Identification of Customer Preferences for New Service Development in the Electricity Domain

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***Abstract*—The electricity domain is currently facing fundamental change on both, the production and the distribution side. In order to compete on this fast changing market, there is a high need for differentiation possibilities of the electricity suppliers as e.g., through new and innovative services. To set the right incentives to customers and offer them the right value propositions, beside a sound knowledge of the customer preferences also the involvement of the customers in the new service development process by means of co-creation is of high importance. This paper contributes to the new service development process in the electricity domain through the identification of customer segments and customer preference relations, represented by respective utility functions. The main findings presented are the results of a choice based conjoint analysis with a total of 107 respondents executed in order to gather the said customer's preferences regarding possible new future services. The customer segmentation was carried out with latent class. The analysis is embedded in a research framework that uses a multi-method approach with a combination of quantitative and qualitative methods, integrating the customers by means of co-creation.**

Keywords—Customer preferences; choice-based conjoint

I. INTRODUCTION

The successful development of new and innovative services and products is a major task for companies and a critical success factor for enterprises profitability [1]. According to Di Benedetto, A.C. [2] about 49% of the sales of innovative companies are generated by new products that were launched within the last 5 years. In the last decades especially the importance of services has been enormously increasing. Today about 70% of the world's gross value added can be attributed to the tertiary sector. This growth is not only reflected in the proportion of different economy segments in the GDP (Gross Domestic Product), but in the growth rates of job creation as well. In contrast to the development of physical products, the development of new and innovative services is often executed ad hoc and not systematically [3]. In order to successfully develop new and innovative services there is still an enormous need for research in the area of service science and service innovation [4]. Given the significant, sustained growth in services, Ostrom et al. elaborated 10 interdisciplinary research priorities focused on service science, among them are "Stimulating service innovation", "Enhancing service design" and "Enhancing the service experience through co-creation" [4]. These are the ones towards which we contribute in this paper. The aim of this paper is to support the new service development process in the electricity domain through a systematic approach used for the identification of customer segments and customer preference relations, represented by respective utility functions, and integrating the customers by means of co-creation. The said preferences build the basis for the development of future new services in the electricity domain. Due to the fundamental changes the electricity industry is currently facing, there is an especially strong need for new opportunities in this field. The deregulation and new technologies are enablers for the development of new and innovative services making the service aspects becoming increasingly important in the electricity industry in the next years. Due to the fact that electricity may not be stored as easily and cost effective without bigger losses as other physical goods, the electricity industry has a special constellation of actors (e.g., network operators, electricity producers, power traders, service integrators, customers) that create value together. These actors need to ensure that supply and demand in the electricity market are always in perfect equilibrium. Due to this special situation, the customers have, beside the economical relation to their service integrator, a physical relation to the grid operator who delivers the electric current. This leads to the situation that many stakeholders have to be integrated into the new service development process. E.g., the generation, distribution and trading of electricity is more and more co-created with customers also called prosumers [5]. Prosumer is a portmanteau that combines the words "producer" and "consumer" and highlights the joint generation of value. Furthermore, new ways of electricity generation and smart grid technologies demand for new and innovative service types. Enablers are for example new tariff model options on the billing side or new opportunities in the load management area.

A relatively new discipline that deals with the opportunities and threats of co-creation is service science [6]. Service science uses the dimensions "people", "organization" and "technology" to understand, categorize and explain a variety of existing service systems, and to analyze how service systems emerge and actors co-create value [7]. The central purposes of service science are: first the adaption and application of systems and

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engineering concepts to the development of services; second the integration of engineering and social sciences for the analysis, construction and management of complex service systems [8]; and third, the integration of consumers for the development of new services. Service Dominant Logic (S-D logic) is a paradigm in service science research that puts a focus on the exchange of competences as a basis for co-creation instead of production and distribution in the goods dominant logic (G-D logic) system. This shifts the production process from producers to a co-creation process of value [5, 9]. The important difference lies in the new understanding of value creation through competences and processes rather than value as a physical product [6, 9, 10]. Lusch and Webster [11] argue that enterprises have to think about how to support customers in their resource integration and value co-creation activities. "All enterprises should strive to be an effective and efficient service support system for helping all stakeholders, beginning with the customer, become effective and efficient in value co-creation" [11]. According to Lusch and Webster the S-D logic is very useful in a highly networked world. In the electricity industry – a highly networked industry – customer could e.g., become co-creators of the production of electricity [11].

