Hackbarth, André

Working Paper

Attitudes, preferences, and intentions of German households concerning participation in peer-to-peer electricity trading

Reutlinger Diskussionsbeiträge zu Marketing & Management, No. 2019-2

Provided in Cooperation with:
ESB Business School, Hochschule Reutlingen

Suggested Citation: Hackbarth, André (2018) : Attitudes, preferences, and intentions of German households concerning participation in peer-to-peer electricity trading, Reutlinger Diskussionsbeiträge zu Marketing & Management, No. 2019-2, Hochschule Reutlingen, ESB Business School, Reutlingen,
https://doi.org/10.15496/publikation-26829

This Version is available at:
https://hdl.handle.net/10419/193144

ESB BUSINESS SCHOOL

André Hackbarth / Sabine Löbbe

Attitudes, preferences, and intentions of German households concerning participation in peer-to-peer electricity trading

Reutlinger Diskussionsbeiträge zu Marketing & Management
Reutlingen Working Papers on Marketing & Management

herausgegeben von Carsten Rennhak & Gerd Nufer

Nr. 2019 – 2

Hochschule Reutlingen
Reutlingen University

Attitudes, preferences, and intentions of German households concerning participation in peer-to-peer electricity trading

December 2018

André Hackbarth

Tel.: +49 (0)7121 271-7131

Fax: +49 (0)7121 271-7004

Email: andre.hackbarth@reutlingen-university.de

Prof. Dr. Sabine Löbbe

Tel.: +49 (0)7121 271-7127

Mobil: +49 (0)172 41 62 796

Email: sabine.loebbe@reutlingen-university.de

Reutlingen University

Reutlingen Energy Center for Distributed Energy Systems and Energy Efficiency

Alteburgstraße 150

D-72762 Reutlingen

Abstract

Based on a survey among customers of seven German municipal utilities, we estimate hierarchical multiple regression models to identify consumer motivations for participating in P2P electricity trading and develop implications for marketing strategies for this currently relatively unknown product. Our results show a low importance of socio-demographics in explaining differences between consumer groups, but high influence of attitudes, knowledge and likelihood to purchase related products. The most valuable target groups for P2P electricity trading marketing strategies of municipal utilities first and foremost should aim at are innovators, especially prosumers. They are well-informed about and open-minded concerning electricity sharing and highly environmentally aware. They ask for transparency and are willing to purchase related products. They are attracted by the ability to share generation and consumption and to a lesser extent by economic reasons. Our results indicate that the marketing efforts should to a special degree take peer effects into account, as they are found to wield great influence on general openness towards and purchase intention for P2P electricity products. Finally, municipal utilities should build on the high level of satisfaction and trust of consumers and use P2P electricity trading as measure to keep and win customers willing to change their supplier.

.

Table of contents

List of Tables

1 Introduction

The EU has set binding targets of a 40% reduction of domestic greenhouse gas emissions (compared to 1990 levels) to be reached by 2030 and a share of renewable energy of 32% (EC, 2018), which led to the implementation of manifold policies to support renewable energy on a European and national level (Kitzing et al., 2012). In 2000 already, the German Renewable Energy Sources Act (EEG) introduced fixed feed-in tariffs for electricity from renewable sources that are guaranteed for a period of 20 years. It led to a share of renewable electricity of 36.2% in 2017 (AGEB, 2018) and so far resulted in about 1.7 million renewable electricity producers, with 31.5% of the production capacities owned by private households (Bundesnetzagentur, 2018; TrendResearch, 2016). However, in 2021 subsidization will run out for the first renewable generation which then has to either be used entirely on site, sold independently by the producer, or shared with others. This entails regulatory requirements, especially regarding trading and billing as well as balancing group management, which generally cannot be fulfilled by private households, so that the support of service providers is necessary. Accompanied by a rapidly increasing degree of digitalization (smart metering, smart grids) and political support on the European level (EC; 2016)[1], this consumer need stimulates perspectives for new, innovative products and services, such as virtual and decentral market places for peer-to-peer (P2P) energy trading and sharing (see Koirala et al., 2016; Parag and Sovacool, 2016; Löbbe and Hackbarth, 2017). Recently, such P2P energy exchange projects – ranging from (blockchain-based) software platforms enabling consumers to directly buy from different local renewable electricity producers without intermediary entity (e.g. *enyway* in Germany) to virtual energy pools for prosumers and consumers which are supervised by a community manager (e.g. *sonnenCommunity* in Germany) – have started to emerge, with Zhang et al. (2017) and Park and Yong (2017) reviewing and discussing some of them.

Corresponding to this market development, research on the different forms of electricity sharing is steadily increasing. It mostly focuses on technological and economic evaluation of the different electricity market architectures and network designs from an individual and macro-economic viewpoint as well as the challenges faced by prosumer communities. Espe et al. (2018) and Sousa et al. (2018) give contemporary and comprehensive reviews of the literature.

To the best of our knowledge, the research of Gstrein (2016) and Reuter and Loock (2017) are the only studies focusing on drivers and barriers for households to engage in such local prosumer-consumer energy communities or electricity markets or.

Gstrein (2016) carried out a survey in Switzerland, Germany and Austria in 2015 but only considered the 154 completed questionnaires from the Swiss participants for his analysis. His results indicate that respondents highly accept local decentral intelligent crowd-based electricity networks. They consider medium network sizes, i.e. block/suburb and village/city, to be optimal for energy crowds, indicating that a certain level of anonymity is required. Respondents, especially those without power generation system, predominantly assign the management of energy communities to electric utilities and service providers, while prosumers show stronger preferences for self-management options. However, both groups favor a highly localized and customized intra-cloud electricity management solution. Transparency

[1] However, as Gui and MacGill (2018) point out, strong resistance from the political and economic establishment can be anticipated, delaying the required regulatory adjustments for local peer-to-peer energy markets.

concerning crowd management processes and intangible values (emotions, trust) are considered to be the most important factors for participating and maintaining a relationship with an energy community, followed by technical security and the degree of automation, while normative values and financial incentives are ranked lowest.

Reuter and Loock (2017) conducted a survey in Germany, Switzerland, Norway and Spain in 2017 with 830 respondents in total, and 206 respondents in Germany, in particular. Focusing on the results for Germany, they find that in sum, 79% of the respondents are favorable about participating in a local electricity market. They detected that with the exception of a negative influence of age socio-demographic characteristics only marginally explain respondents' willingness to participate in local electricity markets and their interest in technological applications. Further, their results suggest that the current number of technological devices in the household, the energy consciousness and energy knowledge positively influence respondents' intention to participate in local electricity markets and interest in technological applications. For German individuals, the most important reasons to participate in local electricity markets are savings on the energy bill, diffusion of renewable energy, and improvement of the local environment, while the least important reasons are the exchange with neighbors, expression of an innovative lifestyle, and volunteering in the local community. The most important perceived barriers are the security of energy supply, bureaucracy, coordination among neighbors and data privacy. Finally, they highlight the most prospective consumer segments and describe priority agendas to tackle marketing strategy, design, governance, and risks of local energy markets.

We expand this research in three ways: (1) our analysis is based on a larger and more heterogeneous group of randomly chosen customers of different energy suppliers, with the main distinction being a higher share of individuals with low involvement regarding energy, i.e. a smaller share of prosumers compared to Gstrein (2016) and a higher share of tenants compared to Reuter and Loock (2017); (2) our analysis lays a stronger focus on the influence of consumer attitudes (e.g. environmental awareness, openness towards the specific technology) and purchase intentions for related products (e.g. microgeneration); and (3) we analyze the impact of peer effects, as they are found to be a key determinant in consumer adoption decisions (e.g. Palm, 2017).

Based on data from a survey carried out in April and May 2017 among customers of seven municipal utilities mainly located in Southwest Germany, the purpose of this study is: (1) to identify private energy consumer and prosumer segments and their preferences for product attributes and motivations for participating in P2P electricity trading; and (2) to describe the implications for marketing strategies of energy suppliers. We apply hierarchical multiple regressions to explain the intention to purchase P2P electricity trading products and to find and quantify the explanatory factors for a general openness towards P2P electricity trading.

The P2P electricity trading product that participants evaluated in our survey is based on and comparable to the majority of the currently available products in the German market (e.g. *sonnenCommunity*, *buzzn*, *Tal.Markt*, *solar+*) – i.e. virtual prosumer and consumer energy communities, where prosumers can trade their unused energy with other members of the group, coordinated by a community manager (provider of controlling software or market platform), who can also be in charge of selling the collective surplus energy to third parties, providing residual power, and managing the balancing group (see also footnote 9). It is also comparable to the following concepts suggested in the literature, but without their general assumption of

spatial proximity between group members (e.g. in local markets, microgrids): goal-oriented prosumer community groups (e.g. Rathnayaka et al., 2014), community-based markets (Sousa et al., 2018), crowd energy (Teufel and Teufel, 2014), and prosumer or energy collectives (Ford et al., 2016; Moret and Pinson, 2018).

The remainder of this article is organized as follows: Section 2 summarizes the research in related energy fields. In Section 3, data and methodology are outlined. On this basis, Section 4 describes the results of the two hierarchical multiple regressions for purchase intention and openness towards P2P electricity trading. In Section 5, the key results are discussed, compared with results from the literature, and marketing strategies for energy suppliers are drawn. Section 6 summarizes and concludes.

2 Literature review

P2P electricity trading just recently developed and still is a niche product, so that research on the motives for participating in these systems or potential adopters' preferred attributes of such products is still scarce. Thus, the results of related streams of research are analyzed to draw conclusions from participants' or potential adopters' motivations and preferences regarding: (1) the participation in the sharing economy, since positioning and branding of the emerging P2P electricity trading products stress the community feeling and sharing motive; (2) the adoption of microgeneration technologies, since most of the currently available P2P electricity trading products particularly aim at prosumers, i.e. owners of microgeneration systems, and in some cases are even marketed as bundle products (e.g. photovoltaic (PV) system, battery storage, and participation in energy community); (3) the participation in community energy projects via investments or volunteering in local cooperatives, since P2P electricity trading is often broken down on a local or regional level, as in the studies of Gstrein (2016) and Reuter and Loock (2017); (4) the adoption of smart energy products as prerequisite, since P2P electricity trading only works based on digitalized processes encompassing smart meters and smart devices in the household, enabling feedback on own electricity consumption and production and demand response options; and (5) the choice of green or time-of-use electricity tariffs, since they share sales arguments with P2P electricity trading products, such as environmental friendliness, innovativeness, or self-responsibility.

Summarizing the findings of these five different streams of research[2] and the studies of Gstrein (2016) and Reuter and Loock (2017), we find evidence that a specific kind of consumer is open towards the new, green, digitally-enhanced, and community-owned energy solutions, which are sold or shared via decentralized market places. I.e. adopters have some general motivations, preferences, and expectations concerning purchase or participation in common which can be summarized as follows (see also Löbbe and Hackbarth, 2017)[3]:

- Economy: Energy cost savings or increases in payments for energy production, secure investment, acceptable payback period, and return on investment (i.e., for assets, such as PV and cogeneration), value increase of house.
- Autonomy: Self-sufficiency, independence from incumbents, possibility to (actively) participate in the energy transition.
- Community: Desire to share and to integrate into a community (democracy and codetermination).
- Ecology: Energy savings, emission mitigation, environment and resource protection (renewable energy), possibility to promote certain energy sources.
- Regionality: Regional or local production and ownership structure of supplier (energy community, municipal utility, and power company), support of neighborhood/local community.
- Comfort and safety: Accessible, trouble-free, and time-saving service or personal assistance (all-inclusive or care-free package), reliability and trustworthiness of the supplier (transparency), data security and privacy, security of energy supply/reduced dependence on foreign energy.
- Technology: Individualized offers (mass customization), general technical interest and innovativeness (do-it-yourself), reliability and simplicity of technology (plug-and-play).
- Specific interest in, knowledge of or familiarity with the product.
- Intrinsic and extrinsic values: Ideology (anti-capitalism, moral, social responsibility, generosity), expression of modern lifestyle (self-identity, image/signaling), social norm

