

Entangled practices: governance, sustainable technologies, and energy consumption

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Abstract

In this paper we provide a timely account of how sustainable technologies become entangled with cultural practices and thus co-evolve, influencing energy consumption. In doing so, we critique the approach current UK policy takes towards energy renewal and carbon reduction. We investigate the effectiveness of the social housing sector's efforts to implement environmental policy initiatives that uses a technology-driven approach. By looking at how social housing residents consume energy as part of domestic practices, we identify tensions between strategies to influence energy consumption by a housing association, and the ways residents incorporate sustainable technologies into everyday practices. Our findings reveal how sustainable technologies become enrolled in established practices; residents creatively develop novel routine strategies to accommodate new technologies to their daily routines. We contend that policy efforts to engender 'behaviour change' through a technology-driven approach have limitations. This approach ignores how practices become entangled, affecting energy consumption.

Keywords

Energy consumption, environmental sustainability, governance, practices, technologies

Introduction

In the UK nearly thirty per cent of energy consumption and carbon emissions are attributed to the residential sector¹. Current UK policy recommends the installment of sustainable technologies (e.g. solar thermal panels), which are designed to help energy and carbon reduction, into homes. Yet, the story does not end here. In order for the sustainable technologies to deliver on their promise of energy renewal and carbon reduction, the technologies require particular forms of use by residents, but the process of user-technology interactions is not straightforward. Current policy asks that individuals 'simply' change their behaviours in accordance with the characteristics and requirements of the technologies. In doing so, policy makers place responsibility for environmental outcomes on households by making environmental sustainability a matter of individual choice (see Webb, 2012). We argue that such an approach is partial and simplistic; it ignores (a) practices of routine domestic consumption, as well as (b) the actions of actors involved in energy infrastructure provision and policy implementation (see Barr et al., 2011; Shove, 2010; Spaargaren, 2011; Webb, 2012). Heading Spaargaren's (2011) call for research into the relations between consumption practices and sustainable technologies, we take these two points as our focus of analysis to investigate how energy is consumed as part of everyday domestic practices that engage with sustainable technologies, and consider the effectiveness of efforts to implement environmental policy initiatives that uses a technology-driven approach. In doing so, we examine tensions between performing and governing practice, focusing on how practices are constituted, conducted and transformed.

In 2006 a UK government policy called the Code for Sustainable Homes was launched as a building standard to tackle environmental sustainability issues such as energy security, resource scarcity and environmental impacts of activities that contribute to increased levels of carbon dioxide from domestic arenas (DCLG, 2006a).² The Code's target is to make all new built homes 'zero carbon' by 2016, with a 25 per cent improvement in energy use before 2010 and a 44 per cent improvement by 2013, against the 2006 Building Regulations (Part L). Pressure to comply with the Code is significant in the social housing sector because housing schemes require Code certification as part of the conditions set by the funding agency in order to qualify for grant subsidy. Furthermore, local authorities often set a minimum Code level in planning conditions for future builds. The installation of sustainable technologies is one recommendation made by the Code. A zero-carbon home is defined as a home with zero net emissions of carbon

dioxide from all energy use (ibid.). This definition encompasses all cooking and electrical appliances, as well as all those energy uses that are currently part of building regulations, such as space heating and hot water (DCLG, 2006b). The home is thus a prime site for policy interventions.

Actors seeking to operationalise policy initiatives to alter individual behaviour deal with energy reduction as a matter of 'pro-environmental' consumer choice (Wilhite, 2008: 122). In doing so, they promote a technology-driven discourse by focusing on the implementation of technologies (e.g. photovoltaic cells) within domestic spaces, which look to intervene in and encourage energy-saving behaviour. In these approaches, firstly, the consumer is cast as an 'isolated rational individual' (Winch, 2006: 32; see also McMeekin and Southerton, 2012) whose practices are supposedly objective and neutral and thus open to intervention and governance (Webb, 2012: 113). Much criticism has been levied at this model. For example, technology is frequently held by policy makers as the 'magic bullet' to environmental problems, which 'fails to engage with the big questions of what our needs are and how they are constructed and reproduced' (Shove, 2004: 1053; see also Slater, 1997). Secondly, these approaches side-line questions of collective responsibility for energy reduction, which allows 'governments to treat the operations of markets and corporations per se as "above" or "outside" the societal frame of reference' (Webb, 2012: 111). By reducing society to the 'sum of rationally self-interested individual choices' (ibid: 113) a range of actors affiliated to government efforts to affect energy consumption, as diverse as energy providers and housing associations, are excluded from consideration. As Spaargaren (2011) argues, this is inherently problematic because the consumption of energy is invariably achieved through the social and material infrastructures through which energy is provided.

In line with these arguments, we examine how a key actor responsible for implementing UK environmental policy – a social housing association – promotes normative assumptions about use through the implementation of policy-recommended sustainable technologies. We focus on how these assumptions are operationalised by housing association professionals to encourage 'pro-environmental' practices by residents. To better understand how these technologies affect residents' domestic energy consumption, we then investigate how residents adapt to the sustainable technologies and creatively manage their routines.

