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Business Model Innovation for the Energy Market: Joint Value Creation for Electricity Retailers and Their Customers

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Abstract

The objective of the present study is to explore and better understand how business model innovation and technology trends have influenced electricity suppliers in the electricity retail market. We investigate how electricity suppliers can create and deliver values to private customers and capture the market for themselves through innovative technology and business models. To reach this goal, the collected data from eleven different European existing business models were analyzed and sorted in a systematic way with the "Business Model Canvas" approach (Osterwalder and Pigneur, 2010). To cluster the real world business models investigated, an identification of the applied patterns was carried out according to the "Business Model Navigator". We find that successful retailers are those companies which try to take a more consumer-centric perspective for creating extra value, while enabling and fostering more sustainable and energy-efficient lifestyles based on the smart orchestration of increasingly distributed energy resources.

Keywords: Electricity suppliers, business model innovation, value creation, private customers, electricity self-sufficient

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1 Introduction

The energy industry is experiencing a new set of changes, driven by the crossing point of three key trends: decentraliztion, decarbonization, and digitalization (the "3Ds"). The increasing decentralization of power systems due to the development of distributed energy generation and more dynamic and cost-responsive energy consumers. The decarbonization of the energy system as part of global climate change reduction efforts has resulted in the development of variable renewable energy sources (VRES) such as wind and solar energy. Finally, the digitalization and inter-connectedness of electrical systems with other critical infrastructure has increased, which improves the quality of power supply in modern economies [1]. These key trends are compelling many energy companies to increase their business model capabilities and innovate on them. The objective of the current research is to explore and better understand how business model innovation and technology trends have influenced service providers in the electricity retail market to take more consumer-centric action; therefore, the other electricity markets – such as generation and wholesale markets – are excluded and beyond the scope of our analysis.

In many countries, the opening of the [retail] market was pursued by a two-fold inflow. Initially, recently start-ups penetrated in the electricity retail market, examining new business models. Their activities were focused on retail supply (branding, value-adding services, customer relationships), endeavoring to benefit from a low-cost, responsive and adaptable organizational structure. Second, new market entrants arose from a different industrial sector or other geographical zones and expanded into the residential electricity market, competing with their regional or national incumbents [2].

Scholars have recently discussed the need for electricity suppliers to reform their business model, i.e. replacing the selling of electricity as a commodity with the provision of services [3]; however, this transition to a service model encounters many obstacles and challenges for energy companies [4]. Responding to the prevailing changes in the energy industry due to the "3Ds" - has created different impacts. As a result, new companies position themselves in the energy sector and offer new products, services, and energy supply conditions. Overholm [5] has shown that these new entrants construct their position in the electricity market by developing new business models based on innovative and often digitalized services, creating a new ecosystem and involving new partnerships.

Regarding this, the electricity retail market creates new business model challenges for the retailers and forces them to develop their business models further in order to remain competitive during the sustainable energy transition. Richter [6] investigates the business model opportunities and challenges for the German utilities in the field of electricity generation from renewable energy resources, whereas Specht and Madlener [7] also examine the challenges of the transition towards distributed power generation for energy suppliers. Niesten and Alkemade [8] analyze the business models for creating and capturing value by offering smart grid services such as vehicle-to-grid and grid-to-vehicle services, demand response services, and services to integrate renewable energy. However, an exploratory research which particularly focuses on the opportunities for the electricity retailers' business models in order to create and deliver

more value rather than supplying only renewable energy to the end consumers, is still missing. Therefore, the purpose of the current paper is to better understand how electricity retailers can create value for their private electricity customers and capture the market for themselves through innovative business models.

To address this question, eleven different electricity supplying companies across Europe are investigated. The data collection process for companies applying various business models is analyzed and sorted out in a systematic way with the help of the "Business Model Canvas" a tool for managers developed by Osterwalder and Pigneur [9]. Afterwards, the applied business model patterns are clustered and identified according to the "Business Model Navigator". The research finally synthesizes and distills the methods which help electricity retailers to renew their business models and create value for private customers.

The remainder of this paper is organized as follows. Section 2 presents the conceptual background and the theoretical frameworks to which the research question is related, i.e. the "Business Model Canvas", "Business Model Navigator", business model innovation and business model innovation in the energy industry. The detailed methodology of this qualitative research is described in section 3, and the results of the analysis are presented in section 4. The discussion follows in section 5. Finally, the implications and limitations of this study are drawn in the concluding section 6.

2 Conceptual Background

Over the last years, interest in the concept of business models and business modeling has started attracting the attention of both managers and academics. While the research in the field of business model development has traditionally concentrated on business activities, the development of new organizational architectures arranged for ambitions other than economic profits, such as solving social issues and sustainability problems, has begun to attract business model researchers and business model developers alike [10].

Companies have always performed according to a business model, at least until the mid-1990s. Companies generally operated following comparative rationale, as ordinary industrial firms, that produced and provided products or delivered services — serving customers and generating revenues and profits. Recently, the scale and speed at which innovative business models are transforming industries and civil society has indirectly attracted the scholars' attention. According to Massa and Tussi [10] the business model is a concept that answers four questions: (1) who is the client, (2) what is the consumer worth, (3) how do we generate revenue in this business, (4) and what is the economic rationale that defines how we can give value to consumers at an applicable cost? The emergence of unique rationale engaged by companies in doing business as they go to market has increasingly revived the relevance of a clear and explicit business model.

When researchers consider the most recent literature on the business model topic, they notice that

different conceptualizations of the business model exist. In any case, we also note that in the literature there are some basic topics developing that frequently appear among the different conceptualizations of the developed business model. Specifically, researchers appear to perceive—explicitly or implicity—that the business model is a system-level idea, fixated on activities and concentrating on value. It accentuates a fundamental and integrated understanding of how an organization's system of activities for value creation is arranged [10].

Additionally, it was noticed that the phenomenon of value creation as illustrated by the business model commonly takes places in a value network, which can incorporate providers, partners, distribution channels, and coalitions that broaden the organization's assets. Subsequently, it is recommended that the business model likewise presents a new unit of analysis further to the firm, product, industry or system levels. Such a new unit of analysis is established not only between the firm, but also its network of exchange partners [10].

These discussions recommend that, at a first glance, the business model might be conceptualized as depicting the logic of how an association (a business firm or other type of organization) makes, conveys, and catches value (social, economic, or different types of value) in association with a system of exchange partners. Concerning the nature of the created value, this definition is flexible and presents the importance of the business model innovation [10].

