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Rethinking energy services: The concept of 'meta-service' and implications for demand reduction and servicizing policy

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Abstract

The idea that energy is not consumed for its own sake but for the services that it provides has become axiomatic. However, the implications are not worked through into energy policy nor into most analyses of energy demand. Instead, energy service demand is usually isolated from its dynamic and varied socio-cultural basis, rendering it inappropriately static and neglecting the core quality of usefulness that definitions of 'energy service' share. To address these limitations, this paper revisits and extends a sociological conceptualisation of services, referred to here as meta-services. These are composite and cross-cutting formations of convention, expectation and experience and the means of achieving them. Meta-services are more-than-energy services and are shaped not only through energy consumption, provision and governance but also by a range of other non-energy providers and organisations. This calls for demand reduction policies to engage wider coalitions of service 'stakeholders'. In addition, because energy-services co-constitute meta-services, aspirations to deliver the same levels of service but more efficiently risk entrenching, rather than reducing, levels of service demand. Implications for service-based business models (servicizing) and policies are discussed.

Keywords

Energy services, Service demand, Demand reduction, Servicizing, Meta-services, Thermal comfort

1. Introduction

It has long been recognised that energy is not consumed, or demanded, for its own sake but for the services that it provides (e.g. Lovins, 1976; Reister and Devine, 1981; Shove, 1997; Wilhite et al., 2000; Shove and Chappells, 2001). Accordingly, energy services are usually defined as the useful work that energy does with common examples including heating, lighting and mobility. Given such a broad definition there remains much ambiguity and inconsistency in the way the concept is understood and used (Fell, 2017). This has a number of consequences for carbon reduction strategies and energy policy.

Firstly, the way that energy services are conceptualised matters for how energy demand management and reduction are understood and how future demand scenarios are modelled and anticipated. In particular, there is some, albeit limited, debate about the potential of *service demand reduction* for reducing carbon emissions (Haas et al., 2008; Kesicki and Anandarajah, 2011; Kainuma et al., 2013; Fujimori et al., 2014). Such a prospect recognises the difference between demand for the services that energy provides and the quantities of energy demanded from supply systems (or final consumption). This distinction is also crucial to direct rebound effects, which occur as service demand increases in response to reductions in price from improved energy efficiency (Berkhout et al., 2000; Schipper and Grubb, 2000; Herring and Roy, 2007). In the case of service demand reduction, however, *lower* consumption results from changes in the demand for services, not the energy efficiency of delivering

them. Whilst most often analysed in economic terms, service demand exists and changes through other historical and social processes that give meaning (or usefulness) to those services (Fouquet, 2014; Heiskanen and Pantzar, 1997; Wilhite et al., 2000). Excluding such understandings precludes possibilities for a wider range of energy and carbon policy options (Wilhite et al., 2000; Shove, 1997, 2004, 2010; Shove and Walker, 2014). Yet when focusing on 'what energy is for' it has become more common to study the social practices in which energy is embedded, and how they are organised, vary and change (Shove and Walker, 2014; Hui et al., 2018) than the nature of service demand per se. This paper argues that further elaboration of *services* is of value. Indeed, it is particularly important for broadening debate about the role of service demand reduction within energy policy.

Secondly, the imperative to (re)consider energy services and how they change is highlighted by concerns over the inadequacies of efficiency policy to deliver sufficiently radical reductions in carbon emissions (Herring, 2006; Calwell, 2010; Sorrell, 2015; Shove, 2017). In the UK, current demand management policy is almost exclusively focused on efficiency (Warren, 2014), but these policies fall well short of delivering the required carbon reductions by 2030 (Committee on Climate Change, 2017). This calls for new policies, and potentially new *kinds* of policy. If, as Shove (2017: 8) argues, the challenge of moving beyond energy efficiency measures is to "debate and extend meanings of service and explicitly engage with the ways in which these evolve", then it is crucial to clarify and develop conceptualisations of 'service'.

Thirdly, there is continued interest in the potential of service-based business models of energy provision to reduce resource use and carbon emissions, an idea known amongst other things as servicizing (Plepys et al., 2015; Hannon et al., 2013). Whilst existing Energy Service Companies (ESCos) sell a wide range of 'efficiency services' such as advice, installing equipment, and delivery of energy savings through performance contracts (Bertoldi et al., 2006), there is little sign of movement away from the core business of selling energy, especially in residential markets (Eyre et al., 2009; Plepys et al., 2015). Nevertheless, such a shift in business models, that is, towards selling the functions that energy provides, retains enduring appeal amongst policy makers (e.g. UK Government, 2017) and researchers alike (e.g. Roelich et al., 2015; Plepys et al., 2015). To pursue such an agenda, and to reformulate the ways that energy services are provided requires a clear definition of what those services are (Heiskanen and Pantzar, 1997) and there are different ways to do this.