From our empirical analysis we identify tensions between strategies mobilised by the housing association to influence technology use and energy consumption, and the incorporation of sustainable technologies as part of everyday practices by residents. Our findings reveal how

sustainable technologies participate in the performance and transformation of established practices, as residents creatively developing new routine strategies to incorporate those technologies and to juggle activities. The socio-cultural conditions of residents' home lives with the use of sustainable and mundane technologies affect how practices are performed and then become entangled. Energy is consumed in those complex entanglements of practice. We conclude that by ignoring these tensions and practices, current environmental initiatives that promote a technology-driven view to influence energy consumption exclude fundamental considerations about routine practice and the pervasive effect of social and technological relationships on energy consumption.

Technology use and social practices

There exists a substantial body of work now widely referred to as the 'social practice' approach to energy consumption (see Shove, 2003; Spaargaren, 2011; McMeekin and Southerton, 2012; Southerton, 2006) that brings back into the debate questions of how routine practices develop and change, since it is through the conduct of practices that energy consumption occurs (Wilhite, 2004). Addressing these questions, researchers advocate a shift from the analysis of technological efficiency to that of 'socio-technological' relations and practices, which encompass the practices of both users *and* producers inclusive of material infrastructures and technologies that shape how energy is consumed (e.g. Guy, 2006; Shove, 2004, 2006; Southerton et al, 2004; Spaargaren, 2011; Wilhite, 2004, 2008). The emphasis here is therefore less upon the provision of consumer choice, than an understanding of how different actors' practices and technologies co-develop to shape energy consumption.

Current energy reduction strategies continue to frame consumption as a rational and static matter of deciding to act in ways that induce environmental benefits (McMeekin and Southerton, 2012: 346). For example, housing associations put into practice these strategies by encouraging so-called 'correct' technology use by households and adopt methods such as the provision of information (e.g. instruction manuals) or incentives such as price to affect behaviour, methods promoted by environmental policy (e.g. 'Code for Sustainable Homes').

With the prevalence of such rational-choice approaches, a focus on how routine practices are influenced by different actors is imperative. Indeed, technologies are used differently to carry out daily practices, such as cooking. As Wilhite (2005: 1) argues, 'energy is of little use in and of itself... it must be converted... before it becomes transformed into something useful'. With this understanding, much of current research shows how *mundane* technologies play a pivotal role in shaping everyday practices through which energy is consumed (see Shove, 2003; Wilhite,

2008). To account for the growing popularity of showering and its association with convenience and speed, Hand et al. (2005), for example, identify different elements that constitute showering practice: infrastructural (e.g. plumbing, electrification and hot water provision), appliance and technology (e.g. power-showers), moral (e.g. notions of cleanliness and hygiene) and temporal (e.g. organisation of time and daily schedules). There is, however, little research that looks at the interrelations between practices and both sustainable and mundane technologies. The prevailing research suggests that residents may develop local strategies to manage energy supply and demand by adapting their practices to sustainable technologies, such as photovoltaic cells (Chappells and Shove, 2004: 139). Or, people might not use sustainable technologies in ways intended by their producers, and hence not generate the sustainable outcomes anticipated by environmental policy (see Ozaki et al., 2013). To understand how energy is routinely consumed we need to examine how practices are mutually configured by both sustainable *and* mundane technologies, whilst carrying out activities and conducting relationships.

Heading this call, we focus on the socio-technological relationships that arise between residents and sustainable and mundane technologies in 'doing' practical activities (Schatzki, 2001: 3). In this perspective, the effects of technologies emerge 'from a combination of persons and materials' (Barry, 2001: 11). According to Reckwitz (2002: 249-50), 'a practice – a way of cooking, of consuming, of working... of taking care of oneself or of others etc. – forms so to speak a 'block' whose existence necessarily depends on the existence and specific interconnectedness of these elements [e.g. practices such as cooking and showering], and which cannot be reduced to any one of these single elements'. This notion of practices being interrelated, and thus inseparable from one another, is echoed in Shove and Walker's (2010: 476) observation that 'patterns and practices of daily life interrelate, erode and reinforce each other'. Despite such theorisations, empirical accounts of the interrelations between practices are significantly lacking. Addressing this, we focus on the performance of practices with regards to the 'sphere of culture' (Pickering, 1995: 4) in which they are both situated and constitute. Pickering describes the 'sphere of culture' as comprising: skills, social relations, technologies and concepts/knowledge; where practice is conceptualised as 'the work of cultural extension' (ibid.: 3). We attend to the conditions and means surrounding how practices become interrelated, considering how sustainable and mundane technologies participate in this process shaping activities, and vice versa. In doing so, we do not consider technologies in isolation, but as active in practical activities (Barry, 2001: 11). With people, technologies and practices are mutually constitutive (see Barry, 2001; Pickering, 1995; Reckwitz, 2002; Schatzki, 2001) in shaping activities and energy consumption. This raises pertinent questions about how residents adapt to sustainable technologies, which can disrupt and alter established routines. How do residents'

interactions with sustainable technologies match up to normative notions of 'correct' use promoted by policy and housing association professionals? What consequences does this have for how practices become interrelated and energy is consumed?

