Energy Research & Social Science 44 (2018) 362–370

Contents lists available at ScienceDirect

Energy Research & Social Science

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

Original research article

Consumer engagement in low-carbon home energy in the United Kingdom: Implications for future energy system decentralization

Aimie Hope[a], Thomas Roberts[a,*], Ian Walker[b]

[a] Department of Sociology, AD Building, University of Surrey, Guildford, GU2 7XH, UK
[b] Department of Psychology, 10 West, University of Bath, BA2 7AY, UK

ARTICLE INFO

Keywords:
Micro-Generation
Renewable energy
Social practice
Off-Grid

ABSTRACT

There are competing visions for what future low-carbon energy systems might look like. However, it is likely that consumers will be more actively involved in managing their energy use. Consequently, there is likely to be some disruption to the current rhythm of everyday domestic social practices. This paper considers what we can learn from people who already take a more active role in managing their energy supply, with the aim of identifying transferable lessons that could be applied to future energy system decentralization. We compare two case studies focused on people with different levels of grid connectivity - people living off-grid on narrowboats and living in semi-grid connected houses in rural Norfolk. We find that where people had constraints on their energy use, they responded in three main ways. First, they diversified their energy supplies, including adopting traditional fuels such as coal and wood. Second, people planned, monitored and shifted their energy use, responding in ways favorable to micro-generation and demand-side response. Third, people curtailed energy use. We propose that UK households may respond in similar ways to decentralized energy. Finally we consider the implications of our findings for future energy policy aimed at decentralizing energy production and supply.

1. Introduction

The way in which households interact with energy systems is changing. To date households have predominately been passive consumers of energy. However, the growth in affordable micro-generation technologies, combined with the introduction of smart metering and time of use tariffs, means that households are now paying a more active role in managing their energy consumption. Increasingly domestic energy users are becoming involved with the production as well as the consumption of energy, as Ellsworth-Krebs and Reid [1:1989] note, changes to *'the fundamental geography of energy networks, [are] blurring previously fixed distinctions between consumers and producers, sites of energy production and of use, and the relationship between supply and demand in general'*. The term 'prosumption' has become a popular way to describe this new emerging relationship between energy producers and consumers (ibid.). Furthermore, as smart technology develops and electric cars become the norm our relationship with energy systems is likely to further change [2].

Both the UK and European governments have set out ambitious targets for reducing the amount of energy consumed by buildings. The EU plans to reduce emissions from existing buildings by 80–95% by 2050 [3] and the British Government has committed to ensuring all new buildings are 'zero-carbon' by 2019 and all existing buildings by 2030 [4]. It is clear that to achieve these targets it will be necessary to fundamentally reconfigure the relationship between households and energy supply systems. An increasing proportion of electricity production is already coming from intermittent renewable sources, presenting challenges for a centralized energy grid designed to operate with a predictable and constant supply of power [5,6].

The way the energy system will develop to deal with these challenges is not yet entirely clear [2]. At one end of the spectrum, a highly centralized automated demand response systems could help to smooth peaks and troughs in energy demand. However, at the other end of the spectrum there is the possibility that the energy system may be more decentralized, with households taking a major role by generating and storing energy. Within this range of possibilities for the energy system there are many configurations that are likely to involve households taking a more active role in the management of their energy supply. How households might adapt to this, and what action might be necessary to help them transition, is the focus of the present research.

In this paper we present two case studies (off-grid and partly grid connected communities) where households already take a more active role in energy management. By exploring the way these households have (re)configured their everyday practices, we provide insights into

* Corresponding author.
E-mail addresses: a.hope@surrey.ac.uk (A. Hope), t.m.roberts@surrey.ac.uk (T. Roberts), i.walker@bath.ac.uk (I. Walker).

https://doi.org/10.1016/j.erss.2018.05.032
Received 29 November 2017; Received in revised form 25 May 2018; Accepted 25 May 2018

some of the changes that may be necessary within UK households more broadly, if reliance upon decentralized energy infrastructure becomes more commonplace. We explore the following questions: 1. what fully-grid connected UK households could potentially learn from people who already use energy differently, 2. whether changes to practices are likely to result in reducing energy consumption and CO_2 emissions and the promotion of welfare and, 3. what the challenges are in more active energy management from a user perspective.

In exploring how the context in which people live influences the pattern of their daily life we generally refer to 'practices' rather than 'behaviors' (for a discussion of theoretical differences see [7]). This reflects a decision to 1. emphasize the 'unthinking' and routine nature of much resource consumption and, 2. take a practice theory informed approach to understanding domestic energy use [8]. Here energy practices are seen as shared routinized types of behavior, for example, cooking, heating and showering involving the production, distribution, storage, and monitoring of domestic energy [9]. We see practices as being comprised of *meanings* (e.g., motivation for acting, norms, expectations), *materials* (e.g., microgeneration technologies), and *skills* (e.g., in managing decentralized energy) [8].

The paper is structured as follows. First we provide an overview of the potential benefits of decentralized energy. We then discuss some risks to achieving these benefits before introducing the two case studies. This is followed an integrated results and discussion section. The paper concludes with a summary of the policy implications of this research.

1.1. Decentralized energy

The idea of decentralized energy is by no means a new one. Prior to the development of the gas network in the latter half of the 19th Century and the development of the National grid in the 1930 s virtually all the energy used by domestic households in the UK was decentralized. However, since the 1960 s the UK's energy consumption has been dominated by a centralized system of production and distribution [10]. Recent developments in renewable energy microgeneration technologies, combined with a growing awareness at both government and household level of the need to diversify and decarbonize energy production, has led to a revival of decentralized energy systems. The term 'prosumption' has been coined to describe this re-emergent phenomenon where energy consumers are also energy producers [1,11]. The vast majority of existing research on contemporary energy prosumption has focused on generating electricity from solar PV panels. However, to fully understand decentralized energy production we also need to consider other renewables such as heat pumps and wood, in addition to non-renewable sources of fuel such as diesel, oil, bottled butane gas and coal.

Renewable decentralized energy is seen to offer a wide range of infrastructural, environmental, economic and social benefits [10]. These include: provision of low-carbon energy, reduced transmission losses, greater resilience to price inflation, and increased energy security because of reduced dependency on a few large power stations [12–14]. Energy generated by communities through co-operatives has also been seen as a way of promoting values such as self-sufficiency, local determination, engagement and empowerment [15]. At present many community renewable projects exist and there are an increasing number of renewable installations on individual households (in particular solar PV). However, decentralized energy generation is still not mainstream [10]. Households are therefore likely to need support in adapting to changes to daily routines resulting from involvement with microgeneration.

1.2. Changing social practices and resource consumption

The benefits of decentralized renewable energy could be undermined if producing their own energy makes people more profligate, inadvertently increasing their overall carbon footprint. For example, people may view decentralized energy as being 'free' and so use more (as found by Baborska-Narozny et al. [16]). In short, while changes to materials can offer significant efficiency and resource savings, the way that people routinely use them can result in savings not being fully achieved [17]. There is historical precedent for this concern. Changing conventions around personal cleanliness is a commonly given example (for an indepth discussions of this see: [18–20]). While it was common in the past for people to have weekly baths to maintain personal hygiene, people now tend to take daily showers for a variety of purposes (e.g. to freshen up), thus increasing resource consumption. The same pattern can be seen in the shift from open fires to gas central heating systems. Although gas central heating systems are far more efficient, people's expectations about what constitutes thermal comfort have changed, with research indicating that more rooms in homes are now being heated at higher temperatures and for longer [21–25]. In summary, while technological innovations may make it quicker, easier and more resource efficient (in theory) to perform practices, changing social expectations (or norms) can undermine savings in both terms of resources and time invested.

While innovations such as central heating have made it easier, for example, to use fuel to keep warm – a shift to microgeneration may actually involve a return to some older and more involved ways of performing practices, offering the opportunity for more careful resource management. Unlike gas heating and cooking where fuel is supplied at the flick of a switch, using solid fuels requires more active management, for example, gathering fuel, building the fire, keeping it supplied with fuel, and cleaning away cinders [26]. Similarly, it is envisaged that people with microgeneration will participate in the production, distribution, storage, scheduling, and monitoring of energy as opposed to simply 'plugging in' [9]. Decentralized energy is seen, therefore, as a way of making energy as a resource far more visible to users, thus promoting more deliberative use. Rather than energy being a by-product of pursuing other goals such as watching TV, cleaning clothes and keeping warm, using energy may become a practice in its own right [27,28]. Furthermore, decentralized energy will mark a shift from hidden infrastructure designed for utility, to an increase in far more visible means of energy production such as roof-top solar PV [29]. This increased visibility and salience could possibly provide a mechanism for changing practices to encourage reduced energy use. If microgeneration makes energy feel like a tangible resource – perhaps even one whose use involves some effort – then profligacy might be more easily addressed.

In light of these different potential outcomes of decentralized energy, efforts may be needed to ensure that practices are (re)configured to accommodate microgeneration in such a way that changes do achieve greater sustainability, as well as benefits to users. In particular it is important to caution that just as moving to more efficient heating systems seems to correspond with greater demand for heating – transitions from grid supplied energy to microgeneration could in fact lead to increased energy use because energy is perceived as 'free'. Furthermore, just as the automation of many domestic chores has impacted on the time and labor involved in running a household – a return to more 'hands-on' ways of doing things will also have implications. It is likely, for example, that some household members will end up spending more time in managing energy/fuel [30]. This is likely to impact some households more than others due to factors such as due to income constraints or reduced flexibility due to family/care commitments [31]. The implications from a user-perspective of a transition to increased decentralized energy should therefore be carefully considered.

There is a growing body of research exploring the most effective ways of reconfiguring energy intensive everyday practices with minimal disruption and investigating the best chances of new routines being maintained. In particular the impact of timing on the introduction of technological interventions designed to both reduce energy consumption and increase the use of low-carbon decentralized energy generation technologies, such as solar PV, has been the focus of a