The transformation and innovation in the electricity industry can profit from structured approaches used by service science. For the identification of such services and customer preferences, a multi-method approach that combines qualitative with quantitative methods is used in the presented research. Among other methods, the choice based conjoint analysis [12] has been applied, being a broadly accepted approach using trade-off situations, to identify customer preferences regarding different features that make up an individual service. Through this survey technique consumers are confronted with a real purchase decision and have to trade one benefit for another. By applying the conjoint method a precise valuation of relevant attributes can be derived. In our study we evaluate six attributes (or variables) that play an important role in user decisions concerning electricity services or products: domicile of service provider, power mix, service channel, presentation of the used electricity, services to enable energy savings and the price per person and month. The results of our quantitative analysis show that the importance of the service attributes is very high. However, due to the increasing meaning of services, they are the main differentiation possibility from competitors for electricity suppliers in the future. An important task for future work will therefore be to further develop surveys that address this issue.

The structure of the paper is as follows. In the Related Work section relevant studies concerning the analysis of customer preferences in the electricity domain are presented. The multi-method research approach used in this study is presented and explained in detail in the section Research Framework. In the section Choice Based Conjoint Analysis the conjoint analysis as a method of empirical research [12] is illustrated. The sampling, analysis structure and analysis of cluster results constitute the core of the paper and are illustrated in section Analysis of Empirical Results. The section Conclusions and Future Research summarizes the implications and outlines the next steps for future research.

II. RELATED WORK

The aim of this paper is to understand the customer's preferences concerning new and innovative services in the energy sector, and based on these preferences being able to design the constituent parts of the future services. Research work from different areas is of great relevance for this research, namely a) related work considering the identification of new services for end-customers in the electricity domain, b) related work considering the new service development process, independent of any specific domain, considering co-creation aspects of consumers.

Regarding a), there is a huge amount of publications available that deal with any kind of problems in the electricity industry, ranging from tariffs [13-15] to certificates of origin [16]. However, publications concerning the identification of new and innovative services based on customer's preferences are scarce. We identified two thematic sources of publications in the area of electricity services and products that deal with service attributes of electricity (e.g.: service channel) and their meaning for consumers, namely 1) the source concerning ecological aspects of the production, distribution and consumption of physical electricity, and 2) the source concerning the effects of price changes to customer behavior.

Publications available in the area of ecological aspects of the production, distribution and consumption of physical electricity are for example [17]. They conduct a choice based conjoint study to identify the most preferred attributes regarding ecological and pricing aspects of electricity. The following attributes were used in the study of [17]: power mix has the highest importance for the purchase decision according to Burkhalter et al. with 38% attribute importance of the total purchase decision. It is followed by the monthly electricity costs with 25% and the place of production with 15% of the total purchase decision. The attributes supplier (8%), pricing model (6%), contract period (4%) and electricity certificates (4%) are less important. Another example of this source is [18] were the authors analyze customer needs regarding smart meters. A further field of interest for this stream is the research regarding the trading of renewable energy certificates (RECs) [16]. Menges mentions e.g., that the motivation of people to buy green energy is not purely altruistic and not only focused on the environmental impact of their purchase. Instead the personal satisfaction of buying green energy is their central motivation [16].