[2] Motivation for participation in the sharing economy (e.g. Bucher et al., 2016; Balck and Cracau, 2015; Hamari et al., 2015; Akbar et al., 2016; Gossen et al., 2016; Schor and Fitzmaurice, 2015; Milanova and Maas, 2017; Böcker and Meelen, 2017); motivation for participation in community energy projects (Seyfang et al., 2013; Dóci and Vasileiadou, 2015; Bauwens, 2016; Holstenkamp and Kahla, 2016; Kalkbrenner and Roosen, 2016; Kaphengst and Velten, 2014; Gamel et al., 2016; Hicks and Ison, 2018; Volz, 2012; Boon and Dieperink, 2014); motivation for adoption of microgeneration technologies (Kairies et al., 2016; Balcombe et al., 2013, 2014; Ruotsalainen et al., 2017; Shelly, 2014; Claudy et al., 2011; Wolske et al., 2017; Karakaya et al., 2015; Oberst and Madlener, 2014; Korcaj et al., 2015; Islam, 2014; Strupeit and Palm, 2016; Bergek and Mignon, 2017; Kastner and Matthies, 2016; Nygrén et al., 2015; Kowalska-Pyzalska, 2018; Michaels and Parag, 2016; Vasseur and Kemp, 2015; Kahma and Matschoss, 2017; Willis et al., 2011; Zhai and Williams, 2012; Simpson and Clifton, 2017; Sommerfeld et al., 2017; Sardianou and Genoudi, 2013; Soskin and Squires, 2013; Sigrin et al., 2015; Leenheer et al., 2011); motivation for choice of green electricity and time-of-use tariffs (Borchers et al., 2007; Herbes and Ramme, 2014; Sundt and Rehdanz, 2015; Ma et al., 2015; Ma and Burton, 2016; Soon and Ahmad, 2015; Kaenzig et al., 2013; Gerpott and Mahmoudova, 2010a, b; Yang et al., 2015; Vecchiato and Tempesta, 2015; Rommel et al., 2016; Oerlemans et al., 2016; Sagebiel et al., 2014; Litvine and Wüstenhagen, 2011; Tabi et al., 2014; Hartmann and Apaolaza-Ibáñez, 2012); motivation for adoption of smart energy products (Gölz and Hahnel, 2016; Forsa, 2010; PWC, 2015; Buchanan et al., 2016; van der Werff and Steg, 2016; BMWi, 2014; Gangale et al., 2013; Girod et al., 2017).

[3] The preferences and motivations are very comparable to those of innovators and early adopters found by Rogers (1995) and the reasons for general environmental behavior (e.g. Groening et al., 2018). However, Bergek and Mignon (2017), Kastner and Matthies (2016), and Nygrén et al. (2015) point out that adopters are a heterogeneous group with regard to number and combination of motives and the relevance they attach to them.

(peer effects)[4], hedonic motivations (having fun, 'warm glow'), positive attitude towards the behavior/technology (usefulness), compatibility with habits.

A general order of influence on the adoption or participation decision of these nine impact factors can hardly be given, as the ranking and impact of the single explanatory factors often differs between studies, depending on the research objective (e.g. technology), underlying sample (size, location, time), methodology and theoretical background (e.g. number and kind of variables). However, a common finding across the different research fields is the dominant role economic motivations and normative considerations, especially environmental concern, play in the participation or adoption decisions (e.g. Balcombe et al., 2013, 2014; Kairies et al., 2016; Kowalska-Pyzalska, 2018; Willis et al., 2011; Zhai and Williams, 2012; Bergek and Mignon, 2017). A further relatively general observation is a change in motivation over time: While early adopters or early initiatives prioritize technical, altruistic, ideological, or environmental aspects, later adopters and more commercial cooperatives are to a larger extent driven by financial reasons and profit maximization (e.g. Codagnone et al., 2016; Bauwens, 2016; Holstenkamp and Kahla, 2016; Simpson and Clifton, 2017; Sommerfeld et al., 2017).

Socio-demographic and household characteristics are generally found to be of lower importance in explaining participation or adoption behavior. Nonetheless, results show that the most important target group are younger, male homeowners with high income and educational level, having an above-average technical interest and good knowledge or experience with energy technologies, living in larger households in suburban and rural areas, and, to some extent, have a higher WTP for innovative or renewable products (e.g. Balck and Cracau, 2015; Andreotti et al., 2017; Tabi et al., 2014; Yang et al., 2015; Sigrin et al., 2015; Claudy et al., 2011; Sardianou and Genoudi, 2013; Soskin and Squires, 2013)

3 Data and methodology

Our analysis is based on data from a survey carried out in April and May 2017, among 100,756 customers of seven municipal utilities mainly located in Southwest Germany[5]. 7,006 participants completed the survey that aimed at gathering information on consumer preferences regarding four energy-related products: product bundles[6], smart home, domestic microgeneration, and P2P electricity trading. In this study only the data concerning P2P electricity trading is analyzed. Therefore, respondents from one participating utility that decided to not interview their customers on P2P electricity trading were discarded. Deletion of incomplete datasets led to 4148 completed surveys available for our analysis.

We compare our data with the German population statistics (Table 1), as specific statistics for the population of household customers in the energy sector usually are not available. In our

[4] Palm (2017) finds that peer effects are important for the adoption decision, in a sense that they confirm the reliability of the technology, with active peer effects (through direct interpersonal contact, especially existing and rather close social relationships) being more important than passive effects (observation).

[5] The seven participating energy suppliers are located in Baden-Wuerttemberg (6) and Bavaria (1), as is the majority of their customers. Accordingly, the 4148 participants, on whose data our analysis is based, are for the most part also from Baden-Wuerttemberg (80%) and Bavaria (7.3%), with the other 12.3% being spread all over Germany.

[6] The purchase intention of product bundles is evaluated in Hackbarth et al. (2019).

sample, respondents being male, highly educated, older, home owners, living in multi-person households in urban areas, and currently having a green electricity tariff are overrepresented, while the low income group is slightly underrepresented.[7] These findings should be kept in mind when discussing the results.

Table 1: Household characteristics of the sample vs. the German population

Variable	Value	Sample (%)	Population (%)
Gender	Female	29.5	50.7
	Male	70.5	49.3
Age	Less than 18	-	13.2
	18 to 39	19.3	26.6
	40 to 59	44.6	29.8
	60 or above	36.1	27.4
Education	No form of school leaving qualification	0.3	4.0
	Still in school education	-	3.6
	Secondary general school leaving qualification	12.7	30.4
	Intermediate school leaving qualification	26.9	29.7
	Higher education entrance qualification	17.2	14.2
	University (of applied sciences) degree	42.9	17.7
Household income per month	Less than €2,000	15.7	43.2
	€2,000 to €3,999[a]	33.6	43.0
	€4,000[a] to €5,999	17.4	8.2
	€6,000 or more	5.6	5.7
	Not stated	27.7	-
Number of persons in household	1	18.4	41.8
	2	43.2	33.5
	3	17.8	12.0
	4	14.4	9.3
	5 or more	6.2	3.4
Residential location	City	51.0	29.0
	Urban district	28.5	39.0
	Rural district with urban agglomeration	18.6	17.3
	Sparsely populated rural district	1.9	14.7
Accommodation type	Rented house (single-family/two-family)	3.4	10.5
	Rented apartment	26.9	46.5
	House (single-family/two-family) ownership	57.5	33.6
	Apartment ownership	12.2	9.4
Electricity tariff	Green electricity	46.6	22.0
	Other	43.1	78.0
	Not stated	10.3	-

Note: [a] €4500 in the population statistics.
Sources: Own calculations; German population shares computed on the basis of BBSR (2017), Destatis (2018), Bundesnetzagentur/Bundeskartellamt (2017).

The questionnaire was distributed in a paper-pencil version (total: 39,270; response: 4168), an online version (61,486; 3041) or both, depending on preferences and decisions of the energy utilities. The supplier-specific response rate ranged from 1.3% to 21.2% depending on the means of delivery (stand-alone vs. part of a newsletter) with an average of about 7%.

The questionnaire consisted of five major parts. The first section comprised an introduction, questions concerning impact of and support for the German energy transition, and the main sources of information on energy-related topics. The second section of the questionnaire

[7] However, the group without stated household income is quite high which hampers final conclusions, as it can be assumed that these participants are more likely to either belong to the low or high income group (Turrell, 2000; Kim et al., 2007).

consisted of 14 items aiming to gather information on participants' environmental attitude and behavior, technical interest, interest in specific energy-related products (electric vehicles, electricity tariffs), price consciousness, importance of independence from electric utilities, and regularity in supplier or tariff change. The third and main section of the questionnaire consisted of four subsections, i.e. the four considered energy products, each comprising a short description of the product[8], an assessment of respondents' prior knowledge of the product, the importance of specific product attributes, their purchase intention in the upcoming two years, and the most preferred supplier of the specific product. Additionally, the subsection focusing on P2P electricity trading contained nine items assessing the attitude towards P2P electricity trading. The fourth section of the questionnaire asked for participants' current energy and telecommunication contracts, the perception of their current energy provider, and the preferred communication channels with the utility. In the final section, socio-demographic and household characteristics were assessed.

Several explanatory constructs were utilized in our survey. The items for their measurement were either adopted from the literature with necessary adaptation as to content where needed and shortened to conform space restrictions (e.g. attitude towards the environment from Kuckartz, 2000; openness towards and purchase intention of P2P electricity trading from Taylor and Todd, 1995, technical interest from Karrer et al., 2009, and utility evaluation from BDEW, 2016), or were – especially the single-item scales – self-developed by the authors (see Tables 2 and 3 for more details on wording, measurement, and statistics of the single-item and multi-item scales).

Principal component analysis was used as method for data reduction for the 27 attitudinal and behavioral items (all measured based on 5-point Likert scales): evaluation of the current energy provider (number of items: 9), P2P electricity trading assessment (7)[9], environmental attitude and purchase behavior (5), technical interest (2), attitude change regarding energy (1), desire for independence from energy provider (1), price consciousness (1), provider change behavior (1). Oblimin rotation was chosen as extraction method since the attitude and behavioral constructs were expected to be slightly correlated.

[8] P2P electricity trading was explained and termed ('energy community') based on the general characteristics of the products that were available on the German market at the time of the survey: "Peer-to-peer electricity trading enables you to join forces with other households to form a so-called electricity community in order to share your privately generated electricity with each other. In other words, all the energy you generate that you do not store in a battery or consume directly is shared with other community members via the power grid. Thus, if others do not generate enough solar, wind or biogas electricity, they can use your electricity. If you cannot supply enough energy for yourself, you are automatically supplied with electricity from other community members who can be spread all over Germany. But even if you don't own a power generation system, you can still become part of the community and get electricity from other members. If there is not enough electricity available in the community, the operator of the electricity community steps in and automatically delivers the required electricity. You can track your electricity consumption and generation online and exchange information with other community members."

[9] All items were inspired by the decomposed Theory of Planned Behavior (TPB) of Taylor and Todd (1995), which explains behavioral intention via perceived usefulness, perceived ease-of-use, attitude, subjective norm, and perceived behavioral control. However, instead of loading on five distinctive and well-defined factors, the items were mainly influenced by three factors, comparable to TPB (Ajzen, 1991), although our result is not as clear cut. That is, five items are mainly influenced by a broader underlying factor indicating the general openness (attitude) towards participating in P2P electricity trading (comprising items originally intended to measure attitude towards the product, subjective norm, and perceived ease-of-use). The remaining two items, which aimed at assessing perceived behavioral control and subjective norm, seem to be independently influenced by two further factors.

The principal component analysis including all 27 items led to an initial solution comprising of seven factors which, however, showed need of improvement. Therefore, in an iterative optimization process one item with high cross-loadings (from the ‚attitude towards environment and transparency' factor) and four items reducing the Cronbach's alpha value of their corresponding factor (three items from the 'utility evaluation' factor and one item from the 'openness towards P2P electricity trading' factor) were permanently removed from the analysis. Furthermore, two two-item factors with bad internal consistency – e.g. the factor comprised of the single-item measures 'decision control' and 'P2P trading participants among acquaintances' had a Cronbach's alpha of 0.094 and the factor consisting of 'price consciousness' and 'regular provider change' had a Cronbach's alpha of 0.502, with both proposed factors also showing below-threshold values for item-total correlation and composite reliability – and one single-item factor ('attitude change') were excluded from the principal component analysis. However, the five items of the three excluded factors entered the multiple regression analysis as individual explanatory variables, as they originally were intended and empirically shown to independently measure different attitudinal and behavioral aspects independently.

