Energy Policy 52 (2013) 126–134

Contents lists available at SciVerse ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Keeping energy visible? Exploring how householders interact with feedback from smart energy monitors in the longer term

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ARTICLE INFO

Article history:
Received 23 September 2011
Accepted 13 March 2012
Available online 10 April 2012

Keywords:
Smart meters and energy feedback
Household energy consumption
Longitudinal research

ABSTRACT

This paper reports on how, over a 12-month period, UK householders interacted with feedback on their domestic electricity consumption in a field trial of real time displays or smart energy monitors. Drawing on the findings of 11 follow-up qualitative interviews with householders involved in a 'Visible Energy Trial', the paper suggests that: (i) over time, smart energy monitors gradually become 'backgrounded' within normal household routines and practices; (ii) the monitors do increase householders' knowledge of and confidence about the amount of electricity they consume; (iii) but, beyond a certain level and for a wide variety of reasons, the monitors do not necessarily encourage or motivate householders to reduce their levels of consumption; and (iv) once equipped with new knowledge and expertise about their levels of electricity consumption, household practices may become harder to change as householders realise the limits to their energy saving potential and become frustrated by the absence of wider policy and market support. The paper concludes by reflecting on the policy and research implications of these findings in relation to future transition pathways to a low-carbon economy.

1. Introduction

Almost all transition pathways to a low-carbon economy in the UK rest upon the development of a 'Smart Grid' capable of handling large amounts of distributed and renewable energy supply and offering improved demand side management. The crucial first step in developing such a grid is the roll-out of 'smart meters' which the UK Department for Energy and Climate Change (DECC) intend to install in all UK households by 2020 (DECC, 2009). By accompanying all smart meters with an in-home display or Smart Energy Monitor (SEM) that provides real-time feedback to householders about their energy consumption patterns, it is hoped that this roll-out will encourage householders to monitor and manage their energy use to save money or reduce their carbon emissions. Despite acknowledging that these measures will: "affect everyday life for millions of people and will empower individuals, businesses and communities to choose how they will play their part in reducing the UK's carbon emissions, while also minimising what they pay for their electricity use" (DECC, 2009, 8), there remains a startling lack of understanding or empirical evidence about how feedback from SEMs will be used by householders, how it will (or will not) translate into changed consumption patterns or, and crucially, about whether or not any changes made will prove durable over time.

We began to address the first two of these questions in a previous paper in this journal (Hargreaves et al., 2010) in which, through qualitative interviews with 15 householders taking part in a trial of SEMs, we highlighted the importance of the social dynamics of household energy use, exploring how SEMs become embedded within household routines and relations leading to negotiation and conflict that hinders energy saving efforts, as often as to rational-planning and cooperative steps to cut consumption. This paper extends this previous analysis by tackling the third question: whether or not the impacts of SEMs are durable over time. It presents the empirical findings of follow-up qualitative interviews, conducted exactly 12-months later, with 11 of the same householders who took part in the initial study. Whilst a few others have previously considered the longer-term impacts of SEMs and begun to raise serious questions about the durability of their impacts (e.g., Van Dam et al., 2010; Van Houwelingen and Van Raaij, 1989; Mountain, 2006), to the best of our knowledge this paper represents the first time in-depth qualitative techniques have been used to examine how usage of SEMs develops over the longer-term and how this impacts on energy use.

The paper begins by examining relevant literature on feedback and energy consumption, emphasising studies that focus on household practices and the social dynamics of energy consumption and those that have considered the longer-term impacts

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0301-4215/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.enpol.2012.03.027

of SEMs. Section 3 then introduces the Visible Energy Trial that forms the context for this research and the methodological techniques used. Section 4 reports the empirical results of 11 follow-up interviews with participants in the Visible Energy Trial focussing specifically on how their usage of the SEMs evolved as the trial went on and how this impacted upon their energy consumption. Finally, Section 5 considers the implications of our findings for future research and policy, raising particular questions about the relationship between contemporary patterns of energy consumption and demand and future transition pathways to a low-carbon economy.

2. Energy feedback and household dynamics over the long-term

The provision of information and feedback on domestic energy consumption is seen as perhaps the key means of overcoming energy's so-called 'double invisibility' — that it can be neither seen nor connected to everyday actions (Burgess and Nye, 2008). Although feedback can take a variety of forms – from more informative bills (Wilhite and Ling, 1995) to the face-to-face provision of advice (Darby, 2003) – current policy hopes, in the UK at least, are pinned heavily on the provision of real-time feedback from smart energy monitors (SEMs — e.g., DECC, 2009; National Audit Office, 2011). A recent review of a range of SEM-trials from across the US revealed savings of between 3 and 13% with an average saving of 7% (Faruqui et al., 2010) with Fischer (2008) suggesting that the effectiveness of feedback depends on its frequency, duration, content, breakdown, medium of presentation, social comparisons and combination with other interventions. In the UK, the final analysis of the large-scale Energy Demand Research Project, involving some 60,000 households including 18,000 with smart meters, observed no statistically significant savings from standalone SEMs and just 3% savings from SEMs when they were accompanied by smart meters (AECOM Limited, 2011)[1]. These kinds of findings reveal the considerable difficulties involved in realising significant savings in domestic energy use through forms of information provision.