In responding to the need for greater clarity and development of the concept of energy services, this paper extends a recent review of energy service definitions (Fell, 2017) and revisits a set of ideas first introduced by Shove (2003). A concept of 'meta-services' as more-than-energy services is developed: these are distinct from, but still co-constituted by, the functions of end-use devices and appliances. In contrast to other notions of 'final' or 'end' services (Cullen and Allwood, 2010; Fell, 2017; Baccini and Brunner, 1991) this offers insight into: a) the role of substitutions and re-configurations in how services change, and b) the role of a wide range of 'stakeholders' in shaping meta-services and therefore energy demand. In working through the implications, the paper advances debates on the nature of demand reduction policy and service-based business models. The overall aim is to strengthen and clarify the status of 'energy-services' and 'meta-services' as concepts and as practical points of reference for policy interventions in energy demand. This is an important step towards more serious consideration of service demand reduction policies: in their own right and as part of service-based initiatives.

The paper begins, in Section 2, by reviewing prominent understandings of energy services, and suggests that applications are often inappropriately static and at odds with the central meaning and

value of the concept: that of *useful* work. In Section 3, a conceptualisation of meta-services is introduced that addresses these limitations and offers an important analytical focus for studying changes in demand. Section 4 considers what this signifies for demand management strategies and for the development of service-based business models. Section 5 concludes by reviewing the key contributions to conceptual and policy debates. Throughout, the paper refers to the example of thermal comfort, reflecting a rich existing debate about its status as an energy service (Shove, 2003; Chappells and Shove, 2005; Shove et al., 2008; Nicol and Humphreys, 2009; Nicol et al., 2015; Nicol and Roaf, 2017).

2. At odds over ends? Definitions and limitations of 'energy services'

This section briefly but critically reviews prevalent ways in which the concept of 'energy service' is used and the limitations this brings for understanding energy demand. Despite general agreement that energy services denote the useful and beneficial 'ends' of energy use, Fell (2017) identifies persistent inconsistencies of definition, evident in the diversity of examples given. These range from the common "mobility, washing, heating, cooking, cooling and lighting" (Haas et al., 2008: 4013) to the more specific "cold beverages, warm dishes, conditioned living spaces, comfortable office rooms, commuting to work or sending an email" (Haas et al., 2008: 4012) to the indirect services of producing goods such as "food, tables" (Lovins, 1976: 78) and the generic "four main energy services" of "heat, power, transport and light" (Fouquet, 2010: 6587). Such ambiguity is reflected in the range of energy services specified when analysing energy demand and policy scenarios: 15 categories are used by Reister and Devine (1981), 32 by Kesicki and Anandarajah (2011) and 50 by Scott et al. (2016).

At least some of this variation, and confusion, reflects two meanings of 'energy service' that are, in fact, rather different (Fell, 2017). First is the "useful work obtained" (Sorrell, 2007: 20) when supplied energy is converted by end-use devices into more useful forms of energy like light, heat, sound, motion and combinations of these in the functioning of appliances like washing machines or computers. Second are the "benefits that energy carriers produce for human well-being" (Modi et al., 2005: 9). Accordingly, Fell proposes a definition of energy services as "those functions performed using energy which are means to obtain or facilitate desired end services or states" (2017: 137). Thus, heating (as an energy service) is undertaken for the purpose of thermal comfort (end state), and lighting (energy service) for the purpose of seeing at night (end service). The difference between heating (or cooling) and comfort has already been well recognised and debated (Chappells and Shove, 2005; Nicol and Humphreys, 2009). Materials balance economics also recognises the distinction between services, as the functions provided by particular products, and end services, as the welfare or utility thereby provided; the latter of which might be achieved through other products, resources and means (e.g. Heiskanen and Pantzar, 1997).