Table 2: Results of the principal component analysis

No.	Component	Cronbach's Alpha	Statement	Mean	Std. dev.	Loading
1	Openness towards P2P electricity trading	0.840	My family and friends would approve if I buy a P2P electricity product.	3.03	0.976	0.809
			P2P electricity trading is innovative and modern.	3.76	0.900	0.804
			P2P electricity trading would go well with me and my lifestyle.	3.19	1.033	0.803
			P2P electricity trading is associated with more advantages than disadvantages compared to a standard electricity tariff.	3.14	0.851	0.784
			Participation in P2P electricity trading is easy.	2.97	0.827	0.687
2	Attitude towards environment and transparency	0.744	I am concerned about human behavior and its impact on the climate and the environment.	4.34	0.850	0.816
			People should live more environmentally friendly to counteract climate change.	4.39	0.804	0.805
			More detailed information about the origin and production of products is important to me.	3.91	0.958	0.695
			I always pay attention to ecological criteria when buying products and services.	3.70	0.890	0.657
3	Utility evaluation	0.881	My energy provider is interested in the common good.	3.80	0.880	0.838
			My energy provider is innovative.	3.70	0.863	0.830
			My energy provider is customer-oriented.	3.95	0.831	0.822
			My energy provider is environmentally friendly.	3.93	0.794	0.807
			My energy provider acts proactively.	3.69	0.865	0.792
			My energy provider is inexpensive.	3.42	0.887	0.692
4	Technical interest	0.598	I always have the latest technical products.	2.77	0.913	0.840
			I am interested in technical novelties.	3.89	1.010	0.814

Table 3: Correlation matrix for extracted components

	Utility evaluation	Openness towards P2P electricity trading	Attitude towards environment and transparency	Technical interest
Utility evaluation	1			
Openness towards P2P electricity trading	0.203	1		
Attitude towards environment and transparency	0.261	0.306	1	
Technical interest	0.094	0.122	0.128	1

Thus, the final result of the principal component analysis[10] revealed four factors consisting of at least two items and with eigenvalues greater one, which account for 62.78% of the overall variance (see Tables 2 and 3). All of the remaining 17 items indicated factor loadings greater than 0.6 and generally loaded strongly on a single factor. To test for reliability and validity of the extracted factors, a confirmatory factor analysis was conducted subsequently. The results revealed that the four multi-item scales are uni-dimensional and reliable (internally consistent) with the present data. In other words, although the Cronbach's alpha value of the extracted technical interest factor (0.598) marginally lies below the proposed critical threshold value of 0.60-0.70 (Peterson., 1994), we decided to proceed with the factor because of the fact that other critical values, such as item-total correlation (0.43) and composite reliability (0.66), were met in the confirmatory factor analysis, and the low Cronbach's alpha value is probably caused by the small number of only two items (Hair et al., 2010). Finally, for each reliable factor, the corresponding item scores were averaged into sum scales.

The variables which are used in the final models are shown in Table 4. Examining the descriptive statistics of the attitudes first, it can be seen that the attitude towards environment and transparency obtains the highest mean score of 4.09, followed by the item measuring the decision control concerning the participation in P2P electricity trading (4.02), utility evaluation (3.75), attitude change (3.57), general openness towards P2P electricity trading (3.23), the desire for independence from the electric utility (3.20), price consciousness (2.69), regular provider change (1.78), and the item measuring respondents' awareness of people who already participate in P2P electricity trading (1.46). Hence, except for the last three influencing factors the mean scores are directing more towards '(strongly) agree' opinions (i.e. values greater 3, the center of the scales).

The attributes of a P2P electricity trading product are all valued to be important in purchase decisions, as all product characteristics entering the final model show average values greater 3: Easy implementation (4.39), energy costs (4.35), personal service (4.09), shared generation and consumption (3.92), transparency of electricity generation (3.88), and independence from energy provider (3.79). Some product attributes were even more important from an absolute viewpoint, but were evaluated equally important by interested and uninterested consumer groups (statistically insignificant effect), so that they did not enter the final regression model, such as climate protection (mean 4.29; standard deviation 0.845), data security (4.45; 0.821), ease-of-use (4.39; 0.693), and purchase price (4.06; 0.833).

[10] The appropriateness of the data was assessed based on items' bivariate correlation matrix, the Kaiser-Meyer-Olkin value (0.873) and Bartlett's Test of Sphericity (Chi-squared value of 27990.63 with 136 degrees of freedom; $p < 0.001$) and considered as satisfactory.

Table 4: Variables used in the model

Variable	Definition	Mean	Std. dev.	Min	Max
Socio-demographic and household characteristics					
Middle age	1 if respondent is between 40 and 69 years old, 0 otherwise	0.62	0.486	0	1
Lower income	1 if respondent has a net household income of up to €4000, 0 otherwise	0.51	0.500	0	1
Higher education	1 if respondent has a higher education entrance qualification or university degree, 0 otherwise	0.55	0.498	0	1
Rented accommodation	1 if respondent lives in a rented accommodation (house or apartment), 0 otherwise	0.29	0.452	0	1
Residential location	4-point scale of household's residential location, ranging from '1 = central city' to '4 = rural area'	1.68	0.837	1	4
Prosumer	1 if respondent is a prosumer, 0 otherwise	0.14	0.347	0	1
Attitudes, knowledge and behavior					
Openness towards P2P electricity trading	Respondent's openness towards P2P electricity trading (average of the five 5-point Likert scale[a] item scores)	3.23	0.704	1	5
Attitude towards environment and transparency	Respondent's attitude towards the environment and transparency of production (average of the four 5-point Likert scale[a] item scores)	4.09	0.650	1	5
Utility evaluation	Respondent's evaluation of their (local) energy provider (average of the six 5-point Likert scale[b] item scores)	3.75	0.675	1	5
Knowledge about P2P electricity trading	1 if respondent already knew about P2P electricity trading before participation in study, 0 otherwise	0.15	0.360	0	1
Decision control	Respondent's degree of accordance to the statement: 'It is my sole decision whether to participate in P2P electricity trading.' (5-point Likert scale[a])	4.02	1.049	1	5
P2P participants among acquaintances	Respondent's degree of accordance to the statement: 'I know people who already participate in P2P electricity trading.' (5-point Likert scale[a])	1.46	0.848	1	5
Attitude change	Respondent's degree of accordance to the statement: 'I have changed my attitude towards energy in recent years.' (5-point Likert scale[a])	3.57	1.125	1	5
Price consciousness	Respondent's degree of accordance to the statement: 'I want the cheapest price and would dispense with customer service in the vicinity.' (5-point Likert scale[a])	2.69	1.158	1	5
Regular provider change	Respondent's degree of accordance to the statement: 'I regularly change my electricity, gas or telecommunications tariff or provider.' (5-point Likert scale[a])	1.78	0.999	1	5
Independence from energy provider	Respondent's degree of accordance to the statement: 'I would like to be more independent from my energy provider.' (5-point Likert scale[a])	3.20	1.020	1	5
Importance of product attributes					
Shared generation and consumption	Importance of shared electricity generation and consumption in purchase decision (5-point Likert scale[3])	3.92	0.974	1	5
Transparency of electricity generation	Importance of transparency of electricity generation in purchase decision (5-point Likert scale[c])	3.88	1.023	1	5
Personal service	Importance of personal service in purchase decision (5-point Likert scale[c])	4.09	0.822	1	5
Energy costs	Importance of (reduction of) energy costs in purchase decision (5-point Likert scale[c])	4.35	0.769	1	5
Independence from energy provider	Importance of independence from energy provider in purchase decision (5-point Likert scale[c])	3.79	0.973	1	5
Easy implementation	Importance of ease of implementation in purchase decision (5-point Likert scale[c])	4.39	0.681	1	5
Telecom company	Likelihood of purchasing P2P electricity trading product from a telecom company (5-point Likert scale[d])	2.03	0.979	1	5
Purchase intention					
P2P electricity trading	Purchase probability of P2P electricity trading in the upcoming 2 years (5-point Likert scale[d])	2.15	1.035	1	5
Microgeneration	Purchase probability of microgeneration system in the upcoming 2 years (5-point Likert scale[d])	2.33	1.167	1	5
Bundle tariff	Purchase probability of a bundle tariff in the upcoming 2 years (5-point Likert scale[d])	2.77	1.215	1	5
Time-of-use tariff	Respondent's degree of accordance to the statement: 'I want to have a time-dependent electricity tariff. Then I could at least partially transfer my consumption to the cheapest time (e.g. washing at night) and, thus, save money.' (5-point Likert scale[a])	3.02	1.282	1	5
Information and Communication					
Information: Family and friends	1 if information source on energy topics is family and friends, 0 otherwise	0.37	0.484	0	1
Communication: Social media	Importance of apps, social media and short messages as means of communication with energy provider (average of the three 5-point Likert scale[c] item scores)	2.15	1.163	0	1

Notes: [a] The 5-point Likert scale ranges from '1 = strongly disagree' to '5 = strongly agree'; [b] The 5-point Likert scale ranges from '1 = applies not at all' to '5 = applies fully'; [c] The 5-point Likert scale ranges from '1 = not at all important' to '5 = very important'; [d] The 5-point Likert scale ranges from '1 = very unlikely' to '5 = very likely'.

The same holds true for the companies consumers would most likely purchase the product from: energy provider (4.20; 0.815), specialized technology companies (3.45; 1.098), telecommunication companies (2.13). The latter are the only potential provider with significant differences in consumer evaluation.

The purchase intention for P2P electricity trading products has a mean of 2.15 and, thus, is more on the negative side, indicating most consumers' reluctance towards this product (1.5% of the respondents stated that they would very likely, and 9.4% that they would likely participate in P2P electricity trading in the upcoming two years). The purchase intention of microgeneration technologies (2.33), bundle tariffs (2.77), and time-of-use tariffs (3.02) is slightly higher, but still on the rejection/indifference side of the scales.

Concerning respondents' preferences for communication channels with the energy provider, social media and apps are not valued highly on average (2.15), in contrast to customer centers (3.89), web portals (3.59), or online contact forms (2.86). Moreover, 37% of the respondents gather energy-related information from family and friends. Only internet in general (0.59) and information of the energy supplier (0.51) are relied more upon, while daily newspapers (0.37), internet comparison portals (0.30), and TV/radio (0.27) seem to be comparably used to gain information.

Estimations were carried out in two steps: First, multiple regression analysis was performed to detect variables with significant influence on the dependent variable. The retained explanatory factors were then entered in a hierarchical multiple regression model to test the incremental power of each predictor. This was done twice, first, to estimate the individual influence of the variables significantly explaining purchase intention of P2P electricity trading products; second, to detect the variables that have the greatest impact on the main influencing factor of purchase intention: openness towards P2P electricity trading.

4 Results

The results of the hierarchical multiple regression of purchase intention of P2P electricity trading products are described in section 4.1, while the results of the hierarchical multiple regression of openness towards P2P electricity trading are shown in section 4.2.

4.1 Results: Purchase intention of P2P electricity trading products

The results of the hierarchical multiple regression analysis for explaining the drivers of purchase intention of P2P electricity trading products are presented in Tables 5 and 6. As can be seen, all variables comply with the assumptions of multicollinearity and homoscedasticity (Hair et al., 2010). The last column of Table 6 indicates at which step the variables were added to the four estimations (Table 5). Only the estimation results of the final model are depicted.

Socio-demographic control variables are not significant predictors of purchase intention of P2P electricity trading, except for age, which entered the first block of the hierarchical multiple regression model and explains 1.2% of variation in purchase intention for P2P electricity trading (see R^2 in Table 5). The perceived importance of product attributes and the evaluation of the telecommunication company as potential supplier entered the model in the second block and

increased R^2 by 10.5%. In the third step, the purchase intention of microgeneration and bundle tariffs in the upcoming two years, and preference for time-of-use tariffs were added to the model, increasing R^2 by additional 21%. In the fourth and final block, scales assessing knowledge of and openness towards P2P electricity trading were entered, increasing R^2 by 11.8%. Overall, the final model explains 44.5% of the variation in consumers' intention to purchase P2P electricity trading products with all four single regression models (blocks) and the according changes in R^2 being significant at the 0.1% level.