In our previous paper (Hargreaves et al., 2010), we highlighted the rationalist and individualistic nature of the linear 'information-deficit' model that underpins the majority of these feedback studies. As Strengers observes, these studies "assume that individuals act as 'micro-resource managers' weighing up the costs and benefits of consuming resources in accordance with their desires, opinions, values, attitudes and beliefs" (2011, 36). By focussing narrowly on individual decision making processes, such studies effectively render households as 'black boxes' (Darby, 2003) in that they fail to account for the ways in which feedback must be made sense of, negotiated against, and acted upon (or not) amid existing domestic situations often involving multiple household members. For example, in our previous paper we highlighted the importance of the social dynamics of households, revealing how energy feedback must be 'domesticated' into a wide range of different household 'moral economies' (Silverstone et al., 1992) – the particular sets of household values, routines and practices that have developed over time and typically remain unquestioned – causing conflict between householders as often as cooperation, and thus challenging the smooth, linear cause-effect progress of the information-deficit model.

Since our paper, others have also focussed on the social impacts of SEMs, and the ways in which they must be 'appropriated' into myriad household circumstances, each time with complex and varying impacts on their overall effectiveness (Wallenborn et al., 2011; and see also Grønhøj and Thøgersen 2011). Further, research has also begun to focus on the ways SEMs interact with household habits, routines and social practices and the technological configurations they involve. For instance, studies have highlighted how different technological configurations provide different 'affordances' for energy saving (Darby, 2010); how household habits and routines are often unconsciously carried out and thus do not respond in a straightforward manner to rational and conscious information provision (Pierce et al., 2010); and how existing social practices can potentially render energy saving socially unacceptable by demanding high levels of energy consumption just to uphold an appearance of 'normality' (Bartiaux, 2008; Gram-Hanssen, 2011; Strengers 2008, 2011). Arguably, these studies contribute broadly to a new interest in theorising the 'energy cultures' (Stephenson et al., 2010) of particular contexts, such as homes or workplaces, that moves the debate some way beyond a narrow focus on the decision-making processes of individual energy users.

Whilst these new modes of theorising energy consumption have made significant progress in opening up the black box of the household, a key shortcoming is that, empirically at least, most fail to keep it open for a sustained time period. As Van Dam et al. (2010) argue, most studies of energy feedback devices last for periods of less than 4 months, with the very few longer-term studies, such as by Van Houwelingen and Van Raaij (1989) or by Mountain (2006), reporting 'indecisive results' (Van Dam et al., 2010, 460). Reviewing several studies to assess the longer-term impacts of SEMs, Van Dam et al. suggest that even over relatively short time periods 'the general trend seems to be that feedback devices slowly drift into the background', and note that 'the exact cause of this finding has not been studied' (2010, 460). In their own 15-month trial, Van Dam et al. confirm this general trend, concluding that 'an energy monitor is not effective over a longer period (more than 4 months) for a majority of users' (2010, 467). Whilst they suggest several causes for this – that people revert to their previous behaviour, that people purchase new appliances raising overall levels of consumption, or the rebound effect – they also acknowledge that their reliance on questionnaires and self-reported meter data left them unable to fully explain how or why it is that SEMs 'drift into the background'. To the best of our knowledge, there are currently no in-depth, qualitative studies that track the usage of SEMs over anything more than a 4-month period, exploring how use of SEMs develops and changes over time, how this differs between different households or what effects this has on energy consumption. This paper attempts to begin filling this important gap in the literature. The next section introduces the Visible Energy Trial (VET) from which the empirical results came.

3. Methodology: The Visible Energy Trial

Throughout 2008–2010, 275 households from across eastern England were recruited to trial three different standalone (i.e., without an accompanying smart meter) SEMs of differing levels of sophistication for at least a 12-month period. Participants were recruited in various ways including through newspaper and internet advertisements, at energy events and fairs, and through local authorities and housing associations. All participants were offered the SEMs at discounted rates. The monitors themselves

[1] Participants in this study received standalone SEMs that were not accompanied by smart meters. As an anonymous reviewer noted, and as the AECOM Limited (2011) results confirm, there is an apparent difference between how standalone SEMs that have been available for a few years and integrated smart metering systems are received by householders. How these differences are explained is certainly worthy of further exploration but was, unfortunately, beyond the scope of this study.