Methodology

We have collaborated with a large social housing provider in South East England and the case study site is located in South East London and consists of 80 terraced houses. It is part of a large urban regeneration site; those living on the housing scheme have moved from an estate that was made up of tower blocks built in the late sixties and early seventies. Residents were not billed individually for the consumption of water, gas and electricity, but paid a fixed amount each month that was included as part of their rent. In contrast, their new homes are terraced houses with solar water heating and heat recovery ventilation systems. Residents are billed individually according to the amount of water, gas and electricity they use. The mechanical ventilation for heat recovery system exchanges stale air for fresh air and recovers heat in the process; and the solar water heating system uses heat from the sun to warm domestic hot water. The aim of these technologies is to reduce energy consumption from heating water and space, which accounts for half of all thermal energy consumption in the UK (Hawkes et al., 2011: 2), and to ultimately reduce carbon emissions.

This study has two parts: interviews with (a) social housing professionals and (b) residents. A detailed information sheet was provided to each participant before the interview explaining the aims of the project: that the interview was voluntary and anonymous, and that they could withdraw from the project at any time. All interviews took between 30 and 60 minutes, and were recorded and fully transcribed. The interviews were coded openly and analysed thematically to capture emerging themes (Thomas, 2006).

The first strand of research comprises 20 semi-structured interviews with professionals working for the housing association between June 2010 and August 2011. Each professional was a 'front-line' actor involved in the design, management or maintenance of housing schemes developed under the directive of the UK government's policy – the Code for Sustainable Homes. These actors included: architects, a building contractor, development managers, a community re-generation officer, maintenance managers and council employees. Interviews were carried out in two phases. Interviews were gained with the assistance of actors working for the housing association.

In the interviews we explored how different professionals operationalised the Code through the installation of sustainable technologies, examining diverse engagements with these technologies. As part of this line of questioning, we enquired into how residents were introduced to sustainable technologies within the home, and how certain forms of use were encouraged by the housing association. Interviews with professionals working in direct relation to the case study are referenced for our analysis.

The second strand of our research is a study with residents consisting of overall 24 in-depth face-to-face interviews with eight households from January 2011 to April 2012. Interviews were carried out in three stages: (1) a few months after moving into new properties (January-February 2011); (2) nine months later (October-November 2011); and (3) subsequently five to six months after the second interviews (March-April 2012). Repeat interviews allowed us to establish a rapport with the residents and gain an in-depth understanding of the routine practices and strategies developed by residents to manage these technologies, their everyday lives and energy consumption over a sustained period of time. Due to issues of confidentiality, the collaborating housing association made initial contact with the residents to see if they were willing to participate, using our introductory material that summarised the aims and conditions of the study. Thereafter we led the recruitment process. The eight households interviewed consisted of first-generation immigrants from Vietnam (1), China (1), and Africa (5) as well as a household from Britain. Their cultural backgrounds and daily practices vary. Details of their profiles are presented in Table 1. Interviews were conducted in their homes and residents were encouraged to discuss how they carried out their everyday routine activities and engage with the sustainable technologies.

[Table 1. about here]

Governance and normative assumptions about sustainable consumption

‘Government presents its role as acting through multiple stakeholders in public, private and third sectors, resulting in an image of an individual consumer targeted by a dense network of complex institutional actors, each seeking to re-channel the choices of the self-interested consumer into a calculus of carbon reduction’ (Webb, 2012: 114).

Diverse actors are involved in the enactment of environmental governance seeking to affect individual behaviour. The social housing association is a key organisation that implements government environmental strategies by installing and encouraging ‘correct’ use of

sustainable technologies. The development of social housing needs to demonstrate the potential for its buildings to achieve targets of carbon reduction and energy renewal set out by the Code to meet funding and planning criteria. In the analysis that follows, we identify three strategies mobilised by the housing association that look to disseminate and implement assumptions about the consumption of energy and the conduct of everyday life: what is 'good, normal, healthy, efficient and profitable' (Miller and Rose, 2008: 55), which are closely tied to technology use. Specific forms of knowledge about technology use and energy consumption are promoted. In attempts to achieve this, the housing association adopts a rational-choice model firmly grounded within a technology-driven discourse: choice and education are two approaches used to try and engender environmental 'behaviour change' through the use of technologies.

Technological determinism: 'do not switch off!'