Table 5: Hierarchical regression analysis of the four predicting blocks of purchase intention of P2P electricity trading

	R^2	ΔR^2	F change	P
Model 1	0.012	0.012	51.168	0.000
Model 2	0.117	0.105	70.135	0.000
Model 3	0.327	0.210	429.307	0.000
Model 4	0.445	0.118	440.926	0.000

Table 6: Hierarchical multiple regression results (Model 4): Purchase intention of P2P electricity trading

	Unstandardized coefficients		Standardized coefficients			Collinearity statistics		
	B	Std. err.	β	T	P	Tolerance	VIF[b]	Added in model
Constant	-0.667	0.100		-6.669	0.000			1
Middle age	0.093	0.025	0.043	3.710	0.000	0.978	1.023	1
Shared generation and consumption	0.055	0.016	0.052	3.468	0.001	0.598	1.672	2
Transparency of electricity generation	0.029	0.014	0.028	2.072	0.038	0.716	1.398	2
Personal service	-0.069	0.018	-0.055	-3.913	0.000	0.674	1.483	2
Energy costs	-0.091	0.019	-0.067	-4.855	0.000	0.698	1.433	2
Independence from energy provider	-0.056	0.014	-0.052	-3.848	0.000	0.725	1.380	2
Easy implementation	0.060	0.022	0.039	2.704	0.007	0.634	1.578	2
Telecom company	0.053	0.012	0.050	4.262	0.000	0.961	1.040	2
Time-of-use tariff	0.036	0.010	0.044	3.691	0.000	0.925	1.081	3
Bundle tariff	0.090	0.010	0.106	8.690	0.000	0.898	1.114	3
Microgeneration	0.289	0.011	0.327	26.176	0.000	0.863	1.159	3
Knowledge about P2P electricity trading	0.188	0.034	0.065	5.522	0.000	0.971	1.030	4
Openness towards P2P electricity trading	0.589	0.021	0.400	28.632	0.000	0.687	1.455	4
Estimation statistics								
F				254.983[a]				
dfs				13, 4134				
R^2				0.445				
Adjusted R^2				0.443				
N				4148				

Notes: [a] Significant at the $p < 0.001$ level; [b] Variance inflation factor.

The standardized coefficients β in Table 6 show the impact of the 13 individual predictors on the purchase intention of P2P electricity trading and can be compared by arranging them in the following descending order (β values in parentheses): openness towards P2P electricity trading (0.400), purchase intention of microgeneration (0.327), purchase intention of a bundle tariff (0.106), importance of energy costs (-0.067), knowledge about P2P electricity trading (0.065), importance of personal service (-0.055), importance of shared generation and consumption (0.052), importance of independence from energy supplier (-0.052), telecommunication company (0.050), wish for time-of-use tariff (0.044), middle age (0.043), importance of easy implementation (0.039), importance of transparency of electricity generation (0.028). As can be seen, openness towards P2P electricity trading has the greatest influence on purchase intention, followed by the purchase intention of related products. Product attributes and age have the smallest impact on purchase intention. That is, having sympathy for the idea of and being open towards P2P electricity trading is a prerequisite and the main explanatory factor for the willingness to actively participate in this market activity.

4.2 Results: Openness towards P2P electricity trading products

Tables 7 and 8 present the results of the hierarchical multiple regression analysis for explaining the drivers of individuals' general openness towards P2P electricity trading. Again, none of the variables violated the assumptions of multicollinearity and homoscedasticity.

Demographic variables together with household characteristics were included as control variables. Except for age, education, income, residential location, home ownership, and ownership of a microgeneration technology, these variables are not found to be significant predictors of a positive attitude towards P2P electricity trading. Entering these six variables into the regression equation in the first step led to a R^2 value of 0.029 (Table 7), indicating that only about 3% of the openness towards P2P electricity trading is explained by demographic and household variables. Three variables were entered in the second block of the estimation dealing with respondents' preferred information and communication channels and the evaluation of their current energy provider, which increased R^2 by 4.7%. In the third step, knowledge about P2P electricity trading, respondents' perceived decision control regarding the participation in P2P electricity trading, and the presence of P2P participants among acquaintances were entered in the model, which increased R^2 by 4.8%. In the final block, the scales assessing respondents' attitude towards environment and transparency, the strength of respondents' attitudinal change in the near past, their degree of price consciousness and regularity of provider change were added to the regression equation, which increased R^2 by 9.5%, so that the final model explains 22.0% of the variation in consumers' openness towards P2P electricity trading products. All four individual models and the changes in R^2 were significant at the 0.1% level.

Table 7: Hierarchical regression analysis of the four predicting blocks of openness towards P2P electricity trading

	R^2	ΔR^2	F change	P
Model 1	0.029	0.029	19.812	0.000
Model 2	0.076	0.047	68.079	0.000
Model 3	0.125	0.048	72.801	0.000
Model 4	0.220	0.095	96.677	0.000

Table 8: Hierarchical multiple regression results (Model 4): Openness towards P2P electricity trading

	Unstandardized coefficients		Standardized coefficients			Collinearity statistics		
	B	**Std. err.**	**β**	**T**	**P**	**Tolerance**	**VIF[b]**	**Added in model**
Constant	0.531	0.095		5.598	0.000			1
Middle age	0.075	0.021	0.051	3.560	0.000	0.941	1.063	1
Higher education	0.067	0.021	0.047	3.224	0.001	0.915	1.093	1
Lower Income	0.055	0.021	0.039	2.648	0.008	0.910	1.099	1
Prosumer	0.129	0.030	0.063	4.306	0.000	0.909	1.100	1
Rented accommodation	0.115	0.023	0.074	4.937	0.000	0.873	1.145	1
Residential location	-0.028	0.012	-0.033	-2.263	0.024	0.920	1.087	1
Information: Family and friends	0.063	0.021	0.043	3.058	0.002	0.987	1.013	2
Communication: Social media	0.040	0.009	0.067	4.684	0.000	0.967	1.034	2
Utility evaluation	0.121	0.016	0.116	7.519	0.000	0.822	1.216	2
Knowledge about P2P electricity trading	0.129	0.029	0.066	4.470	0.000	0.905	1.106	3
Decision control	0.044	0.009	0.065	4.609	0.000	0.990	1.010	3
P2P participants among acquaintances	0.142	0.012	0.171	11.540	0.000	0.893	1.120	3
Attitude towards environment and transparency	0.305	0.017	0.281	17.908	0.000	0.797	1.254	4
Attitude change	0.032	0.009	0.051	3.389	0.001	0.885	1.130	4
Price consciousness	0.020	0.009	0.032	2.105	0.035	0.839	1.191	4
Regular provider change	0.018	0.011	0.026	1.706	0.088	0.839	1.192	4
Independence from energy provider	0.052	0.011	0.076	4.968	0.000	0.846	1.182	4
Estimation statistics								
F				65.659[a]				
dfs				17, 3968				
R^2				0.220				
Adjusted R^2				0.216				
N				3986				

Notes: [a] = Significant at the $p < 0.001$ level; [b] Variance inflation factor.

The standardized coefficients β in Table 8 display the impact of the 17 individual predictors on the openness towards P2P electricity trading and can be arranged in the following descending order of influence (β values in parentheses): Attitude towards environment and transparency (0.281), P2P participants among acquaintances (0.171), utility evaluation (0.116), rented accommodation (0.074), independence from energy provider (0.076), social media as preferred communication channel with the utility (0.067), knowledge about P2P electricity trading (0.066), decision control (0.065), prosumer (0.063), attitude change (0.051), middle age (0.051), higher education (0.047), family and friends as main energy-related information source (0.043), lower income (0.039), residential location (-0.033), price consciousness (0.032), and regular provider change (0.026). Environmental attitude and peer effects have the greatest, and most socio-demographic and household characteristics have the smallest influence on respondents' openness towards P2P electricity trading, respectively.

5 Discussion

Building on the results of the literature review (section 2) and our estimation results (section 4), we discuss our findings and compare them to the results of prior research. We subsequently discuss the implications of this analysis for marketing strategies regarding P2P electricity trading products.

5.1 Discussion of results

First and foremost, our results indicate that openness towards P2P electricity trading is by far the greatest influencing factor of purchase intention and explains a considerable amount of variance. This finding is in line with the theory of planned behavior (Ajzen, 1991) and literature from related energy fields, where attitudes are consistently found to be an important predictor and precursor of behavioral intention. Knowledge of and familiarity with the product also shows a great impact in predicting the intention to participate in P2P electricity trading, which is in line with related studies – e.g. Islam and Meade (2013) show that technology awareness has a significant effect on the adoption probability of PV systems – and general consumer research (e.g. Baker et al., 2002). Further, our finding that interest in a specific product (P2P electricity trading) goes hand in hand with interest in other related technological products (in our case: microgeneration, bundle tariffs, time-of-use tariffs) supports the results found by Rai et al. (2016) and Reuter and Loock (2017).[11]

Second, the perceived product attributes influence respondents' purchase intentions. Our results show that consumers intending to purchase a P2P electricity trading product value the possibility to share generation and consumption, obtain greater transparency about electricity generation, and easy implementation higher as well as energy costs lower than their uninterested counterparts. This finding supports the results from the literature (e.g. Simpson and Clifton, 2017; Sommerfeld et al., 2017) that innovators and early adopters are to a greater part driven by ideological commitment than monetary reasons. However, financial motivators (as well as data security, ease-of-use, and climate protection) remain key in all groups, as displayed by their high average importance ratings (see section 3), and often are a prerequisite for consumer acceptance (e.g. Goncalves da Silva et al., 2012). Our results support the findings of Gstrein (2016) and partially contradict those of Reuter and Loock (2017) by clarifying that although the decision to participate in P2P electricity trading is dominated by the importance of economic, comfort and data security aspects, the potential to exchange electricity with neighbors and to obtain greater transparency is a motivation that distinguishes the interested from uninterested consumer segments – a fact that should be embraced in marketing strategies. Finally, or result that importance of personal service and independence from energy providers reduce purchase intention seems to be contrary to the findings in related literature. However, the former effect could be explained by individuals' willingness to dispense with customer service for cheaper prices (as price consciousness is a predictor of openness towards P2P electricity sharing). The latter effect seems to be an expression of the pronounced satisfaction

[11] This result could be the manifestation of a more general underlying technological interest, which, however, did not show a statistically significant effect in our estimations, although respondents' technological interest is moderately correlated to the purchase intention of the three products mentioned.

with the current energy supplier (expressed in the highly positive utility evaluation rates) found in our sample.[12]

Third, the most likely provider consumers would purchase from is the (municipal) utility, followed by specialized technology companies. Differences between interested and uninterested customer segments are only found regarding the higher likelihood of telecommunication companies as focal point for purchase, although it remains the least chosen option. This finding supports the results of Rommel et al. (2016) and Reuter and Loock (2017), who detect that telecommunication companies are the least preferred providers and cooperatives or municipalities/municipally-owned utilities are the most preferred ones. It is also in line with the result of Gstrein (2016) that especially prosumers would accept other actors to manage energy communities following the predominantly preferred electricity suppliers.

Finally, considering socio-demographic and household characteristics our results mostly point into similar directions as the related literature: they are of limited importance in predicting purchase intention, compared with the attitudinal and behavioral variables. In our final models they explain at most 1-3% of the purchase intention of and openness towards P2P electricity trading. Our results show that it is not the younger consumer group that is more likely to potentially adopt the new product, as suggested in most studies for other green or innovative energy technologies, but respondents from 40-69 years of age. This finding, however, is in line with the results of Sardianou and Genoudi (2013), and also partially supports the results of Reuter and Loock (2017), who find that individuals in their 20s and 50s are more likely to be interested in participating in local energy markets. A possible reason might be that participation in P2P electricity trading usually is aimed at (and sometimes even requires, depending on the product offered) current owners or potential buyers of microgeneration technologies (especially PV systems with battery storage), i.e. house owners – with house ownership rate being highest in the middle age group.

Openness towards P2P electricity trading not only has a great direct effect on the intention to purchase a P2P product, but it also acts as a moderator for several other influencing factors, such as age and product knowledge. Moreover, while no further socio-demographic and household characteristics showed significant influence on the purchase intention of P2P electricity trading, they to a small extent do so regarding the general openness towards it.

First, our finding that higher educated individuals and prosumers (individuals with greater energy-related involvement) are more open towards the new technological product supports prior research. Furthermore, in line with Gstrein (2016) but opposed to related research, our results indicate that individuals living in rented accommodations are more open towards P2P electricity trading compared with home owners.[13] Our results show that respondents living in urban areas are more likely to have a positive attitude towards P2P electricity trading, which is

[12] A comparably positive rating of the electricity suppliers is found in the annual representative German customer satisfaction survey (e.g. BDEW, 2016). This very positive evaluation may originate from the specific structure of the German energy sector: the strong tradition of local utilities and the persistent trend towards remunicipalization (see e.g. Becker, 2017; Wagner and Berlo, 2017).