As said above, the second thematic source is focused on the effects of price changes to customer behavior. Papers in this area primarily focus on behavioral science that analyses the effects of specific tariffs or pricing models and communication technology on the customer's behavior and preferences [13-15]. Central results in this area are often dedicated to the increase or decrease of the quantity of consumed electricity depending on the used tariff models [13]. The fixed tariffs are probably the best-known pricing possibility for electricity. Fixed pricing means almost always that during a given time period a specific quantity of electricity e.g., one kWh may be purchased at a given price [13]. Beside this very popular pricing possibility there are also variable tariff model options available [15]. Variable tariff means in this context that the price paid by the customer depends either on the time period, the actual load a customer is consuming, or on the market price. An example for a pricing mechanism that uses the actual grid load as a basis is the critical peak pricing [19]. In an electricity grid with a critical peak pricing, customers receive pricing information through information systems and decide based on this information whether they want to reduce their electricity consumption or not [13, 19]. The electricity prices a customer pays may be attached to another price or price index as for instance the market price [13, 15]. All these examples look at the attributes of electricity, which are of importance to customers, from an ecological or pricing point of view and do not focus on service aspects like for example the service channel or the visualization of the electricity used. This is exactly where we contribute with our research.

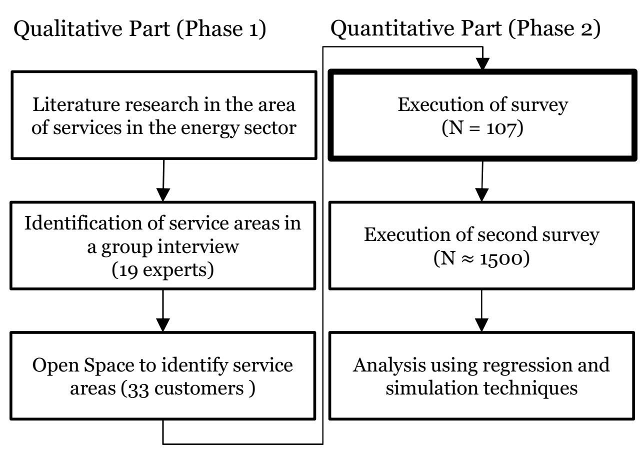
Regarding the service aspects as stated above under b) we identified different sources dealing with the generic development of services. Well established models such as the linear model of Edvardsson and Olsson [20] or the iterative service engineering model of Shostack [21] can be found in [3]. Some of these models reach back to 1989 and may be distinct into three different types of models: linear process models also called phase models, iterative process models and prototyping models [3]. The most models we found are linear models, this might be, because they are easier to understand and apply [3]. Examples for this kind of models are the model of Edvardsson and Olsson [20], the model of Scheuing and Johnson [22], or the model of Ramaswamy [23]. The model of Edvardsson and Olsson [20] e.g., is mainly focused on the quality aspect of the service development. Aim of the model is to support the service engineering from the beginning to yield a higher service quality. Quality means in this context "satisfying the needs and meeting the expectations of three main groups: customers, staff and owners" [20]. In this model the service is seen as a customer process and value is jointly co-created with the customer [20]. The model of Scheuing and Johnson [22] is another example for a linear model. The major contribution of the proposed model is its aggregation of existing models and the empirical foundation. The model of Ramaswamy [23] is a third example for a linear model. Beside the new service development part, this model focuses on the management and performance improvements by using controlling and measures and has therefore a more quantitative focus in the service management part. According to [3] the model of Shostack [21] is a representative of the iterative service engineering models. Shostack differentiates between product dominant and service dominant entities. The basic elements, the services and products that build up a value proposition should be modeled accurately by the use of methods as e.g., service blueprinting. The model of Shostack is primarily focused on a marketing view of the service development and the modeling of the services. Shostack [21] gives no detailed advise on how to develop new services but presents only the service blueprinting and service modeling ideas. An example for a prototyping model is the design thinking model [24]. It consists basically of two parts, the divergent and the convergent thinking part. The ambiguity, the number of ideas, is increasing in the first part and decreasing in the second part. The different stages are supported by specified methods and result documents [24]. From the authors perspective the major aim of the design thinking is the people enablement and not the process support or the further management of services.