To 'educate' the residents about how to use sustainable technologies and reduce the consumption of energy, leaflets are given to residents informing them that the technologies are 'energy efficient'. For example, the housing association's booklet states that solar panels will 'help reduce the amount you pay for hot water'. Sustainable technologies are positioned as the primary means through which environmental change occurs. Efforts to try and ensure technological efficiency include applying stickers and signs to switches that inform the residents not to turn off the solar panel and air ventilation systems:

We did make little stickers saying 'do not... switch off' and stuck it over the socket hoping that they [residents] wouldn't. Most of them haven't, but some of them did have the mentality that if it's a switch it needs to be off otherwise you're paying for it... With the solar panels... if they just left the system running they wouldn't pay for the hot water. In the summer certainly not pay for it, and in the winter probably...half and half. (Housing Development Officer)

This approach promotes the view that sustainable technologies alone will produce the desired environmental effects if left switched on. As the quote suggests, however, there exists a concern that residents will worry about the cost of keeping the sustainable technologies switched on and that by turning the technologies off, this will make them redundant. To try to counteract this potential for technological failure, as well as limit energy consumption, a cost-based incentive is presented to residents.

Cost-based incentives: 'how to reduce energy consumption'

In addition to written instructions, the housing association seeks to regulate energy consumption by offering advice to residents about how to reduce energy costs. As mentioned earlier, residents recently moved from a nearby estate to the newly developed one, which entailed significant changes to the type of residence, technologies used to generate hot water and ventilation, and billing method. Because of the different nature of energy provision and payment method financial considerations are viewed as pivotal to changing residents' behaviour:

There was going to be quite a big increase in rent charges and service charges... [In the previous homes] the residents paid a certain amount, which included unlimited heating... hot water... and cold water... So if they had the heating on 24 hours a day they would be charged the same amount if they had the heating on for 30 minutes... It seemed that rather than turning the heating down... they would just open a window... because they weren't paying for it. So it's educating residents about the changes that are going to happen when they move into their new homes. (Housing Regeneration Officer)

To manage the transition to a different means of energy provision, workshops were devised to tackle budgeting and money management, and information leaflets disseminated among residents:

We did... information booklets for residents... we were making it clear to them that, you know, 'you will pay for the amount of heating and hot water you use'... [If] you had concerns about the heating and water charges... we gave residents the opportunity to sit down with an independent financial advisor. (Housing Regeneration Officer)

Residents do have concerns over the higher cost of living in the new houses. Yet despite this apprehension, strategies that focus on cost alone do not significantly affect the routine practices of residents, as we discuss later. An additional strategy is used to try and create the environmentally beneficial outcomes imagined with the installation of the sustainable technologies. The housing association and affiliated professionals disseminate standardised advice about 'correct' usage of sustainable and mundane technologies within the home.

Standardised advice: 'how to conduct your life and save energy'

Normative concepts about 'correct' technology use is reflected in the advice provided to residents by the housing association to save energy by, for example, regulating water usage by reducing the length of time to take a shower (described below). In the following quote a

development officer tries to give advice to residents on how to live in the new house on the 'moving-in' day, whilst it is evident that residents concentrate on making it their home:

[Residents] have a familiarisation process [to the new home], it lasts an hour per household... and they get leaflets to say 'this is what this does' ... But obviously, the day they get their keys is so exciting that anything they [we] say goes straight over their heads... You're going through the house pointing out where things are and how things should be used. They're thinking... when can I get my carpets in, how big are these windows, can I measure them up for my curtains? Completely different wavelength. *You're trying to go through 'this is how you live in your home' and they're thinking about décor, carpets and all the things that are exciting about moving into a new home* [our emphasis].
(Housing Development Officer)

Housing association professionals promote ways of living within the home that are tied to normative notions of technology use. This is clear in the advice given to residents on how to reduce their energy consumption:

You can cut down on your water by taking a shower than a bath... always load the washing machine when it is completely full. We're directing a lot of residents to the Thames Water website... it gives information about how much a family of four would expect to spend if they have a water meter property. (Housing Regeneration Officer)

This advice neglects socio-cultural practices and related meanings, such as notions of cleanliness. Indeed, a resident described how she had been given a timer device to reduce her shower time to four minutes. This was not sufficient enough time for her to feel clean: 'I'm not using it [the timer] any more...It's too short for me. I'm like, oh my God, I've not cleaned properly!' (FO).

It is evident that there exist potential tensions between the housing association's efforts to introduce energy 'efficient' practices within the home and residents' daily socio-technological practices, which we investigate in detail in the next section. We have discussed three strategies adopted by the housing association that try to govern the behaviour of residents. The first strategy assumes that sustainable technologies alone will achieve the desired environmental effect. The second approach employs cost-based incentives to reduce energy usage, making it a matter of choice to decide to use less heating and hot water, for example. The third strategy offers standardised advice for resource intensive practices such as

showering, which assumes that consumption practices are universal and remain constant with time. The desire for efficient sustainable technology use embodied in these strategies thus neglects the cultural and social concepts and practices that underpin energy consumption (see Shove, 2010; Southerton et al., 2004; Spaargaren, 2011).

