Energy Policy 107 (2017) 413–424

Contents lists available at ScienceDirect

Energy Policy

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

Consumer preferences for electricity tariffs: Does proximity matter?

Bernhard J. Kalkbrenner[a,*], Koichi Yonezawa[b], Jutta Roosen[a]

[a] Chair of Marketing and Consumer Research, TUM School of Management, Technical University of Munich, Germany
[b] Charles H. Dyson School of Applied Economics and Management, Cornell University, New York, USA

ARTICLE INFO

Keywords:
Discrete choice experiment
Distributed energy
Electricity labeling
Regional electricity supply
Renewable energy
Willingness to pay

ABSTRACT

The introduction of renewable energy sources fosters the transformation to an energy system with distributed generation. This alters the relation between consumers and power generation sites, as generation and consumption spatially converge. It allows for new configurations within the energy sector and provides opportunities for marketing regional energy. We empirically investigate consumer preferences for electricity generation in proximity to end-users, focusing on the proximity of generation and providers, and present representative data for Germany. In a discrete choice experiment, a sample of 780 consumer households and 173 adopters of a renewable energy system (prosumers) chose from a range of different electricity tariffs. We estimate the willingness to pay for the following attributes: shares of regional generation, power providers, and electricity mixes. We find evidence in favor of regional production, but in spite of positive attitudes towards local generation from renewable sources, willingness to pay is not responsive to higher shares of regional generation. In addition, a preference for regional providers exists. The results show that renewable energy mixes are preferred, particularly a solar and hydro mix. Adopters state slightly more distinct preferences as compared to consumer households. Thus, we find there is potential for business models offering regionally generated electricity.

1. Introduction

The energy system in Europe is characterized by a high degree of centralization (Naus et al., 2014). However, current developments represent a transformation to a system with distributed generation (Jenkins and Pérez-Arriaga, 2017). Halu et al. (2016) see a shift from centralized large-scale electricity generation towards smaller generation sites at the local level. This small-scale generation is called distributed generation (Pepermans et al., 2005). It can broadly be defined as "electric power generation within distribution networks or on the customer side of the network" (Ackermann et al., 2001, p. 203; see also Theo et al., 2017). Distributed generation includes solutions such as solar systems and wind turbines, storage and controllable loads (Akorede et al., 2010; Peças Lopes et al., 2007). The importance of distributed electricity supply is increasing (Koirala et al., 2016; Kubli and Ulli-Beer, 2016); e.g., due to advances in terms of cost and performance of generation and storage technologies (Bharatkumar et al., 2013). Distributed electricity supply–when based on renewable energies–could be a means to an environmentally friendly future (Karger and Hennings, 2009). Quality and security of supply, affordability, and the potential for jobs and innovations at the local level have been attributed to distributed energy (Halu et al., 2016; Koirala et al., 2016; Müller et al., 2011; Rae and Bradley, 2012). A distributed system changes the relationship between citizens and power generation sites, since generation and consumption spatially converge (Koirala et al., 2016). It thereby shapes a new system with production in proximity to consumers and allows for local and regional production and consumption. Moreover, the traditional passive consumer role transforms and households have opportunities to actively engage in the energy system, e.g. by generating energy on-site using a photovoltaic system – "blurring the distinction between producer and consumer" (Watson and Devine-Wright, 2011, p. 281). Such developments, as well as technological and societal advances, can foster new ways of energy supply at the local and regional level, and open up opportunities for new tariff schemes marketing regionally generated electricity.

Until now, research on the energy system mainly focused on different types of technologies and ways of implementation, and neglected spatial aspects (Devine-Wright, 2011a). The analysis of distributed energy is underreported in the literature (Kubli and Ulli-Beer, 2016), although citizens and communities need to support and accept a distributed energy system for successful implementation (e.g., Wüstenhagen et al., 2007). The attitudes and preferences of citizens need to be incorporated in policymaking because citizens are directly affected by a distributed electricity supply system. McKenna et al.

* Correspondence to: TUM School of Management, Chair of Marketing and Consumer Research, Alte Akademie 16, 85354 Freising, Germany.
E-mail address: bernhard.kalkbrenner@tum.de (B.J. Kalkbrenner).

http://dx.doi.org/10.1016/j.enpol.2017.04.009
Received 15 July 2016; Received in revised form 29 March 2017; Accepted 5 April 2017

(2015) state that consumers might prefer locally marketed electricity generation and call for further research to analyze these preferences. From a business perspective, regional generation could be an underrated selling point (Herbes and Ramme, 2014). A recent German initiative to regulate and introduce a labeling scheme for regionally generated electricity (BMWi, 2016a; EEG, 2016) stresses the relevance and need for analyzing local and regional energy concepts. Labeling and marketing regionally generated electricity from renewable sources as a specific product can help to foster the identification with local renewable energy sites and their acceptance, and support the further expansion of renewables (BMWi, 2016b). Furthermore, a label for regionally generated electricity from renewable sources could reduce information asymmetries and the uncertainty of consumers (see Heinzle and Wüstenhagen, 2012).

The German market represents an interesting case for a changing electricity system, since it is being developed from centralized generation to distributed units of renewable energy production (Mattes et al., 2015). As part of the ongoing energy transition ("Energiewende"), Germany made the decision to shut down all nuclear power plants by 2022 (BMWi, 2014). This "regime shift" (Strunz, 2014, p. 154) is characterized by a particularly high expansion of renewable energy sources and many small production sites (Karger and Hennings, 2009). Distributed electricity is mainly generated from wind and solar power, as well as from biomass (Anaya and Pollitt, 2015). In 2015, renewable sources–in particular, wind and photovoltaics–generated 195.9 TWh of electricity. This represents 32.6% of the German gross electricity supply and an increase of 5.2% points compared to the previous year (Umweltbundesamt, 2016).