The disadvantages of the models introduces are that they either give no advice on the exact methods and techniques that should be used to identify new services and/or the models lack iterations that would improve the service development especially in an environment with many actors like the electricity industry. This is exactly where[25] our study contributes. The aim of our research is to systematically analyze the customer needs in the electricity industry by means of a clearly defined service development process, where the integration of the co-creation of value idea into the service development process becomes an important aspect of the research.[25]

III. Research Framework

In this research we use the service notion as defined by [26]. The product-service bundle is subdivided into three layers. The core product, namely the electricity provided to the customer. Basic services add further core functions to the core product and build therefore a second layer. Basic services could e.g., be the channel the customer uses to communicate with the electricity provider, such as Internet and/or phone and/or service center. Additional services bring more value to the customers and build up the third layer. Additional services could e.g., be visualization tools to see how much electricity the customers have consumed. A service or product-service bundle as used in our research could e.g., be composed of a) renewable energies provided by a local energy provider, b) phone and internet as service channel, c) a visualization tool to support energy savings, and d) all together for a price of 60 Swiss Francs a month. In order to understand which combination of which attributes define the new services, the preferences of the customers need to be understood. In order to derive at the said customers preferences we defined a strong pluralistic multi-method research approach as advocated by [27] that combines qualitative and quantitative methods. It consists of two parts, the qualitative part (phase 1) and the quantitative part (phase 2) that consist of six steps with a sequential structure. Fig. 1 illustrates the research approach used in this study.

Fig. 1: Research Approach that combines multiple methods [27]



The main purpose of the qualitative part (phase 1, shown left in Fig. 1) of our approach is to open up the mind for divergent thinking and to generate more ideas for potential services. The first step of the qualitative part consists of a structured literature research as presented in vom Brocke et al. [28]. In a first step relevant journals and conference proceedings are identified. The literature is then electronically analyzed by using databases as for example EBSCOhost. The identified sources build a basis for the second step of the approach where potential service areas are identified by interviewing experts of related industries. The interests and ideas of customers are considered in the third step of the qualitative approach. To make sure that all ideas are optimally understood and controversially discussed, the use of a creativity method is useful.

We suggest to use the Open Space method as explained in [29], since this method simplifies the structured creative working of the participants. The Open Space method works best if the following conditions are met [29]:

1) The topic is a real issue of concern
2) The topic is highly complex
3) Many skills and people are required to solve the problem
4) Very divers stakeholder needs have to be addressed
5) The topic has a high urgency level

In the quantitative part (phase 2, shown right in Fig. 1), the focus lies on the selection of the most promising service ideas for the implementation. Therefore the used methods are focused on convergent thinking to decrease the number of ideas for potential services. The ideas for potential services that were identified in the qualitative phase are arranged in fields of interest that build the basis for the development of a questionnaire. We suggest to use a questionnaire that uses the choice based conjoint [12] design. This has the advantage that the willingness to pay for each service may be calculated. A survey with a conjoint analysis enables furthermore the evaluation and selection of the most promising services. A survey is therefore a good possibility to reduce the number of ideas for new services without using arbitrary selection mechanisms, but letting the market decide. In the quantitative part two choice based conjoint studies are executed. Besides receiving important and valuable results concerning customer's preferences from the first study, we can learn from that experience in order to further improve the second survey. With two surveys we are able to ask different product-service bundle preferences from different customer groups (e.g., customers from different energy providers), which additionally contribute to better understand the customer preferences. The results of both studies build the basis for the analysis of the results, which is executed in the last step of the multi-method approach. In this last step the questionnaires are analyzed by using statistical methods and simulation techniques to identify the most useful services that shall be implemented. We suggest conducting the analysis in two steps: In a first step the conjoint part-worth values should be calculated. These part-worths represent the customer's preference for a specific product-service bundle compared to other product-service bundles. In a second step we hypothesize that fundamental differences between customers groups may occur. For the further analysis of the groups we suggest to use latent class analysis. According to [30] latent class is currently the best way to find homogeneous segments of customers within choice based conjoint data. A possible simulation scenario with the hereby-generated data is for instance a ceteris paribus price increase in a market simulator. Furthermore we can calculate price sensitivities based on a broad basic population.