We next examine residents' routine practices and their use of both sustainable and mundane technologies as part of accomplishing their daily lives, which, we argue, have a significant impact on the ways in which practices interrelate and the diverse ways in which energy is consumed.

Juggling practices: cooking, showering, and organising social life

In our analysis of residents' practices we find that they conflict with standardised and normative notions about the use of sustainable technologies. We argue that sustainable technologies do influence how everyday practices are conducted, but in ways unexpected by policy makers and the housing association. Adapting to the new technologies as part of carrying out their lives, residents creatively develop novel practices that build on existing cultural practices, which in turn affect processes of energy consumption. We focus on two particular practices that are closely linked to the installed sustainable technologies: cooking, and showering/bathing. We argue that with mundane technologies, sustainable technologies reciprocally and mutually participate in shaping the wider socio-cultural lives of residents, through which resource intensive practices become entwined and energy is consumed.

Cooking

The heat recovery ventilation system installed in the residents' homes is purportedly 'energy efficient' by offering a means to control the indoor climate through providing fresh air. The regulation of the indoor climate is supposed to require a lessened need to open windows and thus allow the heat of the property to increase in the winter and decrease in the summer. We found that some households adapted their cooking practice to try to control steam and cooking smell, developing their own strategies to manage ventilation as the ventilation system did not remove smells from cooking:

I have not used it [heat recovery ventilation]. I don't bother any more... Sometimes I go in there [the kitchen], I see they've [other household members] left it on for two or three days and I just switch it off. But if I'm cooking I don't even bother because it doesn't work... I have to leave the front door open, leave the back door open. All the windows upstairs are open... If I am in the house... the front door, kitchen window [is open]... so that the smell

will go. And I don't cook in the evening, I cook in the morning so that will give it time [for the smell to go]... if I have to fry fish, I can't fry fish in this house because for the next three months the smell will stay in the house. I will have to take it [a cooking hob] out [to the patio] and fry it there. (OO)

In addition to these strategies of scheduling cooking to the morning so that the smells have time to dissipate, and changing the location of cooking from the kitchen to the garden patio, households also manage ventilation by cooking particular dishes, such as an 'African stew'. Residents cook the stew in bulk so that only one day a week is dedicated to intensive cooking (producing smells and steam). Bulk cooking is scheduled when the rest of the household is out of the house. This is important in colder months when opening windows and doors results in heat loss, but other family members are not affected:

[I shop] maybe two weeks ahead... I buy my meat and fish, I have two [freezer] drawers that I have left for that. That's for the stew... If you're doing all this cooking, it takes the whole day... to boil it, fry it, bag them in the freezer... When you cook and you leave this door open, even though you switch on the vent... you can still smell it upstairs in the house... but once you leave the kitchen window open, at least the smell...escapes immediately... It's colder... but then... I'm the only one cooking in the kitchen and I do the cooking when no one is home. (MO)

Bulk shopping and cooking, as well as strategically using doors and windows, aids households to manage ventilation. This process reciprocally shapes how families organise their time and leisure practices. Assembling the stew offers flexibility to conduct these practices and achieve ventilation. This flexibility is also facilitated by technologies, such as the refrigerator-freezer to store large quantities of food and the microwave to provide 'instant' meals (see Shove and Southerton 2000), which 'frees up' residents' time for other activities:

[Now that we have bought a fridge freezer] she [his wife] will cook stew... and then put them in small containers and just freeze them. So you just go to the freezer as and when you need them... put them in the microwave... just like those ready-made foods that you buy... She does a major cooking and she spends something like three hours in the kitchen... And that will last sometimes nearly two months... It's sort of freed up time to attend to other things, like maybe go to the library, go to the pub, and you know, do the shopping. (IA)

I cook for the week... the stew can be eaten with rice or whatever... If I cook it on Saturdays it lasts by [till] Wednesday or Thursday...and Friday we just eat out. Once it's cooked it can be left in the fridge. [The stew]...would be a mixture of... fish, beans, and chicken, everything goes together spiced up... The boys can just come back from school... they will just go in the freezer, get it and, you know, put it in the microwave... Some weekends we have weddings... So I tend to do [bulk shopping and cooking], like I did last weekend, so for the next three weeks now I'm OK, I don't have to get to the market... If you have an African wedding you have to go from about 12 pm, all day practically... My son [also] has football on Saturday... then you have people who want to visit you... we don't have any free weekends anymore... we don't have any free day, let me just put it like that. (MO)

The incorporation of a new technology with existing ways of living in the home culminates in the emergence of novel socio-technological practices and arrangements. Below we see how these new arrangements have a 'knock-on' effect on the conduct of other resource intensive practices, such as showering. How these practices are adapted and become entangled influences how energy is consumed. For instance, to manage ventilation one household made changes to the 'hardware' and techniques of practice, such as: the tools and methods of cooking, giving up their traditional Vietnamese food, and cooking by not frying, but steaming:

