Energy Policy 106 (2017) 547–559

Contents lists available at ScienceDirect

Energy Policy

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

Motives to adopt renewable electricity technologies: Evidence from Sweden

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ARTICLE INFO

Keywords:
Renewable energy
Motive
Adoption
Diffusion
Investment

ABSTRACT

The diffusion of renewable electricity technologies (RETs) has to speed up for countries to reach their, often ambitious, targets for renewable energy generation. This requires a large number of actors – including individuals, companies and other organizations – to adopt RETs. Policies will most likely be needed to induce adoption, but there is limited knowledge about what motivates RET adoption. The purpose of this paper is to complement and expand the available empirical evidence regarding motives to adopt RETs through a survey to over 600 RET adopters in Sweden. The main finding of the study is that there are many different motives to adopt RETs and that RET adopters are a heterogeneous group with regard to motives. Although environmental concerns, interest in the technology, access to an RE resource and prospects to generate economic revenues are important motives in general, adopters differ with regard to how large importance they attach to the same motive and each adopter can also have several different motives to adopt. There are also differences in motives between adopter categories (especially independent power producers vs. individuals and diversified companies) and between RETs (especially wind power vs. solar power). This implies that a variety of policy instruments might be needed to induce further adoption of a variety of RETs by a variety of adopter categories.

1. Introduction

In recent years, many countries have implemented measures to reduce the use of fossil-based energy generation, including various policies to stimulate the deployment of technologies for renewable electricity generation (RETs). As a consequence (at least in part) of such policies, the rate of diffusion of RETs and the installed renewable electricity generation capacity has increased rapidly, but many countries are still far from reaching the ambitious targets set in, e.g., the EU climate and energy package (Eurostat, 2015b; Jacobsson and Bergek, 2011). This implies that further diffusion is needed in the coming years.

Yet, governments cannot undertake the required investments alone (Wüstenhagen and Menichetti, 2012). Indeed, for RETs (or any innovation) to spread, a large number of different actors both have to decide to adopt it and implement their adoption decisions successfully (Linton, 2002; Mignon, 2016). Despite the association of the term "diffusion" with the exchange of gases or transfer of diseases, innovation diffusion is, thus, not a seamless process, but instead built up by a micro-foundation of many singular, and often quite complex, adoption processes by individuals or organizations (Rogers, 1983). These processes are influenced by a large set of economic, behavioural, organizational and structural factors, both at the supply and the demand side (Tidd, 2010). Among these factors, this paper focuses on adoption motives.[1]

Motives are important because an adoption decision will not be made unless the individual adopter has some kind of reason or incentive to adopt (Jensen, 1982). Previous literature also suggests that motives influence how adopters react to different investment contexts (e.g. commercial conditions) (Bauwens, 2016; Dinica, 2006), what types of technologies they choose to invest in (Lillemo et al., 2013; Michelsen and Madlener, 2013) and what business models they choose (Barradale, 2010). Motives are, thus, highly relevant for policy makers: If policy makers want to strengthen the incentives to adopt certain technologies, they need to understand what motivates adoption of these technologies and how adopters with different motives are likely to react to particular policies (Bergek et al., 2013; Mignon and Bergek, 2016).

RETs are often framed as environmental innovations, which might signal the importance of environmental motives. However, as discussed

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[1] It should be noted that *motives* are not necessarily the same thing as *motivations*. A motive is a reason for doing something specific (in this case investing in a particular RET at a particular time), whereas motivation is the reason for a particular, but more general, pattern of action or behaviour (e.g. always choosing the most environmentally friendly alternative when buying something). In the literature, these two concepts are used interchangeably, but we have opted to use the term 'motive' since we are interested specifically in the first of these two meanings.

http://dx.doi.org/10.1016/j.enpol.2017.04.016
Received 7 October 2016; Received in revised form 4 April 2017; Accepted 6 April 2017
0301-4215/

by Stern (2000), environmental behaviour can also originate in non-environmental concerns. In line with this, much of the energy literature assumes that RET adoption is primarily motivated by economically rational profitability considerations (Michelsen and Madlener, 2013). This is, for example, evident in studies that compare investments in RETs with other energy investments based on the assessment criteria used by utilities and energy planners (cf. Awerbuch, 2000, 2003; Bhattacharya and Kojima, 2012). This also seems to be the assumption made by policy makers, considering the dominance of various forms of economic incentives for RET adoption (Mignon and Bergek, 2016; Schelly, 2014).