Together with our partners in the electricity industry we have already executed the first four steps of the service innovation development process. In the second step of our research approach we interviewed 19 electricity professionals from different parts of the electricity supply chain in Switzerland. The group consisted of representatives of the electricity generation, distribution, marketing, electricity grid operators and electricity certificates trading. The third step of the research approach consisted of a group moderation session (Open Space) with 33 participants. This time the attendees were customers and not professionals. The task was to identify interesting areas of electricity services from a customer perspective. Due to the highly relevant topic and the active cooperation of the customers, interesting topics for future services have been identified. The major learning's from the Open Space were that customers are willing to participate in many ways, but are facing several knowledge barriers that make it difficult for them to calculate the expected savings or benefits. In the fourth step of the multi-method approach (highlighted in Fig. 1) a conjoint study with 107 respondents has been executed. This step builds the main focus of the paper and the details of this conjoint analysis are therefore presented in the next sections. The execution of step 1-4 of the presented method resulted in one exemplary service that has been introduced into the market prototypically in mid of 2013. The service evaluation of the first service and the development of further innovative services are subject to current work.

IV. CHOICE BADED CONJOINT ANALYSIS

The choice based conjoint analysis is a decompositional analysis method used in market research and part of the category of interdependence analysis, with the aim of identifying presumed relations in a dataset [31]. The basic idea of choice based conjoint analysis is to subdivide a product-service bundle into its attributes and to show different combinations of these attributes to customers in so-called choice sets. The customers then have to make a trade-off decision between the presented bundles, also called stimuli [12, 32]. The choice based conjoint analysis is a scientifically approved approach, which is broadly used for testing the potential of new products or services in the market [31, 33]. Often a non-option is added to a choice based conjoint design to allow the customer to refuse a specific selection. A major advantage of the choice based conjoint analysis is, that customers do not have to quantify the individual value of each attribute (part-worth) but instead may choose their preferred product/service alternative [34].

The utility for every respondent may be modeled with the service attributes as follows:

$$\widehat{U}_{r,i} = \hat{\alpha}_{r,i} + \sum_{a=1}^{A_C-1} \sum_{c=1}^{C} \hat{\alpha}_{r,ac}\, x_{i,ac} \quad (a \in A, i \in I) \qquad (1)$$

$\widehat{U}_{r,i}$ The estimated total utility of the respondent r for the product/service i

$\hat{\alpha}_{r,i}$ The estimated basic utility of the respondent r for the product/service i

$\hat{\alpha}_{r,ac}$ The estimated part-worth of the characteristic c of the attribute a

$x_{i,ac}$ 1 if product/service i includes the characteristic c of attribute a

I/i Product or Service

A/A_c Attribute / Attribute with characteristic c

If the Sawtooth software is used for the analysis, the calculated part-worth values are automatically summed up to zero for each attribute and are therefore zero centered. We decided to normalize these zero centered differences to a scale reaching from 0 to 1 (Fig. 2). Due to the interval-scaled nature of the analysis, only Ac-1 part-worth values have to be added to exactly define the utility function. This is the case, because the part-worth values are the connections between the attributes and not the attributes themselves. The conjoint technique is not only used for product attributes but also broadly known for the analysis of services. In their paper Commercial Use of Conjoint Analysis: An Update, Wittink & Cattin [35] showed that 18% of the conducted conjoint studies between 1981 and 1985 were already service related studies.