The housing [association] don't give us permission to fit the extractor hood, so that means we're not allowed to make the food like before... We have to change the way we cook... before [we moved in] we can [could] cook our dishes like traditional [Vietnamese food], but ... since we move here we prefer to steam [rather than fry]... Mostly we have for dinner is vegetables, and we mix our fish which [we] make very quickly... We don't cook as complicated as before, so the ingredients we find [are] very simple... We prefer the taste before more than [to] now, but we have to get used to it. (TN)

This change has consequences for ways in which the resident organises her daily life and other practices. The cooking is now simpler but with less flavour; because of this, alternative efforts were sought to introduce flavour by marinating food. This process demands a significant period of time to complete and so the respondent schedules her food preparation for each morning:

You have to leave it [food] for a couple of hours at least and then it turns out very tasty. If you do it too quickly it turns out like... not tasty. That's why I always prefer to do it in the morning... the gap between preparing and the meal is about four or five hours... if I prepare in advance the time I cook is less... And when we have dinner I don't feel so tired... That's

why I prefer a shower in the morning because I prepare the food, after that I have a shower...and in the evening I cook it just 15-20 minutes... and we have dinner... You have a nice dinner with your family... and we're talking, my children are talking about what is happening at school. (TN)

Adopting a new cooking method and arranging her time in this way affects the scheduling of her shower and the demarcation of 'family time'. It is evident that one strategy to cope with a new technology embodied in a new practice has a domino effect on the arrangement of other activities during the day.

Residents alter their practices: the tools (ingredients), methods (steaming, frying) and techniques (recipes) of cooking, to enact unique strategies for ventilation. These strategies are entwined in efforts to juggle family activities and time. The notion that adequate ventilation will occur if 'you just keep the vent switched on' promotes the idea that there exists a 'universal' home and user, separating sustainable technologies from these wider social and cultural practices. Yet in reality we see that the varied practices of food preparation and cooking mutually shape residents' engagement with technologies and their energy consumption. Clearly, a standard ventilation system alone cannot control the indoor climate and improve energy efficiency, as it overlooks the creative and culturally diverse practices of residents. Sustainable technologies can change established routines (Spaargaren 2011) in ways unanticipated by the housing association: residents actively adapt to these technologies with varied implications for use. Through these processes new cultural practices emerge with potentially diverse and conflicting consequences for anticipated environmental outcomes.

Showering and bathing

As we saw above, changes in residents' practices affected by newly installed sustainable technologies have repercussions for alternative practices, such as the scheduling of showering. Indeed, Hand et al. (2005) suggest it is important to 'acknowledge the temporal and sequential scheduling of everyday practices and to know where showering or bathing fit into the daily or weekly routine... the shower belongs to a set of domestic devices whose popularity has grown precisely because they promise to help people cope with the temporal changes of... modern life (Warde 1999)' (Hand et al. 2005: 7-8). The arrangement of time, family members and work, for example, demands careful planning and coordination and the shower aids this by allowing for speed and convenience (ibid.). In the following quote, a family 'morning timetable' is scheduled around showering:

Everyone takes a shower and leaves... We wake around 6.30. I think we finish, all of us, by 7.30. Within one hour everyone has finished, six people... And by eight o'clock we've all left. First me or their mum, because of the nature of our work. It might be delayed. Otherwise my bigger daughter, she has to leave by 7.30. She always gets to her job early. There's a boy, the same thing, he might leave at quarter or ten to eight. There's one she leaves at ten past eight, and the other one, the youngest daughter leaves at 8.30. (GT)

Current work on practices sheds light on the relations between showering and strategies of time management (see Southerton, 2006; Warde, 1999). Building on this, we argue that residents' wider socio-cultural 'organising praxis' is shaped by sustainable and mundane technologies, and vice versa, affecting how practices become interrelated, in turn, influencing other resource intensive practices. As part of the praxis of daily life routine practices are closely interconnected; we cannot view them in isolation.

Showering and bathing practices are also part of, and intertwined with, residents' social life:

[My daughter] doesn't have a bath in the morning, she has a bath in the night... But if it's weekend when I'm at home, she has to have a bath in the morning... because we have to go to church, so I can't leave and go out of the house without having a proper wash. (OO)

We all take a shower in the morning... You use a bath for your children, maybe in the evening... We do baths in the evening if the kids have been to sports, and you know, summertime, because they roll on the grass, they do a lot in summer, we do both morning and evening... (MO)

In the latter household, the demarcation of morning showering (adults) and evening bathing (children) is closely tied to the practices in which adults (work) and children (sports) are involved. The consumption of energy services, such as showering, and energy itself, are together accomplished as part of people's daily lives (Wilhite 2008).