However, such higher-order services or 'ends' are both under-conceptualised and routinely neglected when energy services are analysed. For example, in a striking footnote, Haas et al. explain 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" (2008: 4012, emphasis added). In other words, the purpose of journeys, that is, the very *usefulness* of travel itself, is lost from sight. As Jonsson et al. (2011: 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". They observe that services have other dimensions such as content, quality and motivation. It is also clear that light, heat or miles travelled are not inherently useful or beneficial (in fact, may be just the opposite). Thus, although it is important for the sake of clarity to distinguish

between quantifiable end-use functions and the 'ends' achieved, the latter still need to be included when analysing energy services - if the concept is to retain its core meaning as the *useful* work that energy provides. For this reason, the term 'energy service' is used here in a broad sense that encompasses these two kinds of service: the functions produced by end-use devices (denoted by the hyphenated term *energy-services*) and the beneficial 'ends' achieved. But how are these 'ends' to be conceptualised and included within the analysis of energy services?

The concept of final or end services is already familiar in the analysis of energy and material flows. These are categories of consumption that can be achieved in more and less eco-efficient ways, commonly including communication, illumination, hygiene, sustenance or nourishment, mobility or transport, shelter or structure, and thermal comfort (Cullen and Allwood, 2010; Roelich et al., 2015; Heiskanen and Pantzar, 1997; Baccini and Brunner, 1991). Such end services are characterised in various ways (Heiskanen and Pantzar, 1997): as representing or satisfying basic human needs and activities (Baccini and Brunner, 1991; Cullen and Allwood, 2010), standards of living, "desires arising from cultural values" (Nørgård, 2000: 109) or, slightly different again, as "processes and activities receiving service, or being enabled by service" (Jonsson et al., 2011: 363). Despite these differences, there is a tendency to interpret such categories as enduring and universal hierarchies of 'need', desire or function that are always present in some form or must be satisfied in some way. Indeed, Heiskanen and Pantzar (1997: 424) argue that economists and engineers possess "an excessively functional view" of end services that fails to address their "socio-historical dimensions". In other words, these higher-order categories are themselves changing and culturally varied.

Overlooking the socio-historical nature of energy services is a significant shortcoming in the discussion of service demand reduction. In some studies, it is assumed 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: 7232). Whilst this may be true when service demand is conceptualised *only* in terms of the affordability of achieving set ends, it fails to consider how ends themselves may change. Indeed, it is evident that the demand for energy-services does change over time in ways that go beyond 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 transport-services that provide regular home deliveries of milk or coal.

Indeed, in order to provide insight into long-term carbon reduction strategies, Fouquet argues that it is "important to understand how 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*" (2014: 2011 emphasis added). In other words, to address the wider, socio-historical aspects of service change and to avoid treating current levels of service demand as constant, it is important to turn to other disciplines beyond economics. Whilst sociological discussions of the concept of energy services are less prevalent and less recent, they nevertheless contain a range of ideas about higher-order services that are worth re-visiting in order to elaborate the 'useful' and dynamic nature of service demand. The notion of meta-services is proposed in this paper as an alternative interpretation of end services.

3. Meta-services: Changing interpretations and organisations of 'need'

Anthropologists and sociologists investigate service demand by asking "how energy intensive ways of life become normal, and of how energy demand is embedded in society" (Wilhite et al., 2000: 117). To date, the "social science of energy service consumption" (Wilhite et al., 2000: 115) remains a loose

body of work, most of which has more latterly become known as the 'social practice theory' approach to energy demand (e.g. Røpke, 2009; Gram-Hanssen, 2011; Shove and Walker, 2014). In this, practices are foregrounded, and services no longer feature as a central or generative concept for analysing ways of life. This was not always the case. As Shove (2003) notes, the challenge of understanding why "conventions of comfort and cleanliness are on the move" and how the "collective restructuring of expectation and habit" takes place "means thinking about the definition and appropriation of *services*, rather than discrete objects" as well as "trying to understand both the convergence and divergence of everyday *practice*" (2003: 4, emphasis in original). Importantly, the kind of services referred to here are not end-use energy-services but something more expansive.

In this paper, the term 'meta-service' is used to refer to this more expansive conceptualisation of services, which has been developed in detail by Elizabeth Shove (2003) in her book *Comfort, Cleanliness and Convenience: The Social Organization of Normality.* Informed by the research of Wilhite and colleagues (e.g. Wilhite et al., 1996: 803) into the 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 conventions, expectations and habits change together. In doing so, she foregrounds the "social conditions and circumstances in which needs are defined" (Shove, 2003: 6). The notion of services plays a central role: 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: 166). Services themselves are defined as "composite accomplishments generating and sustaining certain conditions and experiences" (Shove, 2003: 165).