[13] This may be attributed to three reasons: (1) prior research (e.g. Claudy et al., 2011) mostly focused on microgeneration which is not directly accessible for tenants – unlike the P2P electricity trading product – so that results are not directly comparable; (2) respondents living in urban areas where the home ownership rate is lower are overrepresented in our sample; or (3) opinions of tenants regarding (local) P2P energy networks actually are more positive when compared to those of house owners.

in line with research on participation in the sharing economy, suggesting that sharing mainly is an urban phenomenon (Andreotti et al., 2017). Reuter and Loock (2017), however, do not find significant effects of residential location on intention to participate in local energy markets. Our finding that lower income households are more open towards P2P electricity trading is again in line with findings from the sharing economy research (Balck and Cracau, 2015), but stands in opposition to most research in related energy fields, which find higher income levels to go hand in hand with greater openness towards technological innovations.

Second, our finding that price consciousness and regular provider change (which is mainly done for economic reasons, see PWC, 2015) positively affect openness towards P2P electricity trading is in line with the vast majority of studies, which find economic motivations besides environmental reasons to be the major driver in consumer attitudes and behavioral intentions towards new energy technologies.

Third, a positive attitude towards the environment and production transparency is the single largest predictor of openness towards P2P electricity trading in our estimations, which is in line with related literature, where environmental attitudes are positively related to attitudes towards green technologies and transparency aspects are found to predict participation in community energy or the sharing economy (e.g. Gstrein, 2016). Furthermore, our result that environmental awareness (and other attitudes) is not significantly influencing purchase intention directly, but is mediated through openness towards P2P electricity trading, supports the findings of Hamari et al. (2015) who indicate that sustainability is not directly associated with participation in the sharing economy but needs the presence of positive attitudes towards sharing. Our result that the desire to increase independence from an energy provider drives the more positive attitude towards P2P electricity trading supports many previous studies, as P2P electricity trading has the potential to enable independence/autarchy. Recent attitude changes concerning energy (energy consciousness) are positively related to openness towards P2P electricity trading, which is in line with the results of Reuter and Loock (2017).

Third, our results show that having decision control regarding the behavior and especially peer effects – i.e. having P2P participants among acquaintances and relying on friends and family as main information sources for energy-related topics – explain a more positive attitude towards P2P electricity trading, which is in line with the literature on related energy topics (e.g. Palm, 2017). The positive relationship between consumers' preference for digital communication and openness towards P2P electricity trading indicates that consumers who are more interested in technology are also more open-minded towards P2P electricity trading. This supports the findings of Reuter and Loock (2017) that interest in technological applications is an explanatory factor for participation in local energy markets.

Finally, our results show that respondents who evaluate their current electricity provider more positively are more open towards P2P electricity trading, which supports the finding that the most likely supplier of the product would be the utility. Interestingly, the desire to be more independent from energy providers on the one hand positively influences openness towards P2P trading, but on the other hand the importance of independence as product attribute influences purchase intention negatively. The same holds true for price consciousness and energy costs. Possibly, this is due to the difference in tangibility of a more general, undifferentiated evaluation of desire for independence or price consciousness compared to a specific evaluation of importance of these attributes in an adoption decision.

5.2 Implications for marketing strategies

A marketing strategy (product, price, distribution, communication) is based on the company objectives and strategy and covers the definition of goals (e.g. positioning, market share, growth rates) to be realized regarding specific consumer target groups. For the following considerations regarding the development of a market launch strategy for a P2P electricity trading product, we assume an incumbent publicly-owned utility targeting customer retention and acquisition primarily on a regional level. As respondents' utility evaluation indicates, municipal utilities are seen very positively by potential target consumer groups and would also be chosen as principal supplier for P2P electricity trading. Municipal utilities, thus, are in a good competitive position, although interested consumers are also more likely to purchase from a telecommunication company, compared to uninterested consumers. For these customers and those seeking for more independence, different business models (degree of service; outsourcing P2P energy trading into joint ventures etc.) could address the various barriers associated with adoption differently to unlock the diverse segments of potential adopters.

Generally, 11% of the respondents declared they would probably purchase P2P electricity trading in the upcoming two years. The most promising target groups are innovators or early adopters, as results of prior research on related topics show (see section 2 and Rogers, 1995). Our estimation results suggest that these trendsetters are middle aged, higher educated, having lower income, live in (sub-)urban areas and are either home owners (i.e. prosumers or people indicating interest in the installation of microgeneration technologies in upcoming two years) or living in rented accommodations, and prefer digital communication channels. They have a greater openness towards P2P electricity trading, recently changed their attitude towards energy, have a strong attitude towards environment and transparency, and a higher preference for independence from energy suppliers, which, however, is not as decisive as product attribute. They are mainly motivated by the ability to share generation and consumption and the additional transparency in the energy market and to a lesser extent by economic reasons. P2P electricity trading, thus, is very compatible to their innovative lifestyle and would perfectly fit image/signaling purposes, further providing them with a 'warm glow'.

This target group must be differentiated into, firstly, pure consumers buying electricity in the community and, secondly, prosumers sharing their production, consuming residual energy from the community, and gaining access to commercialization of their surplus production. That is, to be successful, P2P electricity trading products must offer specific benefits for prosumers and consumers alike, with the melding gain being the possibility to share. Especially pure consumers without own generation should be in the center of attention as the existing P2P electricity trading products in the market suffer from sufficient demand. They could be attracted with the promise that P2P electricity trading offers them a chance to actively take part in the German energy transition. In general, the benefits for both groups should be conceived as comprehensibly as possible - i.e. despite the high involvement of early adopters, the inherent complexity of the product should not be transferred to the consumer. As our results indicate, this incorporates features such as ease-of-use, transparency, but also data security. Per definition, the product is environmentally friendly and covers the high importance households lay on this product characteristic. Further important product features from related markets should be adopted (see section 2).

Moreover, our findings indicate that P2P electricity trading could be sold as part of a product bundle, as interested consumers are found to be also more interested in related technological

options (microgeneration, bundle tariffs, and time-of-use tariffs). Some battery and microgeneration providers do so already, for instance by selling their batteries with discount if buyers also participate in their energy community (e.g. *Sonnen*). Thus, bundles with other products seem promising, e.g. an offer in combination with electric mobility (r = 0.234), potentially supported by a fitting tariff structure. This is also in line with the findings of Rai et al. (2016), who describe that 82% of solar adopters co-adopt an energy-related product (energy efficiency, electric vehicle, etc.).

Pricing of a P2P electricity trading product needs to build several bridges. On the one hand, upfront cost of constructing the trading platform are high and on the other hand our results show that the target group is price conscious. Finding an optimal and competitive solution which satisfies both sides is challenging, as from a consumer's point of view the price structure needs to be comprehensible and transparent (see e.g. Sagebiel et al., 2014; Rommel et al., 2016), while from the supplier's point of view the complexity of price components is high. I.e. the simpler the price structure (e.g. via flat rates), the lower the reservation of consumers, but the higher the risk for the provider.

Distribution and communication measures should focus on the involvement of the respective target group. In general, P2P electricity trading is comparably unknown – in our sample, only 15% of all respondents had already heard of this product before. However, innovators and early adopters generally are more involved – i.e. show greater technical interest or openness towards technical change, familiarity with the product, have the ability to adopt the product, and have regularly switched their provider or tariff in the past. Therefore, in their communication strategy providers should give detailed information to attract this group. To address further consumers to broaden the market development, the product has to be explained very comprehensibly. Depending on market share targets, education campaigns might be envisioned. Additionally, the information-based communication should be framed emotionally. To do so, peer effects should be utilized, as they greatly increase openness towards and purchase intention for P2P electricity trading. It is, therefore, important to develop peer-group distribution and communication channels – directly or via social media – and use innovators as change agents (Matschoss et al., 2015). This is also in line with the results of Rai et al. (2016) who find that peers (installers, neighbors with PV systems) are directly responsible for about 13% of the adoption decision. However, also traditional communication channels should be used, since our results show that 51% of the respondents gather energy-related information from their energy supplier, 20% from installers, and 11% from energy advisers, which makes them extremely important actors in the information gathering, decision making and adoption process. This is again in line with the results of Rai et al. (2016) who emphasize that direct marketing has a chilling effect on adopters' tendency to reach out to information from neighbors and acquaintances. This finding is valuable for energy suppliers, as customers' positive evaluation and trust can be used to support their information-based communication (the current utility as reliable and known partner).

Regarding positioning of the product, we remind that purchase intention can be based on economic (price consciousness) and ideological reasons and further added values (transparency, sharing possibility, environmental concern, support of local production). Thus, theoretically, communication could be based on either motives and address them accordingly and differently. However, this would foil a clear positioning and branding. Moreover, the cost structure regularly prohibits low-price strategies in the field. Consequently, the added values should be addressed more pronounced, based on an impression of fair pricing. This is supported by the

finding of Bomberg and MacEwen (2012) that the use of symbolic resources, such as shared identity or desire for self-reliant communities, is highly effective in aiding mobilization for participation on community energy projects, and by the results of Reuter and Loock (2017) who indicate that marketing strategies should inform about the local origin of electricity and highlight the benefits to the local community.

6 Conclusion and policy implications

Political efforts are undertaken to enhance decentralized energy markets. This assigns a new, more active role to the consumer. While the trend towards customer-based microgeneration is at the verge from a niche towards a mass market, P2P energy trading still is a rather unknown product for many potential customers. Therefore, based on data from a survey carried out in April and May 2017 among customers of seven German utilities and hierarchical multiple regressions, we identified the most prospective customer segments, their preferences and motivations for participating in P2P electricity trading and described implications for marketing strategies.. Our results show a low importance of socio-demographics in explaining differences between consumer groups, but a high explanatory power of attitudes, knowledge, peer effects, and likelihood to purchase further products. The most valuable target groups for P2P electricity trading are innovators and early adopters. They are well informed about and open towards electricity sharing, highly environmentally aware and favor and ask for transparency about production. They tend to purchase related products (e.g. microgeneration) and their motivation is stimulated by the ability to share generation and consumption and to a lesser extent to economize.

Regarding marketing strategies, the acquisition of prosumers tends to be the easier task, given their generally higher involvement and innovativeness concerning energy-related issues and the German market environment with first renewable generation falling out of the subsidization scheme in the near future. By contrast, gaining new, uninvolved consumers will be the far more challenging task, as the first offerings on the market show. However, it is a crucial one in order to realize a functioning and lively P2P electricity trading community. Marketing efforts, thus, should aim at both target segments focusing on linking digitalized services with at least the look and feel of personalized and P2P-based distribution and tailored communication approaches for prosumers and consumers. Our results indicate that the efforts should take peer effects actively into account, as they are found to wield great influence on general openness towards and purchase intention for P2P electricity products.

Our study expands previous research in several ways. However, some shortcomings have to be mentioned: First, the survey was conducted in cooperation with seven energy providers, which potentially has biased the results. Second, P2P electricity trading was only one of several topics covered in our survey, so that questions had to be skipped and scales to be shortened. This could be a reason why the items measuring the attitude towards P2P electricity trading did not load clearly on their theoretically envisaged factors. Third, we integrated potential prosumers as well as consumers (tenants) in the sample without explicitly and systematically focusing on their differences. Therefore, a more differentiated study of P2P electricity sharing regarding attitudes, preferences and intentions of consumers on the one hand and of prosumers on the other hand assessed via a specialized in-depth follow-up survey represents a valuable and

important topic for future research to better address these different groups and deduce tailored marketing strategies.

Acknowledgements

This study was enabled by a grant received from Südwestdeutsche Stromhandels GmbH and seven German municipal utilities which is gratefully acknowledged. Further, the authors would like to thank participants of the 12th BIEE Research Conference in Oxford, UK, September 18-19, 2018 for helpful comments and fruitful discussions.

References

AGEB, 2018. Auswertungstabellen zur Energiebilanz für die Bundesrepublik Deutschland 1990 bis 2017 (Stand Juni 2018). Arbeitskreis Energiebilanzen e.V. [Online] URL: https://ag-energiebilanzen.de/10-0-Auswertungstabellen.html.