2.1 Business Model

Historically, the business model has its foundations in the late 1990s when it was developed as a trendy expression in the popular papers and media. Since then, it has raised significant attention from the researchers and experts and today forms a distinct aspect in various research streams. Generally, the business model can be characterized as a unit of investigation to depict how the business of an organization operates.

More individually, the business model is frequently characterized as an overarching concept that takes note of the various segments and assembles them all together [11, 9]. The business model concept helps managers as a management tool to plan, execute, act, adjust, and control their business [12, 13]. The business model explanation and the concept of Osterwalder and Pigneur are often used due to the fact that they have been widely tested in practice and, furthermore, have been effectively applied to the energy sector [7].

2.1.1 Business Model Canvas

In the Business Model Canvas (see figure 1) [9] a business model can perfectly be defined by nine fundamental building blocks that exhibit the rationale of how an organization aims to generate revenue, and they interpret the four basic fields of a business: offer, customers, financial viability, and infrastructure. The nine building blocks of a business model are named: key partners, key activities, key resources, value

propositions, customer relationships, channels, customer segments, cost structure and revenue streams (identical to value catching), and are summerized in the following.

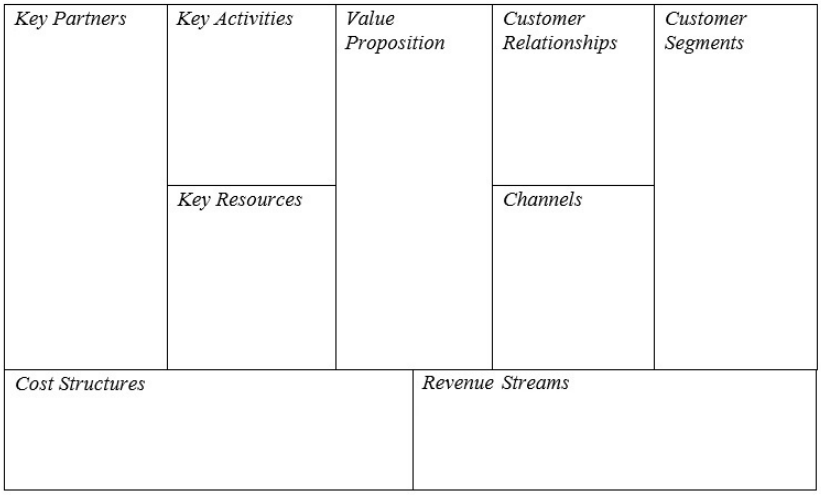

Figure 1. The building blocks of the Business Model Canvas.

Source: Own illustration, based on Osterwalder and Pigneur (2010)

1. Key Partners:

The "Key Partners" building block defines the network of producers and partners that run the business model. Organizations build alliances in order to advance their business models, decrease risk, or acquire assets. The three different motivations for building partnerships are: the economy of scale and optimization, risk reduction and uncertainty, and acquisition of specific assets and activities.

2. Key Resources:

The "Key Resources" building block defines the essential resources needed for a business model operation. Every business model needs key resources. These resources let an organization create and deliver a value proposition, obtain markets, support relationships with customer segments, and generate revenues. Key resources can be described as being physical, intellectual, human, and financial.

3. Key Activities:

The "Key Activities" building block characterizes the most vital things an enterprise must perform in order to run its business model. Key activities are the essential actions an organization must do to work effectively. Key activities are needed to create and deliver a value proposition, obtain markets, support customer relationships, and generate credit. Key Activities can be classified as production, problem-solving, and platform/network.

4. Value Propositions:

The "Value Proposition" building block defines the array of products and services that make an incentive for a particular customer segment. The Value Proposition is the motivation behind why customers change from one company to another. It takes care of a client issue or fulfills a client requirement. Each value proposition includes a selected array of products as well as services that oblige to the prerequisites

of a particular customer segment. In this regard, the value proposition is a package of advantages that an organization offers to its customers.

Some value propositions might be inventive and present a different or disruptive offer. Others might be identical to existing business sector offers, but include highlights and traits. A value proposition makes an incentive for a customer segment through a recognizable mix of components fulfilling that segment's requirement.

5. Customer Relationships:

The "Customer Relationships" building block portrays the kinds of connections an organization sets up with particular customer segments. An organization ought to explain the sort of relationship it needs to build up with each customer segment. Connections can extend from individual to automated services. A few classes of customer relationships are recognized, which may exist together in an organization's relationship with a specific customer segment such as personal assistant, self-service, and automated services.

6. Customer Segments:

The "Customer Segments" building block defines the diverse groups of individuals or organizations an enterprise endeavor to access and serve. In order to improve customers' satisfaction, a company might arrange them into specific segments with common requirements, basic characteristics, or different properties. There are distinctive sorts of customer segment: mass and niche markets, segmented, multi-sided and diversified platforms/markets etc.

7. Channels:

The "Channels" building block defines how an organization speaks to its customers and achieves them in order to convey a value proposition. Channels are clients' meeting points that strengthen the customer experience and deliver a few purposes, such as increasing consciousness between clients about an organization's products and services, supporting customers to assess an organization's value proposition, assisting customers to buy particular products and services, conveying a value proposition to clients, and offering post-buy client support.

8. The Cost Structures:

The "Cost Structures" building block defines all costs spent to make a business model work. This building block depicts the essential expenses during the execution of a specific business model. Making and conveying value, keeping up customer relationships, and earning profit all incur costs. Cost structures can have the qualities such as fixed costs, variable costs, economies of scale, and economies of scope.

9. The Revenue Streams:

This building block characterizes the money an enterprise earns from every customer segment. If clients include the core of a business model, revenue streams are its veins. A business model can include two distinct kinds of revenue streams: transaction incomes due to one-time client installments, and recurring incomes due to progressing installments to either convey a value proposition to customers [9].

2.1.2 Business Model Navigator

To characterize the business models [pattern] throughout the research, a conceptualization that comprises four focal measurements: the Value, the Who, the What, and the How are employed. This idea is easy to apply because of the reduction to four dimensions; however, it is sufficiently comprehensive to give an obvious image of the business model architecture. The business model of an organization is achieved by noting the four related questions and explaining (1) the value proposition towards the customer, (2) the objective customer, (3) the value chain behind the formation of this value, and (4) the revenue model that captures the value [14].

Business innovation study is yet a new phenomenon; Gassmann et al. [14] have used a two-step method to evaluate the basic patterns of business models. In that study, 250 business models that had been employed in various industries within the last 25 years were considered. Consequently, 55 patterns of business models which were presented as the basis for new business models in the past were analyzed and identified [15, 14]. Out of 55 identified patterns, the eight which are frequently employed in the energy case later on (see section 2.3) are introduced below:

Subscription: In the subscription pattern, the client pays a normal charge, regularly on a month-to-month or a yearly premise, with the goal to connect to a good or service. While clients mostly take advantage of the decreased application costs and general service accessibility, the organization creates a more steady revenue stream.