The term 'meta-services', not used by Shove (2003), is derived from Wilhite et al. (2000: 115) who suggest that such services are best thought of as "meta-energy services". It is appropriate to remove the referent to energy altogether since these kinds of service do not always depend upon supplied or artificial energy. "Meta" denotes that such services are *more-than-energy-services.* It speaks to "the achievement of 'higher level' enterprises like those of constructing a cosy home or welcoming environment" (Shove, 2003: 164), involving much more than a single product or practice like cleaning or shopping. Rather, 'meta-services' are useful or beneficial conditions and experiences that depend upon and emerge through multiple, interacting kinds of service, including those realised through human labour, through non-energy using products (such as books, foods, furniture, building structures) as well as energy-using devices and systems. This 'combinatorial' character of end services has been well recognised in the eco-services literature (e.g. Heiskanen and Pantzar, 1997), but to a lesser extent in discussions of energy services (e.g. Jonsson et al., 2011).

Shove (2003) also refers to the qualities of services, and more general facets of everyday life, through the term 'concepts of service'. Thus, on the one hand, services denote distinctive nexuses of expectation, experience and organisation that can be labelled as comfort, cleanliness and so on. On the other hand, interpretations of service, as what is normal and necessary, permeate throughout everyday life but may not always cohere around a single, salient rationale according to which things are ordered. In this sense, it may be tempting to think of 'concepts of service' as *only* conceptual: perhaps as elements of meaning shared by several practices (Shove et al., 2012), as cross-cutting and extended general understandings (Schatzki, 2002; Welch and Warde, 2016) or as teleo-affective formations (Welch, 2017). For the purposes of this paper, however, it is assumed that 'concepts of service' can for the most part be associated with salient integrating notions, like comfort, and that these meta-services are not only conceptual but also exist through modes of provisioning, doing and

a range of interacting processes that *more or less intentionally* subtend related experiences and conditions.

Meta-services therefore refer to systemic formations that are organised (or otherwise emerge) across systems of provision and consumption: "services have to do with the orchestration of devices, systems, expectations and conventions" (Shove, 2003: 165). The concept of meta-services thereby calls attention to how "suites of technologies operate together" (Shove, 2003: 60) in a "blend of method, meaning and hardware" (2003: 166) to "co-constitute[s] the collective conventions of everyday life" (2003: 60). In summary, meta-services are composite formations of convention, expectation and experience *and* the means of achieving them.

This may not be an immediately intuitive concept: meta-services are not discrete or tightly bounded entities, and they differ from other connotations of service as that *directly provided* by someone or something to someone else. In the next two subsections, the paper elaborates why it is worth developing this concept, in particular, for the insight it brings to the relationship between energy-services and 'ends'. Whilst much of this is implied in Shove's (2003) account, the following contributes an explicit discussion of the implications for understanding end-use energy-services and the demand for them.

3.1 Means and ends constitute each other

In contrast to other ways of thinking about end services, energy-services are not simply interchangeable means for delivering independent, pre-existing ends. Rather, the energy-services provided by end-use devices are part of the arrangements through which meta-services are organised and emerge; they help to define what those ends (or 'needs') are and how they are experienced. At the same time, the way that ends are experienced and understood shapes the design and use of end-use devices, and thus energy-services. Thermal comfort provides a good example of this iterative, co-evolving relationship.

Commentators argue that, in many ways, the concept of comfort itself has come to be defined by the technological means of delivering it. For instance, Shove (2003) describes how a lab-based scientific definition of comfort, as experienced probabilistically within specified parameters, was achieved for the purposes of standardising the operational requirements for automatic air conditioning and heating systems (Fanger, 1970). Yet once comfort is specified in this way, as universal and bounded by restricted parameters, heating and cooling systems become the only means to deliver it throughout the seasons, in most buildings and in most climates. In turn, this definition came to define global standards for building management and design, instituting an interpretation of thermal comfort as something provided by heating and cooling systems, including within the very fabric of many buildings (Cooper, 2002; Shove, 2003; Chappells and Shove, 2005; Nicol and Humphreys, 2009).