V. ANALYSIS OF EMPIRICAL RESULTS

As a first step in the quantitative phase we conducted a conjoint analysis [12] with a sample size of 107. The respondents were selectively chosen to make sure that different age groups and genders are represented in the study. The gathered information regarding opinions of experts and customers on interesting services was the foundation for the design of the conjoint questionnaire. They were asked to choose between twelve fixed choice-sets that include three stimuli each. We used a total of twelve choice-sets in our study to generate enough data with a small sample size. A stimulus is in this case a combination of defined attributes that form a service and can therefore be understood as a service bundle that shall be offered to a customer. Every conjoint choice-set, with its three stimuli is therefore a different possible purchase decision. Furthermore we developed a choice based conjoint design that uses different stimuli as a combination of the attribute characteristics as shown in Table I. The number of characteristics per attribute gives the theoretical number of different stimuli.

The total amount of stimuli in our example is therefore 720 since every attribute characteristic may be combined with every characteristic of the other attributes. Formula 2 below shows the combinatory calculation of the amount of stimuli. Every number in the formula represents the quantity of characteristics an attribute has.

$$N = 4 \times 4 \times 3 \times 3 \times 5 = 720 \qquad (2)$$

TABLE I: ATTRIBUTES OF THE CONJOINT ANALYSIS

No.	Attribute	Characteristic
Product	**Domicile of service provider**	Local
		Switzerland
		Neighbor land
		Eastern Europe
	Power mix	CO_2 free (nuclear, renewables)
		Renewables (water, solar etc)
		Low cost (nuclear fossil)
		Nuclear free (fossil, renewable sources)
Services	**Service channel (core service)**	Internet, phone and service center
		Internet and phone
		Internet only
	Presentation of the used electricity (additional service)	Every second
		Every month
		With the bill (every 3 Month)
	Services to enable energy savings (additional service)	No services
		Events, consulting
		Efficiency portal
Price	**Price per person and month**	30 CHF
		40 CHF
		50 CHF
		60 CHF
		70 CHF

Due to the different price levels that were assigned to every stimulus, price elasticity can be calculated for the characteristics of the other attributes. In the survey with 107 respondents we examined both, the product and the service attributes of the stimuli. We did not include a “none” option in the survey since we assume that nobody is willing to abstain completely from electricity. Due to the same reason we forced a decision in each choice task in our survey.

A) *Sampling*

Invitations to participate in the study were distributed as paper-based hand-outs and electronically via personal e-mail invitation. The responses were collected between July and November 2012. The return rate of the paper-based questionnaire was approximately 90% and about half of the electronic invitations were successful. After deleting the incomplete observations a total of 107 usable questionnaires remained in the net sample. Incomplete means in this context that one or more choice tasks were not filled out. The age range of the respondents reaches from 18 to 69 years. Compared to the resident population, the younger people under 45 years are stronger represented. About 69% of the respondents were male and 31% female.

B) Analysis Structure

The analysis of the study results was conducted in two steps. In a first step the utilities (part-worth) for the six attributes shown in Table II were calculated using conjoint analysis. Every part-worth represents the preference of an attribute compared to the other attributes. A major advantage of the choice based conjoint analysis is the possibility to include monetary values as attributes into the analysis. This possibility allows us to calculate e.g., price sensitivities for all attributes. If the utility functions are significant on this level, we can conclude that the respondents agree on a specific valuation of the attributes and their characteristics. If a utility function is not significant on this level that could mean that it is not significant at all or that possible user groups have different utility functions. In a second step we leave the general top layer that looks at the average of all respondents and hypothesize that there may be fundamental differences between customer groups in our study. The result of a latent class analysis revealed three groups of electricity customers that have similar utility functions for the six attributes. For the analysis we used the latent class module from Sawtooth software. The latent class estimation process works as follows [36]:

1) Initially, select random estimates of each group's utility values.
2) Use each group's estimated utilities to fit each respondents data, and estimate the relative probability of each respondent belonging to each group.
3) Using those probabilities as weights, re-estimate the logit weights for each group. Accumulate the log-likelihood over all groups.
4) Continue repeating steps 2 and 3 until the log-likelihood fails to improve by more than some small amount (the convergence limit). Each iteration consists of a repetition of steps 2 and 3.