Pay-per-use: With the pay-per-use model, the real utilization of a product or service is measured. The client pays on the basis of the effective consumption. The company can bring customers who hope to make a profit by the extra adaptability, which may be more expensive.

Open business models: In the open business models, a central source of value creation is obtained due to collaboration with partners in the ecosystem. Companies following an open business model effectively have been looking for novel methods for cooperating with customers, providers, or complementors to open and expand their business.

Layer player: A layer player is a particular company constrained to the provision of one value-adding act for various value chains. This value is normally offered within different free markets and businesses. The firm profits from economies of scale and frequently manufactures more proficiently. Moreover, the learned particular skills can enhance quality.

Direct selling: It indicates a situation whereby the products and services of the firm are not sold through go-between channels, but they are accessible straightly either from the producer or service provider. In this manner, the retail margin or any extra costs related to the intermediates is skipped. These investment funds can be sent to the customers and used to establish an institutionalized deal's experience. In addition, customer relationships can be enhanced because of such a close contact.

Solution provider: A full-solution provider offers all the different types of goods and services in a specific area, centralized manner via a one-contact point. Particularly tacit knowledge is provided to

the client in order to raise the productivity and execution. In addition, close contact with the customer fosters a deep understanding of propensities and requirements, which can be utilized to enhance the products and services.

Cross-selling: In this pattern, products or services from a previously ignored industry are included in the portfolio, thus utilizing existing key assets and abilities. Especially in retail, companies can simply bring extra goods and recommendations that are not connected to the core business on which they were formerly engaged. In this manner, extra revenue can be generated by only moderately imposing some changes to the current framework and resources, since more possible customer requirements are fulfilled [14].

Digitalization: This is a model which is combined with the digitization pattern. The digitization pattern leans on the possibility to turn existing services or products into digital variations, in order to provide favorable circumstances over tangible products, or faster and simpler distribution [14]. It also employs any other products or services to disrupt the current industry and value chain and create a new era by well-going from analogue to digital. (Digitalization, in contrast to digitization, is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.)

In order to accomplish effective business model innovations inside an organization, it is essential to both acknowledge the significance of business model innovation and execute a successful business model innovation process within the company. This step is the most difficult and important one. During the business model innovation process, managers benefit from different developed tools. The future contest for comparative competitive advantages has changed from one involving pure services and products to one involving business models. Companies are required to prepare for that race. Recognizing the opportunity is not sufficient; innovators and business visionaries need to catch the opportunity and actually start moving [14].

2.2 Business Model Innovation

According to Massa and Tussi [10], the literature at the intersection of the business model idea and the innovation field has progressed two corresponding views for the business model development. First, business models enable inventive firms to commercialize new ideas and advances. Second, organizations can likewise regard the business model as an origin of development in and of itself, or as an origin of competitive advantage.

The first outlook is mostly established in the literature on entrepreneurship and technology management. There is no economic value in innovative technologies or ideas *per se*; however, only potential ones. It is through the framework of suitable business models that administrators and business people might have the capability to open the output from investments in research and development and connect it to a market. By permitting the commercialization of novel technologies and thoughts, the business

model turns into a vehicle for innovation.

The second view is that the business model provides a different dimension of newness itself, which goes over the customary methods of process, product, and authoritative innovation. This new measurement of innovation might be the origin of unrivaled execution of a business model, even in developed industries.

However, not all plan or reconfiguration endeavors will certainly result in a business model innovation. In order to be an origin of business model innovation, the output of outline or reconfiguration exercises ought to be described by some level of curiosity or uniqueness. Particularly, the business model innovation might result as the product of outlook as well as the reconfiguration of advanced and current business models. business model innovation also establishes a subset of the bigger set involving the entire result of business model plan and reconfiguration exercises.

While sharing the potential for the similar result (namely the business model innovation), reconfiguration and planning are two particular exercises that suggest essential differences. For instance, since the reconfiguration accepts the presence of a business model, it includes, on the one hand, confronting challenges that are idiosyncratic to current organization – for example, organizational inertia, management processes (that may hinder or cultivate change), change methods, organizational learning methods, and ways which might not be a problem in recently shaped associations. On the other hand, recently shaped associations might confront different issues, such as the significant technological uncertainty, absence of resources, absence of legitimacy, and, more generally, liability of newness, which involve the outline and approval of the advanced business models [10].

2.3 Business Model Innovation in Energy Industry

The business model innovation literature in the energy domain has so far concentrated on the formation of particular innovations in the energy value chain, including: solar electricity generation [16], energy storage [17], and electric vehicle charging [18]. These are helpful commitments to our comprehension of how new technologies can empower new participants to contend with incumbent companies. Additionally, these commitments show the significance of business model research to the energy policy association, as they investigate where business model advancement can have both profitable and disruptive impacts over energy markets [19, 6].

Despite of the general possibility for business model innovation in power supply markets, the retail point of the value chain is surely less concerned. The conventional energy supply business model performs a generally straightforward value proposition; national utilities depend on expanding kWh units delivered (with respect to costs) to stay beneficial [20, 21]. Not only the national focus but also the dependence on expanding unit sales influence the capacity of new participants to contend in or join the market [22].

Being clear about value proposition and value capturing is the main purpose of the business model innovation literature. This is critical for the energy business models since they can provide numerous advantages beyond the services to the energy clients; i.e. to the energy system itself, such as demand-

side management that decreases the need for strengthening networks or building new generators [23]. This makes the business model innovation more difficult due to controlling advantages added to the various performers and achieving value from them. Therefore, the compensation of the investment can be difficult [22].

3 Methodology

This is an exploratory study which covers a less researched topic in the electricity retail market qualitatively. Thus research on the business model innovations in the electricity retail sector is yet at an early stage. The research question is selected based on the authors' motivation for supporting companies during the sustainable energy transition in the field of business model innovation for the electricity retail market. It explores how electricity retailers can create value for their residential customers and capture the market for themselves through innovative business models.

According to Yin [24], a case is a practical examination that investigates a modern phenomenon within its real-life setting, particularly when the limits between phenomenon and context are not obvious. As a result, a case study design is selected corresponding to Yin [24] since (a) the research question is a 'how' question, connected with discovering the actions that an organization makes to adjust to the context change; (b) the experts cannot guide or affect the execution of the events; (c) the context is connected to the phenomenon under the investigation, and (d) the inquiry may need an in-depth analysis of a particular problem.