Over time, similar concepts of comfort may also be reproduced through everyday practices that co-evolve alongside central heating and air conditioning systems: that is, thermal comfort can *be experienced and understood* as being provided almost exclusively by these technologies. Studies have shown how some people directly attribute their feelings of thermal comfort and discomfort to heating systems, apparently ignoring the contributions of other 'means' of achieving comfort, such as clothing (Morley, 2014). This suggests that concepts of comfort are conditioned by the technological means available to provide for them, as well as arrangements like styles of dress, and the practices that affect where people spend time (Kuijer and Watson, 2017). Therefore, comfort is not simply a pre-existing end for which heating and cooling technologies were developed and thereby became immediately

'useful'. As Heiskanen and Pantzar (1997: 426) note "products are not only simple responses to existing problems and needs" but also produce and transform needs as they are used. Indeed, "something must have changed in everyday life for these new technologies to *become of use* to large numbers of people" (Kuijer and Watson, 2017: 78, emphasis in original). In other words, ends co-evolve with means, through an iterative process of co-constitution between energy- and meta-services.

This explains why common understandings of higher order categories as long-standing, universal human needs are inappropriate. To take another example, new 'needs' for communication emerge and co-evolve alongside new means, as in the way that internet technologies have incrementally come to be seen as necessary for most households in order to participate in normal, social activities (Walker et al., 2016). This is not simply an expression of a fundamental human need to communicate, just in a new form. Rather, it is a specific form of necessity that took time to evolve as online services became more central to participation in a wide range of practices (Røpke et al., 2010).

The process of co-evolving 'ends' and 'means' is also significant for energy policies that aim to substitute more energy efficient means for existing ones in order to reduce final consumption. As Shove notes "technological developments that improve performance on one dimension often have consequences for other features, meaning that more efficient solutions are almost always *different* (in some respects) from those with which they are compared" (2017: 3, emphasis in original). It is not only aspects of energy-services that differ but also the related meta-services. For instance, 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 temperatures or even for air conditioning (Gram-Hanssen et al., 2012). That is, the introduction of more efficient, alternative heating and cooling technologies can underpin the emergence of different expectations and experiences of comfort.

3.2 More-than-energy services

It is already well recognised that so-called 'energy' services are dependent on other kinds of products, infrastructures, and 'inputs', such as labour, and not just energy-using devices themselves (Haas et al., 2008; Sorrell, 2005; Jonsson et al., 2011; Roelich et al., 2015). However, the implications of this have not received much attention beyond debates about thermal comfort. In this literature, the concept of adaptive comfort recognises the contributions of the weather, adjustable ventilation, clothing and of understandings of how to warm up or cool down (Nicol and Humphreys, 2009; Nicol et al., 2012). The concept of meta-services can highlight further insights, again readily illustrated with reference to comfort.

Firstly, although widespread recognition of the multiple 'means' of comfort is evident in the controversial advice to wear (extra) jumpers in the winter instead of turning up the thermostat (Wintor, 2013), the idea that clothing can simply *substitute* for heating fails to recognise that both are ingredients of contemporary configurations of comfort and exist in relation to one another. Changing the balance of ingredients, that have co-evolved over time, changes the kind of comfort that is achieved. For instance, there has been a trend towards more casual, lighter dress in the West, both in winter and summer. Not usually understood as improvements for the sake of *thermal* comfort, these trends are associated with a range of other meta-services, like style, cleanliness and other forms of physical comfort. But over the last 50 years, in the UK, they have nevertheless transpired in the context of increasingly widespread and affordable central heating systems, and rising indoor temperatures,

which have plausibly influenced the kinds of dress worn today, including the apparent exclusion of thick, woolly jumpers as a normal and acceptable way of dressing (Morley, 2014).

Thus, although clothing is exceptionally important in shaping and reducing energy demand, meta-services like comfort do not represent simple points of substitution between existing 'means'. They are better understood as nexuses of the co-dependence and co-evolution of relevant 'ingredients'. Not all ingredients are intentionally *about* thermal comfort. Rather, comfort emerges at the intersection of many contributors and detractors, such as illness, emotional experiences and weather conditions. To conceptualise comfort as a *more-than*-energy service helps to foreground these non-energy and non-comfort constituents.

Secondly, whilst it is true that the "end-user provides a point of integration for infrastructure streams since certain services (e.g. hygiene and mobility) require a combination of infrastructure networks" (Roelich et al., 2015: 42), this is not the only form of integration that constitutes and defines meta-services. For instance, builders and building managers, heating engineers, clothing makers and retailers are also implicated in bringing together, sustaining and transforming understandings and ways of 'doing' comfort. Therefore, it is not only "end-users who set the level of demand" (Roelich et al., 2015: 41) but also other 'stakeholders' who, intentionally or otherwise, contribute to definitions of meta-services and also benefit from them (such as through profit).

