and Petersen, 2012).

<a> Selling energy services? The case of ‘Heat as a Service’

The idea of selling services, that is, the enduring ‘functions’ that people want rather than the means, or products, that usually cater for them, continues to appeal to policy makers (e.g. UK Government, 2017) and researchers alike (e.g. Roelich *et al.*, 2015; Plepys, Heiskanen and Mont, 2015). It is anticipated that service-centric business models could help reduce overall resource consumption by increasing the efficiency of delivering services, potentially through alternative means. A classic example is that of a carshare scheme which still provides access to car-based mobility without the need for individually owned and sparsely used cars. As noted above, this literature tends to work with broad and functional typologies of service. For instance, some authors have argued for a service-oriented approach to infrastructural provisioning that recognises the joint roles of multiple utilities, such as gas, electricity and water, in delivering domestic services, such as thermal comfort and cleanliness (Roelich *et al.*, 2015; Knoeri, Steinberger and Roelich, 2016). They propose a notion of Multi-Utility Service Companies (MUSCos) that would undertake to sell such services directly, thereby incentivising reductions in the resources (hence provider costs) required to deliver them. Such companies might, for instance, be more willing to engage with customers on ways to reduce hot water use; and this may directly or indirectly serve to redefine and challenge contemporary cleanliness conventions. However, whilst such propositions are important to explore, there needs to be greater reflection and clarity on the type of service to which they refer, and the implications if providers were to actually undertake to ‘sell’ such services.

Thermal comfort, for instance, depends on a diverse range of ‘ingredients’ across multiple systems of provision: clothing, diet, activities, furnishings and so on. It is simply not the kind of service that can be *directly* provided by others. This is also true of cleanliness, which depends on what people do for themselves. Although it is surely possible to *provide for* these services in less energy-intensive ways (Nicol, Humphreys and Roaf, 2012), the most radical reductions also depend on what people do at home, and how these services are realised in day to day life. As many have already noted (Shove, 2003; Shove and Chappells, 2005) the provision of heat or ‘warm homes’ is not the same as

thermal comfort. To conflate the two is unwelcome from a sustainability perspective because it negates other, and generally less energy-intensive, contributors to comfort, such as clothing. It also occludes the possibility for (radically) different forms of person-centric comfort (DEMAND, 2018).

It is therefore reassuring that one of the first tangible manifestations for UK domestic customers of an energy service model specifies *heat* rather than comfort as the service. Indeed, whilst Energy Service Companies (ESCOs) have long provided industrial customers with agreed levels of ‘service’ in combination with energy efficiency improvements, there has been little sign of movement away from the core business of selling energy per se, especially in residential markets (Plepys, Heiskanen and Mont, 2015). From 2019-2020, a ‘Heat as a Service’ offering was trialled as part of a joint project between Bristol Energy and the Energy Systems Catapult (ESC), a government innovation body. With the help of smart controls and monitors, households participating in the ESC ‘Living Lab’ who were otherwise on a standard gas supply could buy ‘warm hours’ as structured by a personalised ‘heat plan’, rather than volumes of gas, warm water or kWh (Energy Systems Catapult, 2019). Customers who became familiar with this idea were more favourable to the prospect of changing their heating systems from gas to lower carbon alternatives such as heat pumps. That is, shifting the focus to heat, appears to help to raise the acceptability of alternative means of providing it. Given the immense challenge of decarbonising domestic heating across the UK, which is primarily based on natural gas, this appears to offer a hopeful step forward. The concept is also anticipated to provide new opportunities to structure and invest in energy efficiency measures, for instance, if service companies take on ownership of heating equipment located at customers’ homes.

However, the sociological understanding of services, as outlined above, would suggest that undertaking to provide heat rather than units of energy may have unintended consequences. Whilst it may allow households to cut out ‘wasted’ heat in rooms when they are not in use, the shift does not address the demand for heat per se, and by formalising and quantifying performance expectations, it actually stabilises and sustains current comfort expectations. Moreover, it emphasises the role of narrow parameters of air temperature in achieving comfort, potentially at the expense of other comfort contributors. In addition, a more stable temperature, if that is what people choose to pay for, may be more energy intensive than one that fluctuates. For instance, over a prolonged cold spell, people may adapt to feel more comfortable with lower temperatures, not least by adapting their clothing, but also in ways that often go unacknowledged and unnoticed (Nicol, 2011; Nicol and Roaf, 2017). Such tacit adaptability is negated if temperatures are pre-specified. To quantify, specify and pay by units of temperature represents a subtle change in the qualities of heat. Because of the interdependence of heat and comfort, this also stands to redefine comfort, the consequences of which may only become evident over time.

<a> Conclusion

By asking questions of ‘what energy is for’ social scientists have already made a significant contribution to energy research; offering alternative ways of thinking about energy demand reduction, in potentially more radical and deeper forms than the dominant framings of economics and efficiency allow. Most of this work is now articulated in relation to social practices and their relations with infrastructures and policies. Yet as researchers and policy makers increasingly turn to thinking about energy services and the possibilities for service demand reduction, sufficiency policy, and service-oriented business models, it is important to bring insights from the social practice literature back into contention with concepts of energy service. To many, practice theoretical framings already offer a sufficient vocabulary of ideas without the need to reinvigorate an additional and admittedly illusive concept of services. Indeed, the rise of social practice theory within consumption studies relates not only to its strong basis in social theory but also because it was made

accessible. Indeed, there is an argument for simply positioning energy services (as functions) more strongly within practices. For instance, heating and cooling can be positioned as material aspects of practice accompanied by elements of meaning, interpretation and valuation. Whilst this would allow a fuller exploration of the 'benefits' that energy services (as functions) support than many other approaches, I would still suggest that including a concept of services akin to that developed by Shove (2003) would add to this analysis. In particular, it is useful in recognising how practices are interconnected and organised, and thereby co-evolve, with respect to 'regimes' of thermal comfort, cleanliness or connectivity or other socially defined 'needs', conventions or values. This is important as it helps to recognise the roles that various institutions, products, industries and policies *already* play in defining, stabilising or adapting understandings of what is normal and necessary.

Indeed, service-focused policy might include strategies to engage a multifarious coalition of 'stakeholders'. This could be initiated by third sector organisations with support from public funding, or through more direct government programmes, such as with the example of 'CoolBiz' in Japan, which targeted conventional business dress in order to reduce the demand for air conditioning (Shove, 2014; Tanabe *et al.*, 2013). Such approaches foreground a politics of energy demand which energy policy is not accustomed to dealing with. Yet it is likely that achieving any measure of sufficiency, that is, globally equitable living within environmental limits, will require societal re-organisations of some kind. This may not always be easy or attractive. But neither is it an agenda for voluntary sacrifice and disbenefit. Rather than exhorting people to turn down their thermostats or travel less, service-focussed policies would aim to promote a suite of changes to help make these outcomes both more likely and desirable. For instance, if warm jumpers and trousers were to become the default base for fashion ranges over winter, internal air temperatures would likely fall in order that such clothes could be worn comfortably.

In the case of service-based business models, it is important to consider how strategies to manage and reduce service-demand can be included. This is especially true where such enterprises are facilitated by public policy and investment. Such opportunities are likely to vary from case to case. But by paying attention to how such differences in the qualities of energy services are tied into and help to define 'needs' it may be possible to structure energy service provision to take better advantage of this and avoid escalations (or rebound) in service demand. This points to an important role for social research in better understanding the interdependencies and co-evolutionary dynamics of energy services.

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