The use of latent class is according to [30] currently the best way to find homogeneous segments within choice based conjoint analysis generated data. Fig. 2 depicts the results of our conjoint analysis. For every attribute the possible characteristics, their part-worth values and standard errors are shown. The last column contains the relative importance of the different attributes for the basic population. Each attribute has a different impact on the purchase decision of the customers. The relative importance of an attribute reflects this impact in percent of the total purchase decision as well as the differences of the attributes contribution to the total utility. The part-worth values or final utilities must sum up to zero. A negative prefix in front of the final utilities means that the corresponding value has a negative impact on the product valuation relative to the average of the characteristics of this attribute.

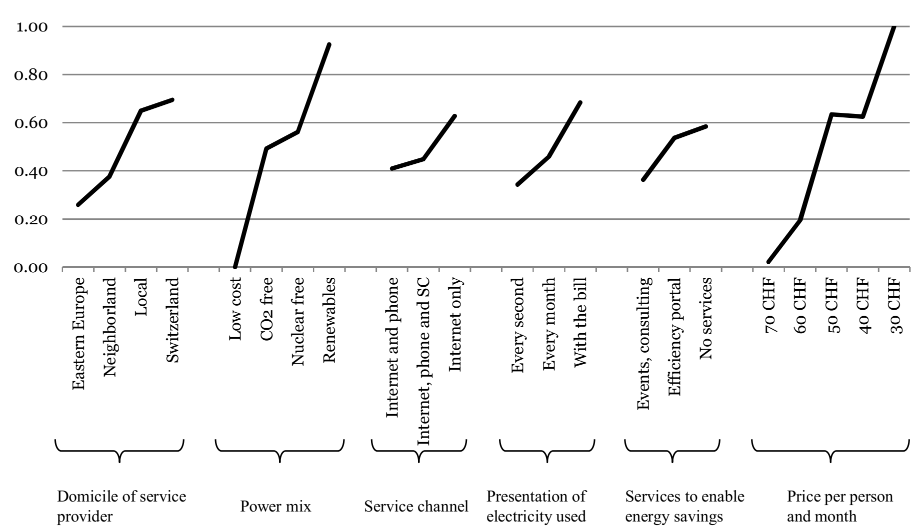
The degree of this impact is reflected in the absolute value of the characteristic. The relative importance values were calculated in accordance with [37] to make sure that the individual relative importance gives an indication what attribute is the most important one. Looking at the characteristics with the highest part-worth values, we can derive the ideal combination of attribute characteristics for the whole population:

The optimal domicile of the service provider would be Switzerland and contain renewable energy as a power mix. The services should be available online via e-mail only and the use of electricity would be presented quarterly with the bill. The optimal price for this would obviously be 30 CHF per person.

In Fig. 2 the part-worth for each attribute is shown on a normalized basis. The normalization of the values of Fig. 2 has been calculated by the following formula:

$$(3) \quad V_{n,i} = \frac{V_i - \min(V)}{\max(V) - \min(V)}$$

Fig. 2: Normalized part-worth values



Where: Vn,i is the normalized value and Vi is the original value from Table II. The values min(V) and max(V) represent the smallest respectively the largest part-worth value. The attributes with the highest relative importance are the “price per person and month” and the “power mix”. These two are responsible for about 61% of the impact on the total purchase decision. The price sensitivity is not a straight line but has a plateau as shown in Fig. 2. A plateau is the visualization of a very small difference between the utility of the involved part-worth values of the respective curve. The part-worth values curve of the power mix attribute is very steep, which means that there is a huge difference in the utility the involved part-worth values provide. The renewable energy sources that provide the biggest value are about 0.4 normalized utility points above the nuclear free energy. This is approximately the utility change of 30 to 40 CHF per person and month. On the third place with about 14% is the “domicile of service provider” located. The difference between “local” and “Switzerland” is small but the difference to foreign countries is clearly visible. The remaining 25% attribute importance can be assigned to the services: “service channel” (7%), “presentation of the used electricity” (11%) and “services to enable energy savings” (7%). Customers valued the online channel to be the most useful one for them. What is interesting at this point is the fact, that all the service categories include the online option and that customers apparently assume that this services have to be cheaper if they do not include the phone or service center as service channels. Another interesting aspect is the proportion of services on the total impact of the purchase decision. Due to the comparably high importance of the price, the very sensitive reaction of customers to this attribute should be kept in mind for the further development of services. The “power mix” seems to be almost as important as the price of the electric current. However, due to the social desirability bias this high importance may also be overestimated [38].