There is, however, little previous research on RET adoption from the point of view of adopters (Vasseur and Kemp, 2015). A particular concern is that while the abovementioned assumptions are derived from knowledge about the investment behaviour of traditional adopters, such as utilities and energy companies, previous studies have shown that the primary drivers of the RET diffusion process are non-traditional RET adopters, such as households, cooperatives, diversifying firms and other organizations (Bergek et al., 2013). Most of the empirical studies of such adopters focus on identifying factors that influence RET adoption at an aggregated level. These factors include, for example, innovation characteristics (e.g. relative advantage and ease of use), adopter characteristics (e.g. income, status and age) or external influences (e.g. government policies) (cf. e.g. Arkesteijn and Oerlemans, 2005; Balcombe et al., 2014; Karakaya et al., 2015; Michelsen and Madlener, 2013; Schelly, 2014; Tate et al., 2012; Walekhwa et al., 2009; Vasseur and Kemp, 2015). Only a few of these studies also look into the question of why non-traditional adopters decide to adopt RETs, and there is little agreement about the relative importance of different motives for RET adoption (Balcombe et al., 2013; Bauwens, 2016). Moreover, most of the available studies of motives of non-traditional adopters are focused on the adoption of solar PV cells by households (see Section 2). Adopters of RE are, however, a heterogeneous group. It does not only consist of households, but also of various types of companies and organizations, and it adopts other RETs than solar PV (e.g. wind power, bioenergy and hydro power technologies) (Bergek et al., 2013; trend:research, 2013). Considering that there are some indications that motives differ between adopter types and RETs (cf., e.g., Caird et al., 2008; Sidiras and Koukios, 2004), more research is needed to confirm (or complement) the insights gained so far.

Against this background, the purpose of this paper is to complement and expand the available empirical evidence regarding motives to adopt RETs by (1) identifying motives for RET adoption in Sweden and (2) investigating the relative importance of different motives, both for the entire population of non-traditional adopters and for different adopter categories and RETs.

2. Motives to adopt RETs: previous literature and remaining gaps

In this section, we will first review and summarize the findings from a number of previous empirical studies of RET adoption motives from the perspective of non-traditional adopters (see Table 1).[2] Based on this review, we will then discuss the current status of knowledge and understanding of motives to adopt RETs in order to identify unresolved issues and formulate our own research questions.

[2] Two things should be noted here. (1) As mentioned in the introduction, there is also a literature that discusses adoption of RETs by utilities and energy planners (for a review, see Bergek et al. (2013)). However, this literature does not concern itself much with investigating the motives behind such investments. Instead, it is focused on the criteria these companies use (or should use) to decide what specific technology to adopt once an adoption decision has been made. (2) We focus on studies of the motives of those who have actually adopted RETs. Studies of mere intentions, attitudes or considerations to adopt have therefore been excluded (see Balcombe et al. (2013) and Korcaj et al. (2015) for reviews of such studies with regard to microgeneration technologies and solar PV systems respectively).

Table 1
Overview of studies of motives to adopt renewable electricity generation technologies.

	RET	Adopter category	Country	Sample size
Balcombe et al. (2014)	Microgeneration (solar PV, solar thermal, micro-wind turbines, heat pumps, biomass, micro-CHP and micro-hydro)	Consumers	UK	Survey (113 adopter-respondents)
Caird et al. (2008)	Various (wood burning stoves, solar thermal systems, solar PV systems and micro-wind turbines)	Households	UK	Survey (121 adopter-respondents)
Fischer (2008)	Micro fuel cell CHP (applications for a field test)	Households (mainly)	Germany	Survey (142 applicant-respondents)
Mbzibain et al. (2013)[a]	Various (e.g. solar PV systems, biomass boilers, wind turbines and CHP)	Farmers	UK	Survey (55 adopter-respondents)
Nygrén et al. (2015)	Various (solar PV systems, micro-wind turbines, heat pumps, production and consumption of biogas, biodiesel and wood energy).	Households	Finland	Interviews (54 adopter- interviewees)
Palm and Tengvard (2011)	Grid-connected solar PV systems and micro-wind turbines	Households	Sweden	Interviews (20 adopter-interviewees)
Schelly (2014)	Solar PV systems	Households	USA (Wisconsin).	Interviews (48 adopter-interviewees (36 cases of adoption))
Tate et al. (2012)[a]	Various (e.g. solar PV systems, biomass boilers, wind turbines, and CHP)	Farmers	UK	Survey (55 adopter-respondents)
Vasseur and Kemp (2015)	Solar PV systems	Households	The Netherlands	Survey (38 adopter-respondents)
Warren (2010)	Microgeneration technologies	SMEs	UK	Interviews (17 SMEs, but unclear if all were adopters)

[a] Tate et al. (2012) and Mbzibain et al. (2013) are based on the same empirical study.