Thirdly, whilst it has long been argued that "asking how demand is made, constructed and sustained, we are drawn, like it or not, into an analysis of inter-dependent practices of producers, providers, utilities and governments" (Wilhite et al., 2000: 118), the account of meta-services developed here makes it clear that it is not just energy-providers and energy-based forms of governance that are relevant. For instance, the clothing industry is also a provider *for* thermal comfort, and thereby contributes to the demand for heating and cooling services (Morley, 2014). Clothing styles imply certain conditions if they are to be worn comfortably, so they can also form a point of intervention in service demand. This potential role for the clothing industry in managing and reducing energy demand goes beyond the promotion of warmer jumpers or underwear to re-thinking whole styles and material qualities of clothing.

4. Implications for demand reduction and service-based business models

In practical terms, the concept of meta-services brings with it at least three key insights which have implications for how energy services, in the broad sense, and energy demand are represented in policy. Firstly, it positions demand for energy-services as an outcome of meta-services and how they are organised. Secondly, this implies that service demand reduction and management is a question of reconfiguring meta-services to demand less from energy-services. Thirdly, because energy-services co-constitute meta-services this prospect is not *simply* achieved by substituting more energy efficient 'means' to deliver the same 'ends': instead, such attempts may unwittingly redefine concepts of meta-service in ways that have unintended consequences for service demand. Together, these insights have implications for a range of policies and initiatives that aim to reduce the carbon emissions associated with energy, including servicizing and energy demand management strategies.

4.1 Selling services: But what kind?

Energy Service Companies (ESCos) have been operating in industrial and commercial markets for several decades, and are thought to offer significant energy savings (Fang et al., 2012) by providing an agreed level of performance or 'service' to customer organisations whilst taking on projects to reduce

the energy used (Sorrell, 2007). Policies to extend this approach beyond large organisations, for example the EU energy efficiency obligation schemes, have encouraged energy providers to implement a range of energy efficiency services, such as fitting insulation. But for the most part, the core business model of selling units of energy remains dominant, especially for residential markets (Bertoldi et al., 2006; Plepys et al., 2015).

However, the UK Government (2017) remains "committed to supporting on-going development of the energy services market to help the UK use less energy, support improvements in business productivity, and help consumers to save money." Specifically, it hopes that smart technologies in combination with low-carbon heating systems will enable new energy service business models. In 2017, the Department of Business, Energy and Industrial Strategy (BEIS) invested £9.8m in a pilot programme (Smart Systems and Heat, Phase 2) with the aim of "building the foundations for innovative energy service business models, encouraging a new generation of energy service providers and testing new offers for British households" (Catapult Energy Systems, 2017). It is not yet clear what kinds of services this will involve, but Ofgem, the UK energy industry regulator, speculates that "consumers might just as easily pay to have their thermostat maintain temperatures within predefined parameters, with the supplier having the freedom to choose the most efficient way of doing so" and that "Consumers may also choose to buy their energy in a bundle along with other services such as telecommunications" (Ofgem, 2017: 12).

In academic debates, too, there is an enduring appeal in the idea that service-orientated or performance economies will reduce energy demand as well as carbon emissions associated with other material flows (Plepys et al., 2015; Steinberger et al., 2009; Roelich et al., 2015; Mont and Tukker, 2006). This is despite concern over the eventual environmental benefits (Heiskanen and Jalas, 2003) and interest from consumers (Tukker, 2015). Some authors have recently argued for a service-oriented approach to infrastructural provisioning that recognises the joint roles of multiple utilities in delivering domestic services (Roelich et al., 2015; Knoeri et al., 2016). They propose the idea of Multi-Utility Service Companies (MUSCos) that consist of "a single organisation or a coalition of several different entities (including local authorities, technology providers and maintenance providers)" (Roelich et al., 2015: 41). This extends the idea of the ESCo beyond energy thereby challenging separate regimes of regulation, and recognising potential to re-organise the efficiency of how services are achieved across utilities. This depends on "selling 'services' (such as thermal comfort, illumination and cleanliness), which can be defined as the ultimate goal of the product or utility purchased" (Roelich et al., 2015: 42).