We present new empirical evidence for consumer attitudes and preferences with regard to distributed electricity supply by focusing on the spatial aspects of electricity generation and purchase. The objective of the present study is to examine if consumers show a preference for regional aspects when choosing an electricity tariff. In order to take into account the different roles of households–as either consumers or prosumers–we analyze each of the two groups independently. We are interested in the willingness to pay for electricity that is produced close to the end users and focus on the proximity of generation and providers. Hence, proximity is defined as the proximity of electricity generation and the proximity of providers. Generation in proximity to end users can reach from producing energy on-site to generation within a specific radius of the consumers' homes–in our study defined as 20 km, representing regional generation. The proximity of providers is defined as having local or regional ties to the end consumers.

This study aims at investigating the spatial aspects connected with electricity tariff choice by analyzing (1) consumers' attitudes towards and preferences for electricity from renewable sources generated close to the end users, and (2) electricity tariff choice focusing on regional generation and the regional ties of the power providers. We test the following three hypotheses: H1, where consumers show a preference for electricity with a high level of regional generation; H2, where consumers show a preference for power providers that have regional ties; and H3, where consumers show a preference for electricity from renewable sources. The rationale of this research is based on a marketing perspective.

In our study, we examine empirical data from Germany. We use a choice experiment to investigate the spatial aspects of regional electricity generation and present the results of a survey conducted in Germany (N=953) among residential energy customers who are in charge of energy-related and financial decisions ('consumer households'; n=780), and the owners of renewable energy systems ('adopters'; n=173).[1] We analyze the data from our experiment by using a mixed logit model and estimate the willingness to pay for the product attributes included in the analysis for consumer households and adopters. This paper contributes to the advancement of research on distributed electricity supply and provides valuable insights for power providers and policymaking at the national and regional levels.

The paper is organized as follows. In Section 2, we review the relevant literature. Section 3 describes the data and gives an overview of the statistical model, followed by the empirical results and discussion in Section 4. The conclusions are presented in Section 5.

2. Literature review and hypotheses

2.1. Spatial aspects of a distributed system

Socioeconomic research on energy asking the questions *what?* (technology and energy system), *how?* (type of project and their consequences) and *where?* (spatial aspects) have lacked a systematic focus on the last question of *where* energy is produced and consumed (Devine-Wright, 2011a, p. 58). In an energy system that is in the process of becoming distributed, there is a need to understand the spatial aspects (Knapp and Ladenburg, 2015). Renewable energy generation brings about various impacts; e.g., on humans, the environment and the landscape, underlining the relevance of spatial aspects (Devine-Wright, 2011a; Pasqualetti, 2000). Proximity to generation sites has an influence on the attitudes of the public (van der Horst, 2007). The acceptance of regional energy projects depends on the type and size of projects and possibilities such as public participation (Hart et al., 2015; Pellizzone et al., 2015; Vecchiato and Tempesta, 2015). Concerns about local production; e.g., the visual impact of renewable energy sites (Sheikh et al., 2016), have been discussed and various papers have analyzed the social acceptance of renewable energies (e.g., Batel et al., 2013; Bronfman et al., 2012). Many of the studies on spatial aspects refer to the not-in-my-backyard (NIMBY) effect (Batel and Devine-Wright, 2015; Friedl and Reichl, 2016; Lienert et al., 2015). NIMBY is characterized by a positive attitude towards renewable energy sites in general, but a negative attitude or low acceptance if projects are located in direct proximity (Friedl and Reichl, 2016; Lienert et al., 2015). The concept has been subject to criticism (Burningham, 2000; Jones and Eiser, 2010; Swofford and Slattery, 2010; Wolsink and Devilee, 2009), since it represents "an easy to use and beguilingly simple way of thinking" (Devine-Wright, 2011b, p. 321). Such a simplified rule cannot explain local opposition (Wolsink, 2012a). In line with this, Batel and Devine-Wright see a "paradigmatic shift from NIMBY" (2015, p. 313). Recently, preferences for local or regional energy generation have been described (Ebers and Wüstenhagen, 2016; Tabi et al., 2015). Still, the findings on energy generation in proximity to the end user are inconclusive (see Devine-Wright, 2013; Gamel et al., 2016; Hart et al., 2015; Wolsink, 2007; Wüstenhagen et al., 2007).

2.2. Regionally generated electricity

Marketing regionally generated electricity from renewable sources as a distinct product can help to foster the identification with local renewable energy sites and their acceptance, and support the further expansion of renewables (BMWi, 2016b). It requires labeling to make regional electricity identifiable. Furthermore, it could increase profits of the private operators of renewable energy sites, community energy projects and enterprises. Marketing regionally generated electricity had not been subject to regulation until recently German policymakers had completed the legislative process for introducing a labeling scheme (EEG, 2016). To our knowledge, no similar regulation on labeling exists in Europe. While a consistent definition and labeling might help to build trust, and avoid the uncertainty of consumers (Heinzle and Wüstenhagen, 2012), this issue is more complicated in the electricity

[1] In this paper, we use 'consumers' as a general term referring to the whole sample consisting of 'consumer households' and 'adopters'. The latter can also be considered as prosumers.