Practices (re)configure and sustain one another; they are intertwined with and constitutive of existing 'ways of doing things', which are adapted and transformed through negotiating new social, cultural, and technological arrangements. Efforts to govern residents' practices and energy consumption through strategies that essentially 'bracket off' sustainable technologies from the lives and activities of residents disregard how sustainable technologies contribute to how residents' arrange their daily lives. During these juggling acts new forms of practice are

created, which do not conform to the technologies' characteristics and technological 'potential' anticipated by housing professionals. Advice, such as taking a shower instead of a bath, therefore, does not lead to so-called 'behaviour change' as imagined by policy makers.

Discussion and conclusion

There are clear tensions between the assumed normative ways of use of technology and actual use. From the social practices perspective it is evident that domestic energy management and consumption is shaped by people's attempts to juggle everyday routines and wider socio-cultural praxis, rather than driven by sustainable technologies alone, as policy makers and housing providers imagine. The heat recovery ventilation system does not manage indoor climate by itself. Rather, it is affected by: culturally diverse cooking practices, ventilation strategies creatively developed by residents, and the scheduling of other resource intensive practices. The solar water heating system is not used according to its technical characteristics (e.g. generating hot water when the sun is out). Instead, residents adapt showering and bathing practices to manage time as well as family and social activities, reflecting divergent cultural norms and priorities. In most cases, these processes of adaptation dominate over efforts to conform to the requirements of the sustainable technologies demanded of residents to achieve sustainable outcomes. Strategies that rely upon consumer choice as a mechanism to deliver sustainable outcomes are thus problematic. Residents' socio-technological practices, which comprise sustainable and mundane technologies, and are affected by the wider socio-cultural conditions and management of everyday life, influence energy consumption. Simply offering cost-incentive and standardised advice overlooks how energy consumption is achieved. Policy's approach to ask individuals to change their behaviours in accordance with the characteristics and requirements of the sustainable technologies simply does not work.

Residents' narratives not only reinforce well-established sociological criticisms of policy's rational-choice model, but also further our understanding of the relations between sustainable technologies, practices and energy consumption. The narratives offer deeper insights into how practices mutually shape and sustain each other. Analysing these we have empirically demonstrated and furthered our understanding of the 'interconnectedness of practices' (Rechwitz 2002; Shove and Walker 2010), by broadening this theoretical contention in relation to the contingent socio-cultural and technological frames of residents' lives and their implicated ways of engaging with technologies. In doing so, we have demonstrated how the entanglement of practices shape energy consumption.

We contend that the relations between mundane practices (e.g. cooking and showering/bathing) are entwined and constitutive of activities as residents creatively adapt to the sustainable technologies, generating new forms of cultural practice. Despite recent work that examines how mundane technologies become enrolled as part of objectual elements of practice and energy consumption, there needs to be a greater appreciation of how *both* sustainable and mundane technologies, affect the interrelations between residents' practices in the 'sphere of culture' (Pickering, 1995: 4) that influence how energy is consumed.

Governance attempts to promote normative concepts of 'correct' use, which depend on consumer choice, do not materialise in practice and thus have limitations. Environmental sustainability cannot be achieved without understanding how sustainable technologies reciprocally shape and are incorporated into residents' activities and lives. The rational-choice model excludes fundamental questions about routine practice and the pervasive effect of social and technological relationships on energy consumption. There is no linear relationship between sustainable technologies and sustainable energy consumption. Rather, future research needs to investigate the different 'trajectories of use' that materialise out of the interrelations between practices. The varied practices that emerge have important implications for how energy is consumed.

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Endnotes

¹ UK domestic energy consumption comprises 28.4 per cent of total energy consumption (BERR 2008) and residential carbon emissions account for 29.4 per cent (DECC 2011).

² The Code for Sustainable Homes provides recommendations for house-builders to make new buildings environmentally sustainable. Developers and builders are able to choose technologies for each development. Points, which are calculated into Code levels, are given depending on how much improvement they make (DCLG 2006a).