Furthermore, Yin [24] has suggested that given a situation that allows to choose from different resources, a multiple-case study should be picked instead of single-case designs. Due to the fact that the analytic conclusions will be more compelling and robust when coming from a variety of cases rather than a single case, a total of eleven different cases have been chosen in the research design. The units of analysis are the following enterprises (main sources of information used in brackets):

E.ON [25, 26], innogy [27, 28], Greenpeace Energy [29, 30], N-ERGIE [31, 32], Sonnen [33], Vattenfall [34, 35], Fresh Energy [36], GridX [37], EDP [38, 39], Good Energy [40, 41], and Oekostrom [42, 43].

Moreover, it is most likely an exploratory contextual analysis because the aim of this study is to develop a better understanding of a specific topic. When conducting this research, we observed that the prior works/previous studies that can be referred to seem to be very few. The main focus of this research is the electricity retailers' approach with the value creation for residential customers.

3.1 Setting

For a homogeneous product such as electricity, opportunities for marketing and transformation (introduction and bundling, packaging) are restricted. Retailing represents only a small portion of total electricity bills because of this reason. The potential demand for an electricity supplier to meet is constrained by

low income created by the retailing activity. The product homogeneity makes it hard to offer any diversification (green electricity, locally produced is the exception). The possibility to generate the value-added services is accordingly limited.

In a fully liberalized market, the retail energy market does not present many profitable opportunities for new competitors. The introduction of competition into the retail electricity market ought to provide the products that consumers really need, to decrease the costs and barriers to entry, to support innovation, and to empower competition in generation. From this point of view, the outcomes of the introduction of competition into the electricity retail market could go far beyond the decrease in commercialization costs which is desired by consumers [2]. This is possible through business model innovation, which enables electricity retailers to strengthen their business model and to prepare for adapting their way of operating in the retail market.

3.2 Case selection

This research contributes to the business model innovation literature on electricity retailers in Europe. Therefore, only cases with the following three main criteria were chosen: Our research only concentrates on the companies which (1) are active in the electricity retail market and provide electricity and other ancillary products and services for (2) households and private customers – namely Business to Customer (B2C) – while the supplied electricity is generated from (3) renewable energy resources such as hydropower, wind, solar PV, and biomass etc. In order to classify the case studies, we have identified four organizational categories according to the size and scope of the companies (see Table 1). The size of the firms refers to the annual revenues in 2017.

Table 1. Categorization of case study companies incl. revenue, total power sale and number of residential customers in 2017.

Category	Company	Revenue	EBIT	Power generation	Employees	Customers
Multinational companies >€10 bn	E.ON [26]	€38 bn	€3,074 m	193.4 TWh	42,699	21.1 m
	innogy [28]	€43.1 bn	€2,816 m	262.4 TWh	42,393	15.9 m
	EDP [39]	€18.2 bn	€2,318 m	70.0 TWh	11,657	9.9 m
	Vattenfall [35]	€13.2 bn	€1,814 m	127.3 TWh	20,041	6.5 m
Medium-sized companies €100 m - €10 bn	N-ERGIE [32]	€2.81 bn	€171.1 m	14.2 TWh	2,447	N.A
	Greenpeace [30]	€110.6 m	€2.14 m	379.3 GWh	94	121,600
	Good Energy [41]	€118.9 m	€9.74 m	87.6 GWh	317	250,000
Small-sized companies €10 m - €100 m	Oekostrom [43]	€28.8 m	€1.613 m	80.5 GWh	33	341,000
	Sonnen*	€65 m	N.A	0	600	+40,000
Start-ups <€10 m	Fresh Energy*	N.A	N.A	0	32	+1000
	GridX*	N.A	N.A	0	30	+1000

* Note: According to the interviewees

3.3 Data collection

According to Yin [24], the research approach is employing various techniques for data collection. There are six main sources of collecting data, each of which has its specific strengths and weaknesses. For the analysis we follow a mixed methods approach. Data analysis from the recorded interviews was conducted in a three step process. First, the answers were coded according to the nine elements of the business model canvas. Second, the coded results were matched according to the patterns identified in section 2.1.2. Finally, in order to enable a complete analysis and discuss the interview results, the coded results were categorized. Documentation and interviews are the two main sources of data collection applied in this study.

Primary Data: The primary data collection approach was based on different types of semi-structured interviews, including face-to-face interviews, and sending questionnaires. The interview participants comprise consultants, project managers, and sales managers, particularly from the business model development or the renewable energies department. All interviewees were provided with a semi-structured questionnaire which conducted the interviews. Five interviews were conducted face-to-face in year 2018. The length of the interviews ranged from 35 to 125 min. The conversations were recorded and accordingly transferred into written protocols. Due to the fact that the interviewees asked for anonymity the quotes in the results section are given without reference to the name of the company. Some e-mails with questionnaires were sent to the potential interviewees but, unfortunately, no relevant answer was received. Therefore, the interviews for this research include five face-to-face interviews. Table 2 shows the source of data collection and table 3 illustrates the interview settings.

Secondary Data: Several sources of secondary data collection for the in-depth analysis of the case studies were selected. The secondary data is mainly gathered from the companies' websites and brochures. Since all companies are publicly registered in the energy supply market, all the required information to inform the public and their stakeholders are published on their website. The documentation contains a large number of reports gathered from the companies' websites, news from the companies' social media channels, brochures, annual reports, and from customers.

Table 2. Interview details

Company	Interviewee position	Duration
E.ON	2 Junior and 3 Senior Consultants	125 min
innogy	2 Sales Managers	65 min
Vattenfall	1 Portfolio Manager	35 min
Fresh Energy	1 Sales and 1 Project Manager	45 min
GridX	1 Sales Manager	45 min

Note: Interviewees of some company interviewed jointly

Table 3. Sources of data collection

Company	Website	Brochure	Interview	Customers
E.ON	X	X	X	X
innogy	X	X	X	X
Vattenfall	X	X	X	X
EDP	X	X		
N-ERGIE	X	X		
Sonnen	X	X		X
GridX	X	X	X	X
Greenpeace	X	X		X
Good Energy	X	X		
Oekostrom	X	X		
Fresh Energy	X	X	X	X

3.4 Data analysis

Coding is an approach that is presented as a means to label, accumulate and analyze the information, and as the reason for building up the investigation. A code can be a keyword, subject or category within the interview transcript or the notes [44]. With the thought of data legitimacy and reliability, this contextual analysis entirely followed the strategy of coding, gathering information, and analyzing data. The information analysis contains not only primary data but also secondary data. There are a number of terms and definitions which are used in this research:

The term *'Photovoltaic (PV)'* describes the type of energy suppliers who offer solar PV systems to private customers.

