Renewable and Sustainable Energy Reviews 22 (2013) 655–666

Contents lists available at SciVerse ScienceDirect

Renewable and Sustainable Energy Reviews

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

Motivations and barriers associated with adopting microgeneration energy technologies in the UK

Paul Balcombe [a,b,c], Dan Rigby [b], Adisa Azapagic [a,c,*]

[a] School of Chemical Engineering and Analytical Science, The University of Manchester, M13 9PL, UK
[b] School of Social Sciences, The University of Manchester, M13 9PL, UK
[c] Sustainable Consumption Institute, The University of Manchester, M13 9PL, UK

ARTICLE INFO

Article history:
Received 16 November 2012
Received in revised form
2 February 2013
Accepted 10 February 2013
Available online 21 March 2013

Keywords:
Microgeneration energy
Renewables
Consumer attitudes
Motivations and barriers

ABSTRACT

Despite significant financial support from the UK government to stimulate adoption of microgeneration energy technologies, consumer uptake remains low. This paper analyses current understanding of motivations and barriers that affect microgeneration adoption with the aim of identifying opportunities for improving the uptake. The findings indicate that, although feed-in tariffs have increased the uptake, policies do not sufficiently address the most significant barrier – capital costs. 'Environmental benefit' appears to be a significant motivation to install, but there is doubt whether consumers are willing to pay extra for that. The issue is complicated by the fact that motivations and barriers differ between segments of the population, particularly with age. Younger age groups are more willing to consider installing but less frequently reach the point of installation, suggesting that other barriers such as costs prevent them from installing. Further investigation into these factors is required to understand how uptake may be increased.

Contents

1. Introduction

In the UK, microgeneration is defined as the generation of electricity of up to 50 kW and/or heat of up to 45 kW from a low-carbon source and includes the following technologies [1]:

* Corresponding author at: School of Chemical Engineering and Analytical Science, The University of Manchester, M13 9PL, UK. Tel.: +44 161 306 4363.
E-mail address: adisa.azapagic@manchester.ac.uk (A. Azapagic).

1364-0321/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.rser.2013.02.012

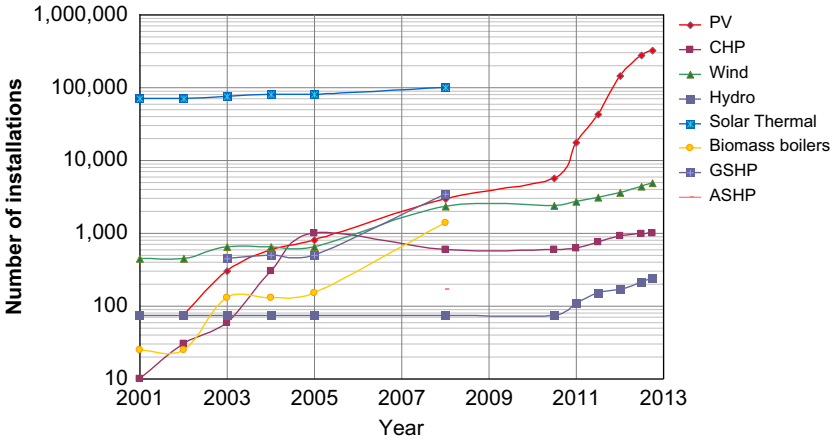

Fig. 1. Increase in the number of installations from 2001 to 2012. [Estimates based on the following sources: 2001–2005: Element Energy [12]; 2008: Element Energy [8]; 2010–2012: DECC [9]. For calculations, see Appendix A].

- electricity: solar photovoltaics (PV), micro-wind, micro-hydro, micro-CHP and fuel cells;
- heat: solar thermal, air source heat pumps (ASHP), ground source heat pumps (GSHP), water source heat pumps (WSHP), biomass stoves and boilers.

This scale of generation is suitable for installation in domestic and non-domestic buildings, including offices, schools, shops, hotels and factories.

The UK government aims to increase the uptake of microgeneration technologies as part of its strategy to improve energy security and reduce greenhouse gas (GHG) emissions [2]. Given that the residential sector accounts for 30% of UK energy consumption [3] and other, non-residential, buildings account for 18% [4], reductions in GHG emissions within these sectors could contribute significantly to meeting the UK climate change targets.

To stimulate the adoption, the Feed-in Tariff (FIT) scheme was introduced in April 2010, significantly reducing capital payback times [5,6]. The FIT scheme offers a payment for each unit of electricity generated to approved, grid-connected, electricity microgenerators of less than 5 MW capacity. There are additional payments for electricity exported back to the grid. Technologies eligible for payments are solar PV, wind, hydro, anaerobic digestion and CHP. The payment, which is guaranteed over 20–25 years (apart from CHP which is guaranteed for 10 years), is made by the energy supplier companies and their costs are recouped by increasing consumer electricity prices. Payments are different for each technology and for different capacities of installation and are based on providing a 5% return on investment. In addition, the government has developed a Microgeneration Strategy to tackle non-financial barriers to greater deployment, such as uncertainties in performance and reliability, by ensuring supplier accreditation through the Microgeneration Certification Scheme[1] [7].

Government support for microgeneration has helped to increase uptake, especially of solar PV, which has grown from around 3000 installations in 2008 [8] to 320,000[2] in 2012 [9]; see Fig. 1. However, the uptake of other technologies has been much slower and the total contribution of microgeneration is still low, meeting less than 0.2% of the final energy demand in the UK domestic sector (see Appendix A for the estimation). This suggests that there are significant barriers to adoption which must be reduced or removed if microgeneration is to contribute to UK climate change targets and energy security.

In an attempt to assist in identifying the barriers as well as motivations for adoption, this paper reviews and discusses the current understanding of different factors affecting consumers when considering installing microgeneration technologies. The paper also seeks to identify any gaps in knowledge about motivations and barriers, and makes recommendations for further research.

In total, 18 relevant studies have been found in the literature; they are summarised in Table 1. As can be seen, the majority of the studies are based in the UK and all except one (Japan) are in Europe. As also indicated in Table 1, a number of different methods of survey and analysis have been employed to elicit attitudes towards microgeneration: open ended interviews with qualitative analysis; closed format questions or rating scales with descriptive statistical analysis; closed format questions with regression analysis; and environmental valuation economic methods.

The next section reviews motivations and barriers associated with microgeneration adoption identified within the literature. This is followed by a review of how perceptions of microgeneration differ between subgroups of the UK population in Section 3. Conclusions and recommendations for further research are given in Section 4.

2. Motivations and barriers

There are many consumer motivations and barriers associated with microgeneration adoption that have been cited in the literature. They can be categorised as: finance, the environment, security of supply, uncertainty and trust; inconvenience and impact on residence. They are summarised in Table 2 and discussed below broadly in the order of their relative importance in the adoption decision as identified from the literature, although with the exception of finance and environment, there is little agreement on the importance of different motivations and barriers across the literature. Note that some of the motivations and barriers in Table 2 could be assigned to more than one of the categories (e.g. the requirement for planning permission could also be a financial barrier), but have been allocated to the

[1] The Microgeneration Certification Scheme is a quality assurance mechanism to set a minimum standard for microgeneration products and installations.

[2] Figure of 320,200 is derived by adding the estimated installations in 2008 (2993) from Element Energy [8] and the number of installations registered with Ofgem as part of the FIT scheme [9] by September 2012 (317,172). As the FIT register only accounts for those within the scheme, this estimation ignores any installations not in the FIT scheme that were installed after 2008. Consequently, this may be an underestimate. See also Appendix A for further details.