Ajzen, I., 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50, 179-211.

Akbar, P., Mai, R., Hoffmann, S., 2016. When do materialistic consumers join commercial sharing systems. *Journal of Business Research* 69 (10), 4215-4224.

Andreotti, A., Anselmi, G., Eichhorn, T., Hoffmann, C. P., Micheli, M., 2017. Participation in the sharing economy. *SSRN Electronic Journal*. [Online] URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2961745.

Baker, T., Hunt, J.B., Scribner, L.L., 2002. The effect of introducing a new brand on consumer perceptions of current brand similarity: The roles of product knowledge and involvement. *Journal of Marketing Theory and Practice* 10 (4), 45-57.

Balck, B., Cracau, D., 2015. Empirical analysis in customer motives in the shareconomy: A cross-sectional comparison. Working Paper No. 2/2015. Otto-von-Guericke-Universität Magdeburg, Magdeburg, Germany.

Balcombe, P., Rigby, D., Azapagic, A., 2013. Motivations and barriers associated with adopting microgeneration energy technologies in the UK. *Renewable and Sustainable Energy Reviews* 22, 655-666.

Balcombe, P., Rigby, D., Azapagic, A., 2014. Investigating the importance of motivations and barriers related to microgeneration uptake in the UK. *Applied Energy* 130, 403-418.

Bauwens, T., 2016. Explaining the diversity of motivations behind community renewable energy. *Energy Policy* 93, 278-290.

BBSR, 2017. Downloads – 'Siedlungsstrukturelle Kreistypen'. Federal Institute for Research on Building, Urban Affairs and Spatial Development, Bonn, Germany. [Online] URL: https://www.bbsr.bund.de/BBSR/DE/Raumbeobachtung/Downloads/downloads_node.html.

BDEW, 2016. BDEW Kundenfokus Haushalte – Repräsentative Bundesstudie 2016. Final Report, Federal Association of the Energy and Water Industry, November.

Becker, S., 2017. Our city – Our grid: The energy remunicipalisation trend in Germany. In: Kishimoto, S., Petitjean, O. (Eds.), Reclaiming public services: How cities and citizens are turning back privatisations. Transnational Insititute, Amsterdam, The Netherlands, Paris, France, 117-129.

Bergek, A., Mignon, I., 2017. Motives to adopt renewable electricity technologies: Evidence from Sweden. *Energy Policy* 106, 547-559.

BMWi, 2014. Smart Energy made in Germany – Erkenntnisse zum Aufbau und zur Nutzung intelligenter Energiesysteme im Rahmen der Energiewende. Bundesministerium für Wirtschaft und Energie, Berlin, Germany.

Böcker, L., Meelen, T., 2017. Sharing for people, planet or profit? Analysing motivations for intended sharing economy participation. *Environmental Innovation and Societal Transitions* 23, 28-39.

Bomberg, E., McEwen, N., 2012. Mobilizing community energy. *Energy Policy* 51, 435-444.

Boon, F.P., Dieperink, C., 2014. Local civil society based renewable energy organisations in the Netherlands: Exploring the factors that stimulate their emergence and development. *Energy Policy* 69, 297-307.

Borchers, A.M., Duke, J.M., Parsons, G.R., 2007. Does willingness to pay for green energy differ by source? *Energy Policy* 35 (6), 3327-3334.

Buchanan, K., Banks, N., Preston, I., Russo, R., 2016. The British public's perception of the UK smart metering initiative: Threats and opportunities. *Energy Policy* 91, 87-97.

Bucher, E., Fieseler, C., Lutz, C., 2016. What's mine is yours (for a nominal fee): Exploring the spectrum of utilitarian to altruistic motives for Internet-mediated sharing. *Computers in Human Behavior* 62, 316-326.

Bundesnetzagentur, 2018. Zahlen, Daten und Informationen zum EEG. [Online] URL: https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/ErneuerbareEnergien/ZahlenDatenInformationen/zahlenunddaten-node.html.

Bundesnetzagentur/Bundeskartellamt, 2017. Monitoring Report 2017. 13 December 2017, Bonn, Germany.

Claudy, M.C., Michelsen, C., O'Driscoll, A., 2011. The diffusion of microgeneration technologies – Assessing the influence of perceived product characteristics on homeowners' willingness to pay. *Energy Policy* 39, 1459-1469.

Codagnone, C., Biagi, F., Abadie, F., 2016. The passions and the interests: Unpacking the 'sharing economy'. Institute for Prospective Technological Studies, JRC Science for Policy Report EUR 27914 EN.

Destatis, 2018. Tables – 'Bevölkerungsstand', 'Einkommen, Einnahmen & Ausgaben', 'Bildungsstand', 'Wohnen'. Federal Statistical Office, Wiesbaden, Germany. [Online] URL: https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/StaatGesellschaft.html.

Dóci, G., Vasileiadou, E., 2015. Let's do it ourselves: Individual motivations for investing in renewables at community level. *Renewable and Sustainable Energy Reviews* 49, 41-50.

EC, 2016. Clean Energy For All Europeans. Communication from the Commission COM(2016) 860 final. November, European Commission, Brussels, Belgium. [Online] URL: https://eur-lex.europa.eu/resource.html?uri=cellar:fa6ea15b-b7b0-11e6-9e3c-01aa75ed71a1.0001.02/DOC_1&format=PDF

EC, 2018. Renewable energy: Moving towards a low carbon economy. European Commission, Brussels, Belgium. [Online] URL: https://ec.europa.eu/energy/en/topics/renewable-energy.

Espe, E., Potdar, V., Chang, E., 2018. Prosumer communities and relationships in smart grids: A literature review, evolution and future directions. *Energies*, 11, 2528, doi:10.3390/en11102528.

Ford, R., Stephenson, J., Whitaker, J., 2016. Prosumer collectives: A review. University of Otago, Dunedin, New Zealand.

Forsa, 2010. Erfolgsfaktoren von Smart Metering aus Verbrauchersicht. Study for Verbraucherzentrale Bundesverband e.V., 12 May 2010, Berlin, Germany.

Gamel, J., Menrad, K., Decker, T., 2016. Is it really all about the return on investment? Exploring private wind energy investors' preferences. *Energy Research & Social Science* 14, 22-32.

Gangale, F., Mengolini, A., Onyeji, I., 2013. Consumer engagement: An insight from smart grid projects in Europe. *Energy Policy* 60, 621-628.

Gerpott, T.J., Mahmoudova, I., 2010a. Determinants of green electricity adoption among residential customers in Germany. *International Journal of Consumer Studies* 34 (4), 464-473.

Gerpott, T.J., Mahmoudova, I., 2010b. Determinants of price mark-up tolerance for green electricity – Lessons for environmental marketing strategies from a study of residential electricity customers in Germany. *Business Strategy and the Environment* 19 (5), 304-318.

Girod, B., Mayer, S., Nägele, F., 2017. Economic versus belief-based models: Shedding light on the adoption of novel green technologies. *Energy Policy* 101, 415-426.

Gölz, S., Hahnel, U.J.J., 2016. What motivates people to use energy feedback systems? A multiple goal approach to predict long-term usage behaviour in daily life. *Energy Research & Social Science* 21, 155-166.

Goncalves da Silva, P., Karnouskos, S., Ilic, D., 2012. A survey towards understanding residential prosumers in smart grid neighbourhoods. Proceedings of the 2012 IEEE 3rd PES Innovative Smart Grid Technologies Europe, 14-17 October, Berlin, Germany, 1-8.

Gossen, M., Henseling, C., Bätzing, M., Flick, C., 2016. Peer-to-Peer Sharing: Einschätzungen und Erfahrungen – Ergebnisse einer qualitativen Befragung. PeerSharing Arbeitsbericht 3, February, Berlin, Germany.

Groening, C., Sarkis, J., Zhu, Q., 2018. Green marketing consumer-level theory review: A compendium of applied theories and further research directions. *Journal of Cleaner Production* 172, 1848-1866.

Gstrein, M., 2016. Handling the crowd – An explorative study on the implications of prosumer-consumer communities on the value creation in the future electricity network. Doctoral thesis, iimt University Press, Fribourg, Switzerland.

Gui, E.M., MacGill, I., 2018. Typology of future clean energy communities: An exploratory structure, opportunities, and challenges. *Energy Research & Social Science*, doi: 10.1016/j.erss.2017.10.019.

Hackbarth, A., Tremml, T., Löbbe, S., 2019: Private households' preferences for product bundles in the energy sector. Reutlingen Working Papers on Marketing & Management, ESB Business School, Reutlingen University, Germany (forthcoming).

Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 2010. Multivariate data analysis. 7th ed., Prentice Hall, New Jersey, US.

Hamari, J., Sjöklint, M., Ukkonen, A., 2015. The sharing economy: Why people participate in collaborative consumption. *Journal of the Association for Information Science & Technology* 67 (9), 2047-2059.

Hartmann, P., Apaolaza-Ibáñez, V., 2012. Consumer attitude and purchase intention toward green energy brands: The roles of psychological benefits and environmental concern. *Journal of Business Research* 65 (9), 1254-1263.

Herbes, C., Ramme, I., 2014. Online marketing of green electricity in Germany: A content analysis of providers' websites. *Energy Policy* 66, 257-266.

Hicks, J., Ison, N., 2018. An exploration of the boundaries of 'community' in community renewable energy projects: Navigating between motivations and context. *Energy Policy* 113, 523-534.

Holstenkamp, L., Kahla, F., 2016. What are community energy companies trying to accomplish? An empirical investigation of investment motives in the German case. *Energy Policy* 97, 112-122.

Islam, T., 2014. Household level innovation diffusion model of photo-voltaic (PV) solar cells from stated preference data. *Energy Policy* 65, 340-350.

Islam, T., Meade, N., 2013. Impact of attribute preferences and attitudinal constructs on adoption timing: The case of solar photo-voltaic (PV) cells for household level electricity generation. *Energy Policy* 55, 521-530.

Kaenzig, J., Heinzle, S.L., Wüstenhagen, R., 2013. Whatever the customer wants, the customer gets? Exploring the gap between consumer preferences and default electricity products in Germany. *Energy Policy* 53, 311-322.

Kahma, N., Matschoss, K., 2017. The rejection of innovations? Rethinking technology diffusion and the nonuse of smart energy services in Finland. *Energy Research & Social Science* 34, 27-36.

Kairies, K.P., Haberschusz, D., van Ouwerkerk, J., Strebel, J., Wessels, O., Magnor, D., Badeda, J., Sauer, D.U., 2016. Wissenschaftliches Mess- und Evaluierungsprogramm Solarstromspeicher: Jahresbericht 2016. Institut für Stromrichtertechnik und Elektrische Antriebe, RWTH Aachen University, Aachen, Germany.

Kalkbrenner, B.J., Roosen, J., 2016. Citizens' willingness to participate in local renewable energy projects: The role of community and trust in Germany. *Energy Research & Social Science* 13, 60-70.

Kaphengst, T., Velten, E.K., 2014. Energy transition and behavioural change in rural areas – The role of energy cooperatives. WWWforEurope Working Paper No. 60, WWWforEurope, Vienna, Austria.

Karakaya, E., Hidalgo, A., Nuur, C., 2015. Motivators for adoption of photovoltaic systems at grid parity: A case study from Southern Germany. *Renewable and Sustainable Energy Reviews* 43, 1090-1098.

Karrer, K., Glaser, C., Clemens, C., Bruder, C., 2009. Technikaffinität erfassen – der Fragebogen TA-EG. In: Lichtenstein, A., Stel, C., Clemens, C. (Eds.), Der Mensch als Mittelpunkt technischer Systeme. 8. Berliner Werkstatt Mensch-Maschine-Systeme, VDI Verlag, Düsseldorf, Germany, 196-201.

Kastner, I., Matthies, E., 2016. Investments in renewable energies by German households: A matter of economics, social influences and ecological concern?. *Energy Research & Social Science* 17, 1-9.

Kim, S., Egerter, S., Cubbin, C., Takahashi, E.R., Braveman, P., 2007. Potential implications of missing income data in population-based surveys: An example from a postpartum survey in California. *Public Health Reports* 122, 753-763.

Kitzing, L., Mitchell, C., Morthorst, P.E., 2012. Renewable energy policies in Europe: Converging or diverging?. *Energy Policy* 51, 192-201.