C) Analysis of Cluster Results

In order to get more homogeneous customer clusters, we conducted a latent class analysis and therefore used the Sawtooth software module “latent class”. Choosing the right number of segments is a difficult task, since there is often no “perfect” number of clusters. The statistical data from latent class build a basis for the decision. We decided to use 3 clusters for our further analysis based on the statistical indicators mentioned in [36]. The consistent Akaike`s information criterion (CAIC) and Bayesian information criterion (BIC) are at their minimums at three clusters.

The sizes of the three clusters range from 27% to 39%. The first cluster is characterized by an especially high weighting of the price of electricity and the domicile of the service provider. The services are less important with a total weight of 19%. The second cluster is focused on the power mix with a total value of 38% and the domicile of the service provider with an importance of 25%. The importance of services within this cluster is with a total of 24% higher than in the first cluster. The presentation of electricity used has the highest importance of the services for this cluster with 13%. The third cluster is primarily price oriented with a total impact of 36% on the purchase decision. The domicile of the service provider and the services to enable energy savings are equally important for this customer cluster with 17% each. This cluster is especially sensitive to services that are responsible for about 35% of the purchase decision.

TABLE II: RELATIVE IMPORTANCE PER CLUSTER

Attributes	Cluster 1 (39%)	Cluster 2 (34%)	Cluster 3 (27%)
Domicile of service provider	**20%**	**25%**	**17%**
Power mix	14%	**38%**	12%
Service channel	4%	6%	6%
Presentation of the used electricity	8%	13%	12%
Services to enable energy savings	7%	5%	**17%**
Price per person and month	**47%**	13%	**36%**

The two most important attributes are written in bold numbers per cluster.

VI. CONCLUSTION AND FUTURE WORK

Our study is a first step towards a systematical analysis regarding utilities of services in the electricity industry. To identify the importance of the different attributes on a purchase decision, we used a conjoint approach that is embedded in a multi-method approach.

Within this paper we have shown, that the service aspects of electricity are important for electricity suppliers to differentiate themselves from their competitors. The service pricing and service aspects make up 56% of the customers purchase decision. The survey results of a first choice based conjoint study with 107 respondents are a first step to identify interesting services. In our opinion, the attribute preferences of electricity are well known but the added value of services is until now relatively unknown. This is exactly where our study contributes to the field.

We find that service prices and the mix play the most important role in the customer`s purchase decision with approximately 30 % each. A major advantage of the conjoint analysis is that it allows deriving profound inferences on the value respondents attach to specific attribute levels and their characteristics. Our study shows that on average respondents would pay about 10 CHF more for renewable energy compared to nuclear free energy. Customers preferred service channels with an online only approach and a visualization of the consumed electricity with the bill instead of an electricity monitor with a real time display. Regarding the domicile of the electricity supplier the customers valued especially whether a supplier has its domicile in Switzerland or not. We used latent class to identify three user groups with similar utilities.

The aim of future work is to focus completely on the services in relation to the price of the newly developed product-service bundles. This is reached by further applying the multi-method approach. The first four steps of this approach have already been completedThe next steps are a bigger customer survey with approximately 1600 respondents and the further analysis of these results.

Furthermore we are aware that this study is subject to several limitations. Differences in income and education may also have an impact on how much customers are ready to pay for a specific service. We did not take into account that differences in the income level may also cause changes in the utility function of a specific person. Finally, the results of a choice based conjoint analysis depend on the choice attributes and the characteristics. We tried therefore to give reasons for our design decisions. The service prototyping and further evaluation is not part of this paper and remains for future work.

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