Biography

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References

- Barr S, Gilg A and Shaw G (2011) Citizens, consumers and sustainability: (Re) framing environmental practice in an age of climate change. *Global Environmental Change: Human and Policy Dimension* 21: 1224-1233.
- Barry A (2001) *Political Machines: Governing a Technological Society*. London and New York: The Athlone Press.
- Chappells H and Shove E (2004) Infrastructures, crises and the orchestration of demand. In Southerton D, Chappells H and Van Vliet B (eds) *Sustainable Consumption: The Implications of Changing Infrastructures of Provision*. Cheltenham: Edward Elgar, 130-143.
- Department for Business, Enterprise and Regulatory Reform (2008) *Energy Consumption in the United Kingdom: Overall Data Tables*, 2008 update, URN09/452. London: BERR.
- Department for Communities and Local Government (2006a) *Code for Sustainable Homes: A Step-change in Sustainable Home Building Practice*. London, DCLG.
- Department for Communities and Local Government (2006b) *Building a Greener Future: Towards Zero Carbon Development*. London: DCLG.
- Department for Energy and Climate Change (2011) *2009 Final UK GHG Emissions Data*, London: DECC.
- Guy S (2006) Designing urban knowledge: Competing perspectives on energy and buildings. *Environment and Planning C: Government and Policy* 24: 645-659.
- Hand M, Shove E and Southerton D (2005) Explaining showering: A discussion of the material, conventional, and temporal dimensions of practice. *Sociological Research Online* 10(2). Available at: <http://eprints.lancs.ac.uk/11294/>
- Hawkes A, Munuera L and Strbac G (2011) *Low Carbon Residential Heating*, Grantham Institute for Climate Change, briefing paper No 6. Available at: <https://workspace.imperial.ac.uk/climatechange/Public/pdfs/Briefing%20Papers/Low%20carbon%20residential%20heating.pdf>
- McMeekin A and Southerton D (2012) Sustainability transitions and final consumption: Practices and sociotechnical systems. *Technology Analysis and Strategic Management* 24: 345-361.
- Miller P and Rose N (2008) *Governing the Present*. Cambridge: Polity Press.
- Ozaki R, Shaw I and Dodgson M (2013) The co-production of "sustainability": Negotiated practices and the Prius. *Science, Technology and Human Values* 38(4). In print. Doi:10.1177/0162243912441029
- Pickering A (1995) *The Mangle of Practice: Time, Agency and Science*. Chicago: The University of Chicago Press.

- Reckwitz A (2002) Towards a theory of social practices: A development in culturalist theorizing. *European Journal of Social Theory* 5(2): 243-63.
- Schatzki T (2001) Introduction: practice theory. In: Schatzki T, Knorr Cetina K and Savigny E (eds) *The Practice Turn in Contemporary Theory*. London: Routledge, 1-14.
- Shove E (2003) Converging conventions of comfort, cleanliness and convenience. *Journal of Consumer Policy* 26: 395-418.
- Shove E (2004) Efficiency and consumption: Technology and practice. *Energy and Environment* 15(6): 1053-1065.
- Shove E (2006) Constructing home: a crossroad of choices. In: Cieraad I (ed) *At Home: An Anthropology of Domestic Space*. New York: Syracuse University Press, 130-143.
- Shove E (2010) Social theory and climate change questions often, sometimes and not yet asked. *Theory, Culture & Society* 27: 277-288.
- Shove E and Southerton D (2000) Defrosting the freezer: From novelty to convenience: A narrative of normalization. *Journal of Material Culture* 5: 301-19.
- Shove E and Walker G (2010) Governing transitions in the sustainability of everyday life. *Research Policy* 39: 471-476.
- Slater D (1997) *Consumer Culture and Modernity*. Cambridge: Policy Press.
- Southerton D, Chappells H and Van Vliet B (2004) Introduction: consumption, infrastructures and environmental sustainability. In Southerton D, Chappells H and Van Vliet B (eds) *Sustainable Consumption: The Implications of Changing Infrastructures of Provision*. Cheltenham: Edward Elgar, 1-14.
- Southerton D (2006) Analysing the temporal organization of daily life: Social constraints, practices and their allocation. *Sociology* 40: 435-454.
- Spaargaren G (2011) Theories of practices: agencies, technology, and culture: Exploring the relevance of practice theories for the governance of sustainable consumption practices in the new world-order. *Global Environmental Change: Human and Policy Dimensions* 21(3): 813-822.
- Thomas D (2006) A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation* 27(2): 237-246.
- Warde A (1999) Convenience food: space and timing. *British Food Journal* 101(7): 518-27.
- Webb J (2012) Climate change and society: The chimera of behaviour change technologies. *Sociology* 46(1): 109-125.
- Wilhite H (2004) Equating efficiency with reduction: a self-deception in energy policy. *Energy and Environment* 15 (6): 991-1009.
- Wilhite H (2005) Why energy needs anthropology. *Anthropology Today* 21(3): 1-2.

- Wilhite H (2008) New thinking on the agentive relationship between end-use technologies and energy-using practices. *Energy Efficiency* 1: 121-130.
- Winch D (2006) The problematic status of the consumer in orthodox economic thought. In: Trentmann F (ed) *The Making of the Consumer: Knowledge, Power and Identity in the Modern World*. Oxford and New York: Berg Publishers, 31-52.

Table 1. Residents' profile

<i>Residents</i>	<i>Household composition</i>	<i>Nationality</i>
AW	4 (mother, father, two pre-teen children)	Chinese
MO	3 (mother, teenage children)	Nigerian
GT	6 (mother father, two teenage children, two pre-teen children)	Eritrean
OO	3 (mother, grown-up son, teenage daughter)	Nigerian
IA	4 (mother, father, two pre-teen children)	Nigerian
TN	4 (mother, father, two pre-teen children)	Vietnamese
GM	2 (husband, wife)	British
FO	3 (mother, two pre-teen children)	Nigerian