From the discussion of meta-services in this paper, however, it becomes clear that the ambition to sell services is not so straightforward: it requires careful attention to multiple types of service and their dynamics. Firstly, meta-services like comfort and cleanliness are very different from the energy-services provided by heating systems and washing machines. For instance, whilst it is technically possible to provide levels of heating or cooling service within pre-specified contractual parameters, this is not the case with comfort. Since comfort depends on a diverse range of 'ingredients' across multiple systems of provision (clothing, diet, activities, furnishings and so on) even coalitions of utility companies and housing providers may find it impossible to orchestrate and re-negotiate such diverse configurations in more efficient ways. In other words, it is misleading to expect that comfort *itself* is the kind of service that can be *directly* provided.

Secondly, the undertaking to provide services, even energy-services, in itself risks sustaining energy-intensive concepts of service (Shove, 2003; Chappells and Shove, 2005; Shove, 2017). This is because

the provision of a service depends on defining and then providing certain aspects or indicators of that service. This not only assumes that such indicators *should* be stable over time (an inappropriate assumption given the argument herein that meta-services are dynamic) but also works to actively make sure that this is the case, i.e. that the *same* recognisable service *is* delivered. Even where more energy-efficient arrangements can be made (for example, with a new technology) this might stabilise concepts of service that would have otherwise changed in less energy-intensive directions (for example, by reinforcing the necessary status of energy-using technologies to meet particular ends, such as relaxation, and the character and status of those ends themselves).

Thirdly, and relatedly, even though business models aligned to the sale of energy-services such as heating or lighting may incentivise more efficient provision, they do not address energy-service demand. That is, efficiency improvements to energy-services (as that which is actually being sold) do not necessarily apply to meta-services, which may adapt in ways that result in greater demand for energy-services. The literature on rebound effects amply illustrates this problem. Indeed, would it not be in the interests of companies selling energy-services to sell 'more' of them?

In sum, although the re-organisation of economic exchange around services instead of units of energy may be helpful in managing demand from large organisations, particularly during peak loads, there are reasons to be cautious about wider implementation and the prospects for overall demand reduction. Careful thought is required as to how service-based business models could include ways to directly engage with the demand for energy-services: be it with a goal of reducing demand, ensuring that demand does not escalate, or making explicit the role of other 'stakeholders'. Indeed, given the apparent limitations of directly *selling* either kind of service (meta- or energy-), other ways to incentivise collaborations between the 'stakeholders' who *already* provide many of the other ingredients of meta-services should also be explored.

4.2 Reducing demand, managing meta-services

If energy demand is an outcome of configurations of meta-service, then managing and reducing energy demand is not just a question of energy efficiency, but of shaping how meta-services are defined, organised and change over time. If, as suggested above, this involves an array of non-energy 'stakeholders', how might such roles be identified and fostered?

In the first instance, whilst device manufacturers may already be recognised as 'tertiary actors' in delivering services (Steinberger et al., 2009) their roles are not limited to device efficiency; they also already contribute to shaping the meta-services to which their products contribute. For example, marketers often attempt to extend and re-articulate concepts of service for which their products can then become 'essential'. For instance, Strengers and Nicholls (2017) study the ways that 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'.

Providers of products and services that do not directly use energy also construct and specify the qualities of meta-services. In the case of comfort, warmer fashions need not be achieved through an explicitly 'thermal' or energy-related campaign: designers, manufacturers and major retailers might co-ordinate to subtly steer adjustments in the kind of clothing that is considered normal to wear in winter. They have the 'power' to do this because, in a way, they have already achieved the opposite; over decades they have helped to normalise lighter winter clothing.

Such explicit recognition of the shared responsibility that diverse product and service providers play in creating and sustaining energy demand beyond their own organisational boundaries might be achieved through corporate social responsibility mechanisms. For example, it might be possible to include 'external' energy demands, associated with the meta-services to which companies contribute and benefit from, within lifecycle assessments of business operations. Alternatively, these responsibilities might be enacted through involvement in cross-cutting initiatives or campaigns. For instance, supermarkets in the UK have been involved in efforts to reduce domestic food waste because they accept that the food industry is primarily responsible for the problem, even though it manifests in homes (Evans et al., 2017). Similarly, shared narratives of '(un)sustainable fashion' could be extended to include concern for the heating or cooling costs that are incurred by customers when wearing particular styles. In other words, there is potential for demand reduction policies to recognise and leverage existing roles in (re)orchestrating and (re)defining meta-services, and help foster new ones.