The *Smart home solution* explains companies that provide households with any intelligent lighting, efficient heating, and security systems based on the Internet of Things "IoT", in which these devices are able to communicate with each other via the Internet.

Energy storage providers are those companies which sell home battery storage systems of different sizes [45].

Electromobility solution refers to any ancillary services related to electric vehicles, such as installing charging stations, offering special tariffs for electric vehicle owners etc.

The *Online shop* is a platform that enables companies to sell different products or services via their website.

A *Smart meter* is a device which enables companies to receive actual metered data on electricity consumption.

An *Energy management app* characterizes an interface such as a smartphone app and/or other online platforms that enables the customers to actively manage their electricity consumption in real time.

Demand-side management (DSM) is a technique to enhance the energy framework at the consumption

side. It is different from energy efficiency enhancement by utilizing better products, over smart energy costs with incentives for particular consumption approaches, up to practical real-time monitoring of distributed energy resources [46].

3.4.1 Data Analysis for Business Model Canvas

Having gathered the information in terms of various existing business models from the company's website, case studies, interviews etc., the achieved data are analyzed according to the building blocks of the Business Model Canvas [9]. Regarding the *Key Partners* building block, companies need to answer the following questions: "Who are our key partners? Who are our key suppliers? Which key resources are we acquiring from partners? Which key activities do partners perform?"

In order to point out the companies' *Key Activities* and *Key Resources* building blocks, the following questions need to be addressed: What Key Activities and Resources do the Value Propositions, Distribution Channels, Customer Relationships and Revenue Streams need?

To complete the *Value Propositions* building block, the customers are entitled to ask the companies the following questions: Which one of the customers' problems do you help to resolve? Which customer requirements do you fulfill? What kind of products and services do you give to each customer group?

The *Customer Relationships* building block answers the questions about: "What type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established? How costly are they? How are they integrated with the rest of our business model?"

The *Channels* building block explores how an enterprise communicates with and reaches its customers in order to offer them a Value Proposition and the most important questions are: How is the company reaching its customers now? Which ones are most cost-efficient?

For the *Customer Segments* building block, the following questions are asked: "For whom are we creating value? Who are our most important customers?"

In the *Cost Structures* building block company asks the following questions: "What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive?"

To fill in the *Revenue Streams* building block, the following questions were posed: "For what value are customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues?".

3.4.2 Data Analysis for Business Model Navigator

Identification of the applied patterns and their clustering is carried out according to the Business Model Navigator. The following patterns are exploited in the electricity retail market:

Through the *subscription* pattern, the customers pay a fixed charge, typically on a monthly basis, to the energy supplier in order to have access to electricity.

Through the *pay per use* model, the actual consumption of electricity is metered. The more electricity is used, the more the customer pays. The payment can be a fixed value or differ according to the actual consumption.

Open business model users collaborate with customers and partners to create value. Basically, through the feed-in-tariff scheme[1], the customers are able to actively participate in the energy industry by generating electricity and delivering it to the public grid. Moreover, companies collaborate with the partners in order to offer unique solutions. These partners may give different products or other ancillary services such as PVs, batteries, smart home instruments, electromobility (e-mobility) services, IT solutions, energy efficiency products etc.

The *layer player model* depicts the specialized companies which only generate electricity from renewable energy resources and do not operate any non-renewable power plant. These companies mostly benefit from economies of scale and their established special expertise – such as renewable power generation – can lead to a higher quality process.

The *direct selling* pattern describes the firms that generate electricity from their own renewable energy resources and sell it directly to the end consumers.

Energy solution providers offer any kind of energy-related products and services, such as energy efficiency, consultation, generation, and energy management solutions.

The cross-selling pattern encourages the companies to advertise various products and services besides supplying electricity. These products typically include solar panels, energy storage systems, smart home equipment, electric vehicle charging points, etc.

Digitalization of households in the electricity supply market is made possible by turning energy data into digital variants and monitoring activities through IT solutions. There are several technologies such as solar panels, energy storage systems etc. that make customers' electricity supply more self-sufficient. These technologies have already changed electricity retailer's business models and created a new revenue stream and value-adding opportunities for them. As a result, companies which employ IT solutions and offer self-sufficiency technologies to the residential customers actually apply the 'Digitalization' business model pattern.

3.4.3 Within case analysis

Within-case analysis regularly includes detailed case studies investigating reviews for each site. These reviews are typically only pure explanations, but they are key to the insight creation [47], since they enable scientists to adapt early in the examination process with the generally large volume of data. In fact, there is most likely the same number of methodologies as there are specialists. Although the general concept is to turn into each case as a single element, this process reveals the particular case patterns before researchers apply generalized patterns across cases. Additionally, it provides researchers

[1]Households or businesses are paid when they generate their own electricity over the use of methods that do not commit to the reduction of natural resources, corresponding to the volume of power generated.

a complete closeness with each topic and, as a result, helps to pursue cross-case analysis [48].

3.4.4 Cross-case analysis

A cross-case examination is coupled with within-case analysis for patterns. The strategies here are driven by the fact that individuals are notably weak data processors. One strategy for cross-case analysis is to choose dimensions or divisions and later search for within-case similarities combined with inter-group diversities. Dimensions can be recommended by the research question or by current literature, or the scientist is able to simply pick several dimensions. Generally, the concept behind the cross-case analysis is to push academics forward to go beyond original impressions, particularly using organized and assorted lenses on the information. These strategies enhance the probability of the precise and dependable hypothesis, a hypothesis with a close match with the information. Also, cross-case analysis strategies improve the likelihood that the examiners will capture the innovative discoveries which might be contained in the information available [48].

4 Results

This section presents the results from the interviews and the secondary data collection for within-case and cross-case analysis. Section 4.1 describes the current situation of each company in some detail, whereas section 4.2 compares all the companies in terms of their applied business patterns and value creation efforts in tables 4-7.

4.1 Within-case analysis

4.1.1 E.ON

E.ON is an international, privately owned energy supplier which relies on renewable energies and operates modern and sustainable energy supply assets. E.ON has more than 5 million private customers in Germany and concentrates on the expansion of renewable energies, intelligent power grids, and tailor-made customer solutions. The company generates electricity from its own distributed generation resources – such as wind, solar, combined heat and power (CHP) units, biomass, biogas, and hydropower plants. Other key resources contain IT solutions, software technologies, network infrastructures, and expert consultants.

E.ON provides solar and energy storage systems for residential customers which let them keep their energy supply independently from the public grid. Through the 'E.ON SolarCloud' platform, extra generated electricity is fed into the grid that can later be consumed again. This helps to make households more energy-self-sufficient. In collaboration with partners, E.ON has developed smart home solutions and offered energy efficiency services for private customers. As a result, households are able to optimize their energy consumption. E.ON also invests in e-mobility services such as the installation of charging

infrastructure in Europe. Customers with electric vehicles can benefit from flexible tariff schemes and charge their vehicles with cheaper green electricity.

E.ON provides households with simple and easy-to-understand electricity bills without advance payment. It provides 'smart' energy solutions including energy management and enables customers to monitor the energy flow via smartphone apps or customer portals. Since 2015, E.ON customers have been able to benefit from the 'E.ON Smart Check' app which provides transparency on their electricity consumption in order to manage their energy consumption on a regular basis and prevent unexpected supplementary payments. E.ON offers energy solutions including energy management to achieve domestic demand side management, aimed at reducing clients' energy consumption significantly.

E.ON communicates with residential customers and reaches them through social media, energy apps, press, and broadcast media. It establishes and maintains the customer relationship through the call center, by telephone and email, online chat, after-sale services, on-site visiting and annual shareholder meetings. Customers are able to help themselves without direct connection with the company via automated services and customer portals. E.ON designed the Phoenix program in 2016 in order to reduce bureaucracy and complexity, optimize its organizational setup and processes, delegate authority, and to become faster, more agile, and closer to the customers. According to their expectations, it shall enable E.ON to achieve annual earnings improvements of €400 m from 2018 onward.

The total sales volume of E.ON has been €37,9 m in 2017 and is generated by three main segments; 'Customer Solutions', 'Energy Networks', and 'Renewables'. At that time, the 'Customer Solutions' segment consisted of 19,222 employees, which includes activities that provide customers in Germany with electricity, gas as well as the distribution of associated products and services such as energy storage, e-mobility, and heat supply in the fields of enhancing energy efficiency and energy independence. By investing €595 m in 2017, E.ON's sales from the 'Customer Solutions' sector has been €21,5 m or 56.8% of the total sales of the year. E.ON has invested €1 bn in 2018, which accounts for 26% of the total cash-effective investments on the 'Customer Solutions' segment; therefore, it can be expected that the company will increase the sales further in the following years. The 'Renewables' segment consisted of 1,206 employees in 2017 and has invested €1,2 m in renewables, yet the sales were reported at €1,6 m. E.ON has also invested €1,4 m in the 'Energy Networks' segment in 2017 and has achieved sales amounting of €17 m. The other important costs were associated with employees (€3,1 m) and consolidation costs (€4,6 m) in 2017 [25, 26].

4.1.2 innogy

innogy SE is a joint-stock European energy company from Germany. The company addresses the requirements of a modern, decarbonized, decentralized, and digital energy world with its three divisions renewables, grid and infrastructure, and retail. innogy generates electricity from renewable energy resources including wind, solar, biogas, biomass, and hydropower plants; therefore, it is an electricity retail

supplier. In 2018, E.ON acquired 76.8% stake in innogy and made a voluntary public takeover offer for the stock of the other shareholders of innogy.

With around 7,000 smart charging stations in more than 20 countries, innogy is one of the largest electricity suppliers for e-vehicles in Europe. It has installed 5,300 charging points in more than 700 cities in Germany of which some 2,400 are publicly accessible. The charging stations and their installation have roughly costed €7.8 m in total. Moreover, in the year 2018, innogy has planned to invest £200 m for charging infrastructure in the United Kingdom.

To optimize home energy consumption, innogy offers self-generation systems — such as solar panels and energy storage systems – and operates smart home services, electric vehicle charging stations, and energy consultation solutions. In order to create value for private households, innogy exploits key resources including distributed generation producers, software technologies, integrated storage systems, e-mobility, and grid infrastructures.

In the year 2017, innogy has totally invested €2,2 m on renewables, grid and infrastructure, and retail as the main three segments which allocate €264 m, €1,3 m, €164 m to each of the segments, respectively. Moreover, it has devoted €1,8 m for the capital expenditure on property, plant and equipment and on intangible assets. Of the total generated revenues from these segments, €1,3 m was allocable to renewables, €14,2 m to grid and infrastructure, and €31,5 m to retail. In the year 2017, other important costs for innogy were associated with operating expenses (€1,1 m) and personnel costs (€3 m).

During the same year, innogy could sell 262.4 TWh of electricity to external customers, which was 8% higher than the volume sold in the year 2016. The sales trend has benefited from the acquisition of new customers in the German distributor business and due to the improvement of company's supply relationships with existing customers. However, decreases in sales volumes were issued for the residential and small commercial customers due to the market competitiveness.

Through the social media, the company's website, press, and media, innogy builds up channels to connect and inform the customers. innogy creates and maintains the relationship with customers through the personal assistant e.g. telephone and email, on-site visit, after-sale services, and customer portal. Shareholder meetings are held on an annual basis. In order to improve these customer relationships and similar assets, the company has spent €2,809 m and has reached a 'Customer loyalty index' of 76/100 in the year 2017 [27, 28].

4.1.3 Sonnen

Sonnen is a German company which supplies renewable energies and offers intelligent storage system solutions. It has interconnected households with solar panels and battery storage systems through the Sonnen community. In this manner, households are able to share their surplus energy on a virtual energy storage platform with each other. The company provides energy storage systems, smart home services, and e-mobility solutions. To create these values, Sonnen exploits key resources including strong software

technologies and integrated battery storage systems.

Sonnen has integrated renewable energy resources, and particularly solar generation units. Through the Sonnen community, members are able to share their surplus electricity together and become electricity-self-sufficient. It provides a competitive and stable energy price during trading. Sonnen optimizes the energy consumption and increases the flexibility by providing storage solutions and energy management systems. It presents households' energy profile according to the consumption and generation. As a result, Sonnen provides domestic demand side management. Through the 'flat-rate' scheme, prosumers are able to consume free electricity according to their generation profile.

Sonnen reaches the customers through communication channels such as social media, the press, and the company's website. It supplies energy to domestic consumers as a mass market, and households with electric vehicles as a niche market. Customer relationship is established through personal assistance e.g. telephone and e-mail, online assistant, on-site visits, a call center, customer portals and energy apps. Costs related to the software, technologies, contracts, and staff (€581,300) are indicated as the main costs, while the most important revenue stream is generated from selling electricity, batteries, and community membership [33].

4.1.4 Greenpeace Energy

Greenpeace Energy, a first mover in supplying only renewable energies, is an energy retailer in Germany. It has a very active contribution to climatic and environmental protection; hence, it promotes the sustainable energy transition ('Energiewende'). Greenpeace Energy creates value for residential customers by generating electricity from its own renewable energy resources and providing e-mobility services for households with electric vehicles. The key resources are distributed generation units including wind farms, solar PV power stations, and hydropower plants which are under the operation of 'Planet energy GmbH' as the founded subsidiary.

In order to reduce CO_2 emissions and take care of the forests, Greenpeace Energy has collected a total amount of €6,600 in terms of donations from a customer advertising program at the end of 2017 and will spend this donation for the national park Hunsrück-Hochwald in Rheinland-Palatinate and Saarland (approximately a 2 hectares area).

Customers are reached via social media, press and the website as the main communication channels, whereas customer relationship is created within the customer portal, call center, telephone, and email. Greenpeace Energy also holds annual meetings with shareholders. Due to a stable electricity price and the active response of the customers, customer loyalty has increased further in 2017 comparing to the previous year. As a result, the contract terminataion rate in the electricity segment decreased by 0.9%, which had a positive effect on the company's net growth.

The main income of Greenpeace Energy is earned from renewable electricity supply. In the 2017 financial year, the company has experienced a higher sales volume, from €93.4 m to €101,9 m, excluding

the taxes related to electricity and gas divisions. Rising customer numbers caused electricity sales to increase from 370 GWh in 2016 to 379 GWh in 2017. Overall, the average electricity consumption of residential customers was decreasing. However, the energy sales volume has increased slightly from 251 GWh in the previous year to around 259 GWh in the 2017 year due to the increase in the number of customers.

Greenpeace Energy has already invested €251.3 m for the costs of renewable energy generation units. The cash flow from investing activities resulted in a cash outflow of €1.55 m, which was slightly above the level of the year 2016. The main driver of this development is the project for the integration of billing services. The other important costs amounting to €0.54 m are connected to contracts, personnel and intangible assets e.g. industrial property rights and similar rights [29, 30].

4.1.5 Fresh Energy

Fresh energy is a start-up, founded in 2017 in Germany, that operates as an energy company with a strong IT background which completely concentrates on data management and design. It delivers energy services only for the private customers. The start-up analyzes customers' consumption data from smart meters and sends them to the Fresh Energy app. As a result, the energy consumption of home appliances such as refrigerator, washing machine etc. is depicted in real time. Fresh Energy was established with venture capital and has already created a number of partnerships with different companies, including Discovergy and innogy. Discovergy provides smart meters, and innogy is the founding investor of the start-up.

Fresh Energy operates energy software and apps to optimize the households' energy consumption. It identifies all home appliances' energy consumption, especially energy guzzlers; therefore, it fulfills the domestic demand side management. Fresh Energy provides the customer with a very detailed and transparent electricity bill. Residential customers are reached by social media and website. Moreover, the customer relationship is established through the call center, telephone and email, customer portal, and the Fresh Energy app.

The essential cost structure for Fresh Energy is associated with software and staff. The main revenue stream is generated through electricity supply, software, and energy management apps produced for the residential customers [36].

4.1.6 N-ERGIE

N-ERGIE is a utility which supplies large areas of northern Bavaria, Germany, and is active in electricity generation and retail markets. It was founded by the Städtische Werke Nürnberg GmbH (StWN) and the Thüga AG in March 2000. The N-ERGIE is committed to the energy transition and a consistently decentralized approach to its implementation. N-ERGIE generates its own green electricity from renewable energy resources such as wind, PV, biomass, biogas, and hydropower plants. It also operates

small-scale power generation units including solar and energy storage systems for households and offers electric charging points for electric vehicle owners. N-ERGIE gives energy solutions including energy consultation, energy efficiency, and saving solutions.

N-ERGIE Customer Service communicates with customers through social media, website, press, and media. N-ERGIE has established customer relationships with domestic clients through the customer portal, social events, online chat, telephone and email, on-site visits, and after-sale services.

In 2017, revenues from electricity supply (without electricity tax) including ancillary service revenues amounted to €2.14 bn (€2.1 bn in 2016). The reason for increasing the revenue was mainly due to the decrease of sales, which declined by €65.1 m, or 5.6%, while the increase in electricity sales was attributable to the Syneco Trading GmbH, Munich, (Syneco) which had a positive effect. Key account customers accounted for 53.5% of electricity sales (54.5% in 2016) and 46.5% (45.5% in 2016) were due to regular private and corporate customers. In the residential segment, primary energy consumption is expected to increase. This is mainly due to legal requirements (e.g. the Energy Saving Ordinance) and the increasingly decentralized generation in the electricity sector. In addition, many new competitors from outside will gain market shares with growing momentum. With attractive energy solutions, N-ERGIE is going to face this competition and convince customers of its advantages. Also, the introduction of modern measuring equipment and intelligent measuring systems within the framework of the Digital Transformation of the Energy Transition Act has opened up new opportunities which are actively used by the N-ERGIE and designed to be customer-focused.

In 2017, the group has invested €112.94 m (2016: €109.3 m). Of this amount, €99.5 m (2016: €101.3 m) was attributable to property, plant and equipment, €10.29 m (2016: €5.9 m) on financial assets and €3.1 m (2016: €2.1 m) on intangible assets. Capital expenditures arose from concentrated renewal and expansion measures for production, production and supply and distribution systems. Financing of investments in intangible assets and property, plants, and equipment in 2017 accounted for 81.5% (2016: 81.0%) of depreciation. Finally, in 2017 the cash flow from investment activities (which includes investments in property, plants and equipment) was €51 m.

N-ERGIE's electricity sales decreased in particular as a result of volume declines in the corporate customer segment by 2.1% to 14.2 TWh in 2017. New contracts could not compensate for the declines. In the key account segment as well as the private customer segment, there was also a decline in deliveries. The key account customers continued to hold 80.9% of the total sales volume (previous year: 79.5%) as the highest-sales customer group [31, 32].

4.1.7 GridX

GridX is another start-up in Germany, based in Aachen and Munich, that supplies electricity for more than 1000 households. It operates a virtual power plant and is active in the electricity retailing market. It integrates local electricity producers and consumers on the GridX platform in order to support

decentralization and the energy transition. GridX builds partnerships by collaborating with prosumers, local energy generators and other industry partners such as innogy. GridX provides its customers with electricity, and GridBox as an intelligent energy management system which optimizes electricity consumption and maximizes the use of households' self-generated energy. GridBox automatically monitors the energy flow in the house and manages it such that the degree of autonomy is maximized; therefore, it fulfills domestic demand side management. Through the GridX dashboard, residential customers are able to monitor the actual energy flows in a very intuitive and transparent way. GridX creates the channels to connect to domestic customers through the website and social media. It also builds and maintains the relationship with the clients within personal assistance such as call center, online chat, telephone and email, on-site visit, customer portal, and after-sales services.

The essential costs and expenses for GridX are incurred with the software and technology, staff, and contract. The most important revenue is generated from electricity supply, selling the GridBox as a white label product and providing solar PV systems and charging stations [37].

4.1.8 Vattenfall

Vattenfall is one of the largest electricity generators and distributors in Europe. It strives for being a leader in the sustainable generation of electricity and ensuring a reliable and cost-effective energy supply. Vattenfall generates electricity from wind, nuclear, natural gas, biomass, coal, and hydropower plants. By 2050, the company wants to be climate-neutral by increasing the share of sustainable energy resources, with the aim of minimizing CO_2 emissions and other environmental impacts.

Besides electricity supply, the main activities of the company are operating small-scale solar systems and energy storage solutions, providing energy consulting, smart home services, and charging solutions for electric vehicles. It operates around 8,400 charging stations throughout Germany, Sweden, Denmark, and the Netherlands. Vattenfall offers flexible tariffs with competitive prices for households and relatively lower-cost electricity for electric vehicle owners. Additionally, the company implements subsidized energy-saving measures through an energy-saving tool, and offers special loans for selling solar panels. As part of the business model, Vattenfall not only sells solar PV systems and batteries, but also rents these infrastructures to private customers. As a result, significant personal investment on the side of the private households is not required.

Total investments in 2017 has been SEK 21,2 m (1 SEK = 0.1 €) of which SEK 711 m was dedicated to the 'Customer and Solution' segment, SEK 3,4 m to 'Power Generation' and SEK 7,2 m to the 'Wind' segment; the reported cash flow from investing activities has been SEK 18,5 m. The total sales of electricity in 2017 has decreased slightly compared with 2016, from 88.9 TWh to 84.0 TWh due to the entry of new competitors in the electricity retail market. However, the number of retail customers has grown by almost 290,000 contracts during the year 2017. The most important changes were the growth by 120,000 contracts in the German market and also by entering the UK market through the acquisition

of a fast-growing electricity supplier company with 195,000 contracts at the year-end. The generated profit from the 'Customers and Solutions' segment, which is responsible for sales of electricity and energy services in all of Vattenfall's markets, has expanded by SEK 0.1 bn, mainly because of lower operating costs in comparison with the previous year. The underlying operating profit for the 'Power Generation' segment, which includes Vattenfall's nuclear and hydro power plants, optimization, maintenance services business, and trading operations, has declined by SEK 0.6 bn compared with 2016, primarily due to a lower contribution from the gross margin that was slightly compensated by lower operating costs. The operating profit generated from the 'Wind' operating segment, which is related to the development and operation of Vattenfall's wind farms and decentralized solar power as well as batteries, enhanced by SEK 1.3 bn, principally because of the commissioning of new wind farms. For the first time in 5 years, Vattenfall has reported a positive result, with a net profit of SEK 9.6 bn and a basic operating profit of SEK 23.3 bn for 2017. The net sales volume has been SEK 139.2 bn in 2016 which slightly decreased to SEK 135.3 bn in 2017. The revenues from the 'Customer and Solution' segment included SEK 67.5 bn, which is equal to the generated value in the previous year (2016).

Customers are reached through diverse channels, including social media, press and the website as the main communication bridges. Vattenfall builds customer relationships with personal assistance e.g. a call center, live chats, on-site visits, telephone and email, after-sale services, customer advisory board, a customer portal, and a self-designed energy app. Since Vattenfall provides its products and services through various sales channels, it incurs different types of costs in connection with these channels. Incremental costs to achieve contracts are to be capitalized and amortized over the length of the contracts. Since part of these costs have been expenses previously incurred, an effect of SEK 62 m lower costs arises in the restated 2017 figures. Vattenfall gives customers bonuses and discounts mainly on electricity purchases through various schemes. These bonuses and discounts granted to customers are primarily reported as a reason for the decrease in income (SEK -108 m).

The most important costs are the costs connected to depreciation and amortization e.g. products sold (SEK 13.6 bn), administrative expenses (SEK 1.3 bn) and personnel costs (SEK 18 bn) [34, 35].

4.1.9 Oekostrom

Oekostrom AG was founded in 1999 with the aim of developing a sustainable energy industry in Austria. Through building a partnership, it offers solar PV systems to private customers and thus drives the energy transition forward. The basis for supplying customers is a balanced mix of electricity from wind, solar PV and hydropower plants. Also, as a first step in the area of e-mobility, Oekostrom offers its customers a roaming-capable charging key and an associated app, which provides access to more than 52,000 charging stations all over Europe, of which more than 2,200 are located in Austria.

Oekostrom employs various channels to connect to and inform the domestic customers. These channels include social media, the company's website, press and media. Customer relationships are built and

maintained through personal assistance, such as phone calls and emails, on-site visits, a customer portal, and after-sale services.

In the year 2017, Oekostrom AG has recorded an increase in power generation of 80.5 GWh (60.0 GWh in 2016) and total electricity sales of 275 GWh, an increase of 7% compared to 2016. Oekostrom has invested heavily (€27.7 m) from public funds in technical equipment and machinery in 2017 and has reported a net cash flow of €-8.1 m from its investment activities.

The main costs for Oekostrom are incurred due to the infrustructure costs e.g. land, buildings, technical equipment and machinery etc. (€18.1 m), contracts (€1.1 m), and staff (€2 m) [42, 43].

4.1.10 EDP

EDP is one of the largest energy suppliers in Europe, operating mainly in Portugal and Spain. The company generates electricity from various energy resources including hydro, wind, solar, coal, CHP, and nuclear power plants. EDP offers e-mobility services by providing electric charging points. EDP also offers energy efficiency solutions; it optimizes the households' energy consumption through smart home systems, software, and self-generation systems.

By collaborating with partners, EDP offers solar panels and energy storage systems; therefore, customers become energy-independent. In order to optimize households' electricity consumption and energy savings, EDP provides energy solutions including energy management and efficiency solutions. This has consequently resulted in lower electricity dissipation. EDP presents interactive and detailed electricity bills and enables customers to monitor the electricity data in real-time through a customer portal and an energy app.

There are a number of channels which EDP exploits to reach potential residential customers. These channels consist of social media, the company's website, press, and other media. EDP creates and maintains the relationships with the existing customers through a call center, online chat, telephone and email, on-site visits, customer portal, after-sale services, and an energy app. Moreover, shareholder meetings are held on an annual basis. Currently, about two million smart meters are installed in Portugal and 28% of customers are benefiting from an electronic invoice. