Journal of Cleaner Production 129 (2016) 102–112

Contents lists available at ScienceDirect

Journal of Cleaner Production

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

Adoption of green electricity by German small and medium-sized enterprises (SMEs) – a qualitative analysis

Sebastian Rahbauer [a, b, *], Luisa Menapace [a], Klaus Menrad [b], Thomas Decker [b]

[a] Technische Universität München, Center of Food and Life Sciences Weihenstephan, Baywa Endowed Professorship for Governance in International Agribusiness, Alte Akademie 12, 85354 Freising, Germany
[b] University of Applied Sciences Weihenstephan-Triesdorf, Straubing Center of Science, Chair of Marketing and Management of Biogenic Resources, Petersgasse 18, 94315 Straubing, Germany

ARTICLE INFO

Article history:
Received 2 March 2016
Received in revised form
23 April 2016
Accepted 24 April 2016
Available online 4 May 2016

Keywords:
Green electricity
SME
Adoption factors
Barriers
Qualitative research
Conceptual framework

ABSTRACT

The German government aims at generating 80 percent of the country's electricity from renewable sources by 2050. In the German liberalized electricity market, customers can support this target by purchasing green electricity (GE), i.e., electricity produced from renewable energy sources. Yet, the demand for GE has remained low among small and medium-sized enterprises (SMEs), which represent the country's biggest electricity customer group.

Based on a review of the relevant literature, this article investigates factors that determine SMEs' decisions whether to adopt GE. For this purpose, thematic interviews with GE providers and representatives of SMEs are performed and qualitatively analyzed. The results of the interview analysis form the basis for a conceptual framework that reflects the GE adoption decisions of German SMEs and lay the groundwork for future analysis in this area.

1. Introduction

Since the liberalization of the German electricity market in 1998, private and industrial electricity customers are able to voluntarily purchase green electricity (GE). This type of electricity is produced from renewable electricity sources (RES), e.g., hydropower, wind power or photovoltaics, and marketed as being environmentally friendlier than nuclear or fossil energy (Salmela and Varho, 2006). GE customers pay a price premium for GE in comparison to conventionally marketed electricity (CE) to promote the transformation of electricity generation into a more sustainable form based on RES (Hast et al., 2015; Köpke, 2014). By doing so, these customers support the aim of the German government to generate 80% of the country's electricity from RES by 2050 (Reichmuth, 2013; Richter, 2013). Prompted by the discussion on climate change and the perceived danger of nuclear energy, a respectable 20% of all private electricity customers in Germany purchased GE in 2014 (Hast et al., 2015; Köpke, 2014).

Nonetheless, a corresponding industrial demand for GE has been absent thus far (Immerschitt and Stumpf, 2014). In 2014, 5.5% of all German companies purchased a total of 10.14 billion kWh of GE (4.5% of the industrial gross electricity consumption) (Köpke, 2014). In particular, the demand among small- and medium-sized enterprises (SMEs) remains subdued (Reichmuth, 2013). SMEs are businesses with less than 250 employees and no more than 50 million Euro in sales revenues or 43 million Euro balance sheets according to the Commission of the European Union (2003). There are over three million SMEs in Germany. Combined, they represent 52% of the country's total electricity consumption, making them the biggest electricity customer group in Germany. As electricity from RES emits significantly lower amounts of nitrogen oxide, sulfur oxide and carbon dioxide, a complete switch to GE in the German small- and medium-sized industry sector represents a massive opportunity to reach the goals of climate protection (Constantinos et al., 2010; Reichmuth, 2013). Nonetheless, most German SMEs' decision-makers have thus far not switched to GE.

Very few scientific papers attempt to explain the GE adoption behavior of SMEs and identify barriers to adoption (e.g. Luukkanen,

* Corresponding author. University of Applied Sciences Weihenstephan-Triesdorf, Straubing Center of Science, Chair of Marketing and Management of Biogenic Resources, Petersgasse 18, 94315 Straubing, Germany. Tel.: +49 9421 187216; fax: +49 9421 187 211.
E-mail addresses: s.rahbauer@wz-straubing.de (S. Rahbauer), luisa.menapace@tum.de (L. Menapace), k.menrad@wz-straubing.de (K. Menrad), t.decker@wz-straubing.de (T. Decker).

http://dx.doi.org/10.1016/j.jclepro.2016.04.113
0959-6526/

2003; Salmela and Varho, 2006; Wüstenhagen and Bilharz, 2006). Wiser (1998) attributed the low rate of GE adoption in the industrial realm to high costs of green marketing (GM), unfavorable regulatory rules and the intangible nature of GE. Other authors have dealt with the obstacles to voluntary measures of corporate environmentalism (Cagno and Trianni, 2014; Coles et al., 2016; Wu et al., 2015). However, to our knowledge, no study has yet been conducted that analyzes, summarizes and provides a critical discussion of the barriers and factors affecting firms' adoption of GE in the small- and medium-sized industry sector in a highly industrialized country like Germany.

This paper fills the gap in the current literature by investigating adoption factors (AFs) and discussing resulting barriers that influence a SME's attitudes and intentions and which ultimately determine a SME's decision whether to adopt GE.

By combining the results of a preceding literature review (ref. to Rahbauer et al., 2016) and systematic interviews with SMEs and GE providers, this paper aims to answer the following questions:

- Which factors do German SMEs perceive as crucial for the adoption of GE?
- What are barriers to the adoption of GE for German SMEs?

The results of this study are aggregated into a conceptual framework of GE adoption behavior in German SMEs.

2. Study procedure

To find answers to our questions, a multistage research approach was implemented. Stages and methods are described in Sections 2.1–2.3. The chronological sequence of the procedure is visualized in Fig. 1.

2.1. Literature review

The first step was a review of the relevant literature on factors that influence a SME's attitudes and intentions and that ultimately determine a SME's decision of whether to adopt GE in Germany (ref. to Rahbauer et al., 2016). This review provided 14 AFs that have the potential to influence the decision of German SMEs to adopt GE and which may constitute barriers to adoption. These adoption factors are subdivided into six factor groups and are listed and briefly described in Table 1.

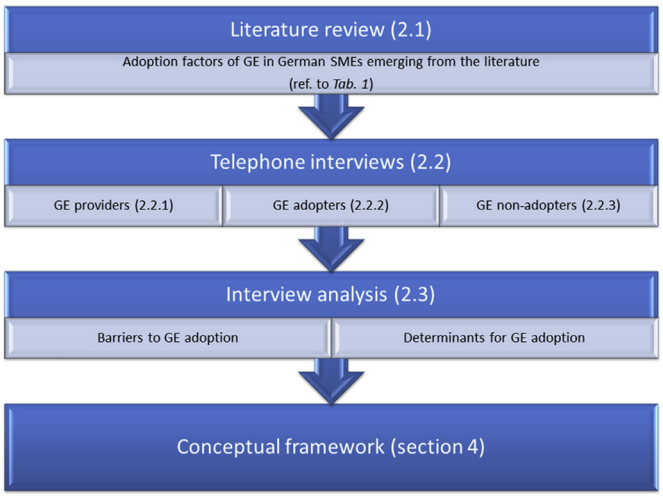

Fig. 1. Chronological sequence of the study procedure.

2.2. Interviews

The empirical material for this study consists of three sets of telephone interviews (for a total of 28 interviews) which were conducted from February to May 2015. Our interviewees were chosen to represent GE providers, SMEs that were already buying GE and SMEs that were not purchasing GE at the time the interviews were performed. We made this choice in order to screen the GE adoption process from three perspectives, namely the sales, purchase and non-purchase perspectives (Sections 2.2.1–2.2.3).

Each interview with GE providers lasted approximately half an hour. Each interview with representatives of SMEs took about 1 h. Some of the interviewees wanted to stay anonymous. Therefore, we anonymized all interviewees for reasons of data protection and uniformity.

We developed separate interview guides for each set of interviews to extract the required information from each interviewee group. The questions posed in our interviews are listed in Appendix A.

2.2.1. Sales perspective of GE

We performed interviews with eight German GE providers that charged tariffs to industrial customers. Five were independent companies and three were subsidiaries of large German energy providers. These eight companies supply a combined share of more than 50% of the overall industrial GE in Germany (Köpke, 2014). Each of the interviewed providers operates throughout Germany. Our interview partners were employed as press spokesmen or marketing managers for the GE providers.

The interview guide for the GE providers is presented in Appendix A.1.

2.2.2. Purchase perspective of GE

Ten interviews were conducted with representatives of SMEs that had already adopted GE. We received their contact information from the GE providers that were interviewed prior. Five of the interviewees were from metalworking SMEs and five from furniture-producing SMEs. These two energy-intensive sectors were chosen because energy represents a large component of total costs and also because these sectors were able to develop green divisions in recent years, allowing aspects of customer preferences to be examined (Ghanbari et al., 2015; Parikka-Alhola, 2008; Thamling et al., 2010). On the one hand, this focus on two specific sectors limits the applicability of our results to all SMEs. On the other hand, it has the potential to explain how motives other than environmental attitudes influence adoption behavior in SMEs, e.g., economic interests and marketing strategies, since energy costs represent a substantial proportion of the total variable production costs in the interviewed industry branches (Salmela and Varho, 2006).

The SMEs interviewed had between 5 and 220 employees. We were mindful to maintain a balanced distribution of employee numbers within the defined range and to avoid geographic concentrations in order to eliminate size-specific and regional influences. Our interview partners were SME owners or employees in positions as press spokesmen or marketing managers for the SMEs.

The questions used in this second set of interviews are presented in Appendix A.2 and A.3.

2.2.3. Non-purchase perspective of GE

We interviewed ten representatives of SMEs not purchasing GE at the time of the interviews. These SMEs were also chosen from the metalworking (five SMEs) and furniture-producing (five SMEs) sectors to maintain consistency. The participating SMEs had between 3 and 185 employees, nearly evenly distributed throughout