5. Conclusions and Policy Implications

If the widely-stated and important insight that energy is consumed not for its own sake but for the services it provides is to be more fully reflected within energy policy, it is important to clarify and develop thinking as to what energy services actually are. This paper contributes a rethinking of energy services: it has reviewed the ways in which the concept is typically mobilised and has revisited and extended a sociological conceptualisation of services (as meta-services). It then examined the implications of this idea for policies and interventions in energy demand and provision, revealing tensions in servicizing initiatives and highlighting avenues for different kinds of demand-side policy that engage coalitions of service 'stakeholders'. Overall, it argues that since energy demand is an outcome of configurations of meta-services that managing and reducing demand is a question of shaping how meta-services are defined, organised and change over time.

As with practice theoretical approaches (Shove, 2014; Shove and Walker, 2014; Strengers, 2012) this proposes a way of thinking about demand management and reduction that shifts focus away from both the end-user (no longer the sole originator of service demand) and energy efficiency. Yet it also complements practice-theoretical analyses by providing an alternative point of connection between multiple practices and material arrangements, contributing to how they are organised, interact and hang together.

In addition, the paper contributes a cautionary note for those working with the concept of service efficiency, or eco-efficient services (Nørgård, 2000; Jonsson et al., 2011; Heiskanen and Pantzar, 1997; Hinterberger et al., 1997; Baccini and Brunner, 1991). Since adjustments in the means of achieving meta-services constitute change (however subtle) in the way they are defined, it is unlikely that major reconfigurations of meta-service could deliver the *same* service in any meaningful way. Thus, rather than improving the *efficiency* of meta-services (which retains the connotation of delivering the same service for less resource throughput); a more appropriate description might be meta-service *transformation*, such that they become less *dependent* on energy-services.

In policy terms, this calls for greater attention to be paid to service demand management and reduction strategies, as a part of carbon reduction and energy policies. To date, research into service demand reduction per se has been limited to studying the effects of price and income (Haas et al., 2008; Kesicki and Anandarajah, 2011; Kainuma et al., 2013; Fujimori et al., 2014). Yet there is a broader discussion of service demand reduction to be had; one that also draws insight from social and

historical processes of change. In the first instance, it is worth investigating how socio-historical trends might inform service demand scenarios that could be included within energy and carbon models (e.g. Tyfield et al., 2016).

Another starting point is with policies that already seek to facilitate the provision of energy- or meta-services, including the development of an energy service market. One practical concern here is how include strategies to manage or reduce service demand within service-based business models (since this is not inherent to these approaches, as might be assumed). Such opportunities are likely to vary from case to case. For instance, research shows that users of car sharing services tend travel more selectively than car owners (Heiskanen and Jalas, 2003). By paying attention to how such differences in the qualities of energy-service 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. In the case of ESCos, this might include flexibilities within the parameters of contracted services to reflect ambient temperatures or re-contracting in the case of building extensions or changes in occupancy.

The paper also calls for further debate on strategies to engage a multifarious coalition of 'stakeholders' who, in combination, already provide for many of the 'ingredients' of meta-services, and thereby shape and specify their characteristics. As this would involve parties who are not commonly considered within the scope of energy policy, such programmes might be best initiated by third sector organisations, with support from public funding. For instance, in the UK an organisation called WRAP works extensively across different sectors, including supermarkets, to reduce material waste. However, programmes like 'CoolBiz' in Japan, which targeted conventional business dress in order to reduce the demand for air conditioning, also indicate the potential for governments to initiate policies and programmes that extend beyond narrow 'energy' remits to the broader issues, such as how people dress (Shove, 2014; Tanabe et al., 2013; Tamura, 2007).

Before concluding, it is worth re-emphasising one final point: that it is possible for policies to engage with an agenda of service demand reduction without reducing wellbeing or quality of life. This is because meta-services, which articulate these ideas, are not the same as energy-services. Whilst reductions in quantifiable levels of energy-services, and the demand for them, implies some change in meta-services and how they are organised, it does not necessarily mean dis-benefit or 'lower' standards of wellbeing, as some might suggest. Service-demand reduction policies should therefore be considered as a serious goal for energy policies, even if that requires a re-thinking and extension of current policy remits. To this end, it is important to maintain a broad definition of the concept of 'energy services' that is cognisant of *both* meta-services and energy-services and their relation.

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