Koirala, B.P. Kolioua, E., Friege, J., Hakvoort, R.A., Herder, P.M., 2016. Energetic communities for community energy: A review of key issues and trends shaping integrated community energy systems. *Renewable and Sustainable Energy Reviews* 56, 722-744.

Korcaj, L., Hahnel, U.J.J., Spada, H., 2015. Intentions to adopt photovoltaic systems depend on homeowners' expected personal gains and behavior of peers. *Renewable Energy* 75, 407-415.

Kowalska-Pyzalska, A. 2018. What makes consumers adopt to innovative energy services in the energy market? A review of incentives and barriers. *Renewable and Sustainable Energy Reviews* 82 (3), 3570-3581.

Kuckartz, 2000. Umweltbewusstsein in Deutschland 2000 – Ergebnisse einer repräsentativen Bevölkerungsumfrage. Study for the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety / Federal Environment Agency, Berlin, Germany.

Leenheer, J., Nooij, M., Sheikh, O., 2011. Own power: Motives of having electricity without the energy company. *Energy Policy* 39 (9), 5621-5629.

Litvine, D., Wüstenhagen, R., 2011. Helping "light green" consumers walk the talk: Results of a behavioral intervention survey in the Swiss electricity market. *Ecological Economics* 70 (3), 462-474.

Löbbe, S., Hackbarth, A., 2017. The transformation of the German electricity sector and the emergence of new business models in distributed energy systems. In: Sionshansi, F. (Ed.), Innovation and disruption at the grid's edge – How distributed energy resources are disrupting the utility business model. Academic Press, London, UK, 287-318.

Ma, C., Burton, M., 2016. Warm glow from green power: Evidence from Australian electricity consumers. *Journal of Environmental Economics and Management* 78, 106-120.

Ma, C., Rogers, A.A., Kragt, M.E., Zhang, F., Polyakov, M., Gibson, F., Chalak, M., Pandit, R., Tapsuwan, S., 2015. Consumers' willingness to pay for renewable energy: A meta-regression analysis. *Resource and Energy Economics* 42, 93-109.

Matschoss, K., Kahma, N., Heiskanen, E., 2015. Pioneering customers as change agents for new energy efficiency services – An empirical study in the Finnish electricity markets. *Energy Efficiency* 8 (5), 827-843.

Michaels, L., Parag, Y., 2016. Motivations and barriers to integrating 'prosuming' services into the future decentralized electricity grid: Findings from Israel. *Energy Research & Social Science* 21, 70-83.

Milanova, V., Maas, P., 2017. Sharing intangibles: Uncovering individual motives for engagement in a sharing service setting. *Journal of Business Research* 75, 159-171.

Moret, F., Pinson, P., 2018. Energy Collectives: A community and fairness based approach to future electricity markets. *IEEE Transactions on Power Systems*, doi: 10.1109/TPWRS.2018.2808961.

Nygrén, N.A., Kontio, P., Lyytimäki, J., Varho, V., Tapio, P., 2015. Early adopters boosting the diffusion of sustainable small-scale energy solutions. *Renewable and Sustainable Energy Reviews* 46, 79-87.

Oberst, C.A., Madlener, R., 2014. Prosumer preferences regarding the adoption of micro-generation technologies: Empirical evidence for German homeowners. FCN Working Paper No. 22/2014 (revised 13 October 2015), RWTH Aachen University, Aachen, Germany.

Oerlemans, L.A., Chan, K.-Y., Volschenk, J., 2016. Willingness to pay for green electricity: A review of the contingent valuation literature and its sources of error. *Renewable and Sustainable Energy Reviews* 66, 875-885.

Palm, A., 2017. Peer effects in residential solar photovoltaics adoption – A mixed methods study of Swedish users. *Energy Research & Social Science* 26, 1-10.

Parag, Y., Sovacool, B.K., 2016. Electricity market design for the prosumer era. *Nature Energy* 1, Article number: 16032.

Park, C., Yong, T., 2017. Comparative review and discussion on P2P electricity trading. *Energy Procedia* 128, 3-9.

Peterson, R.A., 1994. A meta-analysis of Cronbach's coefficient alpha. *Journal of Consumer Research* 21 (2), 381-391.

PWC, 2015. Bevölkerungsbefragung Stromanbieter. PricewaterhouseCoopers, Frankfurt, Germany.

Rai, V., Reeves, D.C., Margolis, R., 2016. Overcoming barriers and uncertainties in the adoption of residential solar PV. *Renewable Energy* 89, 498-505.

Rathnayaka, A.D., Potdar, V.M., Dillon, T., Hussain, O., Kuruppu, S., 2014. Goal-oriented prosumer community groups for the smart grid. *IEEE Technology and Society Magazine* 33 (1), 41-48.

Reuter, E., Loock, M., 2017. Empowering local electricity markets: A survey study from Switzerland, Norway, Spain and Germany. Institute for Economy and the Environment, University of St. Gallen, St. Gallen, Switzerland.

Rogers, E.M., 1995. Diffusion of Innovations. 4th ed., The Free Press, New York, US.

Rommel, J., Sagebiel, J., Müller, J.R., 2016. Quality uncertainty and the market for renewable energy: Evidence from German consumers. *Renewable Energy* 94, 106-113.

Ruotsalainen, J., Karjaleinen, J., Child, M., Heinonen, S., 2017. Culture, values, lifestyles, and power in energy futures: A critical peer-to-peer vision for renewable energy. *Energy Research & Social Science* 34, 231-239.

Sagebiel, J., Müller, J.R., Rommel, J., 2014. Are consumers willing to pay more for electricity from cooperatives? Results from an online choice experiment in Germany. *Energy Research & Social Science* 2, 90-101.

Sardianou, E., Genoudi, P., 2013. Which factors affect the willingness of consumers to adopt renewable energies?. *Renewable Energy* 57, 1-4.

Schor, J.B., Fitzmaurice, C.J., 2015. Collaborating and connecting: The emergence of the sharing economy. In: Reisch, L.A., Thøgersen, J. (Eds.), Handbook of research on sustainable consumption, Edward Elgar, Cheltenham, UK, 410-425.

Seyfang, G., Park, J.J., Smith, A., 2013. A thousand flowers blooming? An examination of community energy in the UK. *Energy Policy* 61, 977-989.

Shelly, C., 2014. Residential solar electricity adoption: What motivates, and what matters? A case study of early adopters. *Energy Research & Social Science* 2, 183-191.

Sigrin, B., Pless, J., Drury, E., 2015. Diffusion into new markets: Evolving customer segments in the solar photovoltaics market. *Environmental Research Letters* 10 (8), 084001.

Simpson, G., Clifton, J., 2017. Testing diffusion of innovations theory with data: Financial incentives, early adopters, and distributed solar energy in Australia. *Energy Research & Social Science* 29, 12-22.

Sommerfeld, J., Buys, L., Vine, D., 2017. Residential consumers' experiences in the adoption and use of solar PV. *Energy Policy* 105, 10-16.

Soon, J.J., Ahmad, S.A., 2015. Willingly or grudgingly? A meta-analysis on the willingness-to-pay for renewable energy use. *Renewable and Sustainable Energy Reviews* 44, 877-887.

Soskin, M., Squires, H., 2013. Homeowner willingness to pay for rooftop solar electricity generation. *Environmental Economics* 4 (1), 102-111.

Sousa, T., Soares, T., Pinson, P., Moret, F., Baroche, T., Sorin, E., 2018. Peer-to-peer and community-based markets: A comprehensive review. Preprint submitted to *Renewable and Sustainable Energy Reviews*, 7 June 2018.

Strupeit, L., Palm, A., 2016. Overcoming barriers to renewable energy diffusion: Business models for customer-sited solar photovoltaics in Japan, Germany and the United States. *Journal of Cleaner Production* 23, 124-136.

Sundt, S., Rehdanz, K., 2015. Consumers' willingness to pay for green electricity: A meta-analysis of the literature. *Energy Economics* 51, 1-8.

Tabi, A., Hille, S.L., Wüstenhagen, R., 2014. What makes people seal the green power deal? Customer segmentation based on choice experiment in Germany. *Ecological Economics* 107, 206-215.

Taylor, S. and Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research* 6, 144-176.

Teufel, S., Teufel, B., 2014. The crowd energy concept. *Journal of Electronic Science and Technology* 12 (3), 263-269.

TrendResearch, 2016. Anteile einzelner Marktakteure an Erneuerbare Energien-Anlagen in Deutschland. 3rd ed., TrendResearch, Bremen, Germany.

Turrell, G., 2000. Income non-reporting: Implications for health inequalities research. *Journal of Epidemiology Community Health* 54, 207-14.

Van der Werff, E., Steg, L., 2016. The psychology of participation and interest in smart energy systems: Comparing the value-belief-norm theory and the value-identity-personal norm model. *Energy Research & Social Science* 22, 107-114.

Vasseur, V., Kemp, R., 2015. The adoption of PV in the Netherlands: A statistical analysis of adoption factors. *Renewable and Sustainable Energy Reviews* 41, 483-494.

Vecchiato, D., Tempesta, T., 2015. Public preferences for electricity contracts including renewable energy: A marketing analysis with choice experiments. *Energy* 88, 168-179.

Volz, R., 2012. Bedeutung und Potenziale von Energiegenossenschaften in Deutschland - Eine empirische Aufbereitung. *Informationen zur Raumentwicklung* 9/10 2012, 515-524.

Wagner, O., Berlo, K., 2017. Remunicipalisation and foundation of municipal utilities in the German energy sector: Details about newly established enterprises. *Journal of Sustainable Development of Energy, Water and Environment Systems* 5 (3), 396-407.

Willis, K., Scarpa, R., Gilroy, R., Hamza, N., 2011. Renewable energy adoption in an ageing population: Heterogeneity in preferences for micro-generation technology adoption. *Energy Policy* 39 (10), 6021-6029.

Wolske, K., Stern, P.C., Diertz, T., 2017. Explaining interest in adopting residential solar photovoltaic systems in the United States: Toward an integration of behavioral theories. *Energy Research & Social Science* 25, 134-151.

Yang, Y., Stubbe Solgaard, H., Haider, W., 2015. Value seeking, price sensitive, or green? Analyzing preference heterogeneity among residential energy consumers in Denmark. *Energy Research & Social Science* 6, 15-28.

Zhai, P., Williams, E.D., 2012. Analyzing consumer acceptance of photovoltaics (PV) using fuzzy logic model. *Renewable Energy* 41, 350-357.

Zhang, C., Wu, J., Long, C., Cheng, M., 2017. Review of existing peer-to-peer energy trading projects. *Energy Procedia* 105, 2563-2568.

Reutlinger Diskussionsbeiträge zu Marketing & Management –
Reutlingen Working Papers on Marketing & Management

herausgegeben von

Prof. Dr. Carsten Rennhak
Universität der Bundeswehr München
Institut für Organisationskommunikation
Werner-Heisenberg-Weg 39
D-85577 Neubiberg
Fon: +49 (0)89 / 6004-3128
Fax: +49 (0)89 / 6004-2252
E-Mail: carsten.rennhak@unibw.de
Internet: www.unibw.de/bw/institute/organisationskommunikation

und

Prof. Dr. Gerd Nufer
Hochschule Reutlingen
ESB Business School
Institut für Marketing, Marktforschung & Kommunikation
Alteburgstraße 150
D-72762 Reutlingen
Fon: +49 (0)7121 / 271-6011
Fax: +49 (0)7121 / 271-906011
E-Mail: gerd.nufer@reutlingen-university.de
Internet: www.marketing-nufer.de

Bisher erschienen

2006 - 1 *Felix Morlock / Robert Schäffler / Philipp Schaffer / Carsten Rennhak*:
Product Placement – Systematisierung, Potenziale und Ausblick

2006 - 2 *Marko Sarstedt / Kornelia Huber:*
Erfolgsfaktoren für Fachbücher – Eine explorative Untersuchung verkaufsbeeinflussender Faktoren am Beispiel von Marketing-Fachbüchern

2006 - 3 *Michael Menhart / Carsten Rennhak:*
Drivers of the Lifecycle –
the Example of the German Insurance Industry

2006 - 4 *Siegfried Numberger / Carsten Rennhak:*
Drivers of the Future Retailing Environment

2006 - 5 *Gerd Nufer:*
Sportsponsoring bei Fußball-Weltmeisterschaften:
Wirkungsvergleich WM 2006 versus WM 1998

2006 - 6 *André Bühler / Gerd Nufer:*
The Nature of Sports Marketing

2006 - 7 *Gerd Nufer / André Bühler:*
Lessons from Sports:
What Corporate Management can learn from Sports Management

2007 - 1 *Gerd Nufer / Anna Andresen:*
Empirische Untersuchung zum Image der School of International Business (SIB) der Hochschule Reutlingen

2007 - 2 *Tobias Kesting:*
Marktsegmentierung in der Unternehmenspraxis: Stellenwert, Vorgehen und Herausforderungen

2007 - 3 *Marie-Sophie Hieke / Marko Sarstedt:*
Open Source-Marketing im Unternehmenseinsatz

2007 - 4 *Ahmed Abdelmoumene:*
Direct-to-Consumer-Marketing in der Pharmaindustrie

2007 - 5 *Mario Gottfried Bernards:*
Markenmanagement von politischen Parteien in Deutschland – Entwicklungen, Konsequenzen und Ansätze der erweiterten Markenführung

2007 - 6 *Christian Führer / Anke Köhler / Jessica Naumann:*
Das Image der Versicherungsbranche unter angehenden Akademikern – eine empirische Analyse

2008 - 1 *Gerd Nufer / Katharina Wurmer:*
Innovatives Retail Marketing

2008 - 2 *Gerd Nufer / Victor Scheurecker:*
Brand Parks als Form des dauerhaften Event-Marketing

2008 - 3 *Gerd Nufer / Charlotte Heine:*
Internationale Markenpiraterie

2008 - 4 *Gerd Nufer / Jennifer Merk:*
Ergebnisse empirischer Untersuchungen zum Ambush Marketing

2008 - 5 *Gerd Nufer / Manuel Bender:*
Guerilla Marketing

2008 - 6 *Gerd Nufer / Christian Simmerl:*
Strukturierung der Erscheinungsformen des Ambush Marketing

2008 - 7 *Gerd Nufer / Linda Hirschburger:*
Humor in der Werbung

2009 - 1 *Gerd Nufer / Christina Geiger:*
In-Game Advertising

2009 - 2 *Gerd Nufer / Dorothea Sieber:*
Factory Outlet Stores – ein Trend in Deutschland?

2009 - 3 *Bianca Frank / Carsten Rennhak:*
Product Placement am Beispiel des Kinofilms
Sex and the City: The Movie

2009 – 4 *Stephanie Kienzle / Carsten Rennhak:*
Cause-Related Marketing

2009 - 5 *Sabrina Nadler / Carsten Rennhak:*
Emotional Branding in der Automobilindustrie –
ein Schlüssel zu langfristigem Markenerfolg?

2009 - 6 *Gerd Nufer / André Bühler:*
The Importance of mutual beneficial Relationships
in the Sponsorhip Dyad

2010 - 1 *Gerd Nufer / Sandra Oexle:*
Marketing für Best Ager

2010 - 2 *Gerd Nufer / Oliver Förster:*
Lovemarks – emotionale Aufladung von Marken

2010 - 3 *Gerd Nufer / Pascal Schattner:*
Virales Marketing

2010 - 4 *Carina Knörzer / Carsten Rennhak:*
Gender Marketing

2010 - 5 *Ottmar Schneck:*
Herausforderungen für Hochschulen und Unternehmen durch die Generation Y – Zumutungen und Chancen durch die neue Generation Studierender und Arbeitnehmer

2010 - 6 *Gerd Nufer / Miriam Wallmeier:*
Neuromarketing

2010 - 7 *Gerd Nufer / Anton Kocher:*
Ingredient Branding

2010 - 8 *Gerd Nufer / Jan Fischer:*
Markenmanagement bei Einzelsportlern

2010 - 9 *Gerd Nufer / Simon Miremadi:*
Flashmob Marketing

2011 - 1 *Hans-Martin Beyer / Simon Brüseken:*
Akquisitionsstrategie "Buy-and-Build" –
Konzeptionelle Aspekte zu Strategie und Screeningprozess

2011 - 2 *Gerd Nufer / Ann-Christin Reimers:*
Looking at Sports –
Values and Strategies for International Management

2011 - 3 *Ebru Sahin / Carsten Rennhak:*
Erfolgsfaktoren im Teamsportsponsoring

2011 - 4 *Gerd Nufer / Kornelius Prell:*
Operationalisierung und Messung von Kundenzufriedenheit

2011 - 5 *Gerd Nufer / Daniel Kelm:*
Cross Selling Management

2011 - 6 *Gerd Nufer / Christina Geiger:*
Ambush Marketing im Rahmen der
FIFA Fußball-Weltmeisterschaft 2010

2011 - 7 *Gerd Nufer / Felix Müller:*
Ethno-Marketing

2011 - 8 *Shireen Stengel / Carsten Rennhak:*
Corporate Identity – Aktuelle Trends und Managementansätze

2011 - 9 *Clarissa Müller / Holger Benad / Carsten Rennhak:*
E-Mobility – Treiber, Implikationen für die beteiligten Branchen und mögliche Geschäftsmodelle

2011 - 10 *Carsten Schulze / Carsten Rennhak:*
Kommunikationspolitische Besonderheiten regulierter Märkte

2011 - 11 *Sarina Rehme / Carsten Rennhak:*
Marketing and Sales – successful peace-keeping

2011 - 12 *Gerd Nufer / Rainer Hirt:*
Audio Branding meets Ambush Marketing

2011 - 13 *Peter Kleine-Möllhoff / Martin Haußmann / Michael Holzhausen / Tobias Lehr / Mandy Steinbrück:*
Energie- und Ressourceneffizienz an der Hochschule Reutlingen – Mensa, Sporthalle, Aula, Containergebäude 20, Kindertagesstätte

2011 - 14 *Peter Kleine-Möllhoff / Manuel Kölz / Jens Krech / Ulf Lindner / Boris Stassen:*
Energie- und Ressourceneffizienz an der Hochschule Reutlingen – Betriebshalle, Vorlesungsgebäude Textil & Design, Hochschul-servicezentrum

2011 - 15 *Peter Kleine-Möllhoff / Svenja Gerstenberger / Junghan Gunawan / Michael Schneider / Bernhard Weisser:*
Energie- und Ressourceneffizienz an der Hochschule Reutlingen – Verwaltung, Bibliothek, Rechenzentrum, Betriebswirtschaft, Chemie, Wirtschaftsingenieurwesen

2012 - 1 *Gerd Nufer / Aline Kern:*
Sensation Marketing

2012 - 2 *Gerd Nufer / Matthias Graf:*
Kundenbewertung

2012 - 3 *Peter Kleine-Möllhoff / Holger Benad / Frank Beilard / Mohammed Esmail / Martina Knöll:*
Die Batterie als Schlüsseltechnologie für die Elektromobilität der Zukunft. Herausforderungen – Potentiale – Ausblick

2012 - 4 *Miriam Linder / Carsten Rennhak:*
Lebensmittel-Onlinehandel in Deutschland

2012 - 5 *Gerd Nufer / Vanessa Ambacher:*
Eye Tracking als Instrument der Werbeerfolgskontrolle

2012 - 6 *Gerd Nufer / Catrina Heider:*
Testimonialwerbung mit prominenten Sportlern – eine empirische Untersuchung

2012 - 7 *Peter Kleine-Möllhoff / Holger Benad / Marina Bruttel / Aron Leitmannstetter / Mourad Ouaid / Stefan Will:*
Infrastrukturelle Aspekte der Elektromobilität von morgen

2013 - 1 *Patrick Bieg / Carsten Rennhak / Holger Benad:*
Strategien zur Implementierung von alternativen Antriebskonzepten in China

2013 - 2 *Holger Benad / Martin Bode / Andreas Hack / Peter Kleine-Möllhoff / Hanna Wagner:*
Developing a potential business model for the automotive and the energy industry

2013 - 3 *Gerd Nufer / Sabrina Bohnacker:*
Marken- und Produktrelaunch –
Charakterisierung und Analyse von Praxisbeispielen

2014 - 1 *Köllnberger, Jan / Sander, Christian / Wiederkehr, Viktor / Rottenaicher Stefan / Rennhak, Carsten:*
Ergebnisse einer Marktstudie zur Kundenbindung im Retail Banking

2014 - 2 *Emil Nyerki:*
Wende in der Politik – Wende in der Unternehmenskultur?

2014 - 3 *Kristina Kurz / Peter Kleine-Möllhoff / Kristina Steinbiß:*
Chancen und Risiken deutscher Automobilhersteller im Bereich Alternative Antriebe in der VR China (induktive Analyse)

2014 - 4 *Gerd Nufer / Simon Kronenberg:*
Chancen für nachhaltige Geschäftsmodelle im Lebensmittel-Onlinehandel

2014 - 5 *Lina Hölker / Carsten Rennhak:*
Bank der Zukunft oder Zukunft der Bank?
Herausforderungen, Trends & Handlungsempfehlungen für die Retail-Bank der Zukunft

2014 - 6 *Gerd Nufer / Florian Fischer:*
Gender Marketing im Retail Management

2015 - 1 *Gerd Nufer / Claudia Sauer:*
Neuromarketing im Handel

2016 - 1 *Peter Kleine-Möllhoff / Claudio Dürr:*
Ökonomische und ökologische Betrachtungen zur Erhöhung der Methanausbeute von Biogasanlagen

2017 - 1 *Gerd Nufer / Caroline Verena Lenzen:*
Marketing mit Instagram

2017 - 2 *Gerd Nufer / Victoria Wenk:*
Wirkungen von Farben im Marketing

2017 - 3 *Sabine Löbbe / André Hackbarth:*
Geschäftsmodelle in der Energiewirtschaft:
Ein Kompendium von der Methodik bis zur Anwendung

2017 - 4 *Gerd Nufer / Anne Kaps:*
Marketing mit Youtube

2018 - 1 *Gerd Nufer / Claudia Halbauer:*
Marketing-Kommunikation für Startups

2018 - 2 *Gerd Nufer / Linda Ellsässer:*
Corporate Social Responsibility und Marketing

2018 - 3 *Anja T. Braun / Peter Kleine-Möllhoff / Volker Reichenberger / Stephan Seiter:*
Survey concerning enablers for material efficiency activities in manufacturing, their supply chains and the transformation towards circular economy

2018 - 4 *Gerd Nufer / Felix Donges:*
Mobile Marketing

2019 - 1 *Gerd Nufer / Horst Moser:*
The Sound of Brands

2019 - 2 *André Hackbarth / Sabine Löbbe:*
Attitudes, preferences, and intentions of German households concerning participation in peer-to-peer electricity trading

ISSN 1863-0316

Institut für Marketing Marktforschung & Kommunikation

Erfolg durch Denken in Kundennutzen

Marktorientierte Unternehmensführung ist eine Führungsphilosophie, die einerseits von den Anspruchsgruppen eines Unternehmens und deren Bedürfnissen ausgeht, um echte Problemlösungen für den Markt anzubieten, und andererseits die eigenen Kernkompetenzen zielgerichtet vermarket. Die Umsetzung dieser Philosophie gelingt nur, wenn alle Unternehmensbereiche – und damit auch alle Mitarbeiter – zugleich markt- und ressourcenorientiert denken und handeln.

Das Institut trägt mit seinen maßgeschneiderten Angeboten in **Weiterbildung, Marktforschung und Beratung** auf höchstem Niveau dazu bei, das Verständnis in diesen Themenfeldern zu vertiefen, Entscheidungsgrundlagen bereitzustellen und geeignete Maßnahmen zu empfehlen.

Leitung:

Gerd Nufer ist Professor für Betriebswirtschaftslehre mit dem Schwerpunkt Marketing an der ESB Business School der Hochschule Reutlingen. Er wurde für seine innovativen didaktischen Konzepte mit dem Lehrpreis der Hochschule Reutlingen ausgezeichnet und für den Landeslehrpreis Baden-Württemberg nominiert. Darüber hinaus erhielt er den ersten Sonderpreis für innovative Lehre der ESB Business School. Er ist ein national und international renommierter Experte und Autor zahlreicher Veröffentlichungen zu den Themen Marketing, Marktforschung und Kommunikation.

Kontakt:
Institut für Marketing, Marktforschung & Kommunikation
Prof. Dr. Gerd Nufer
Alteburgstraße 150
D-72762 Reutlingen
gerd.nufer@reutlingen-university.de

Weiterführende Informationen unter:
http://www.marketing-nufer.de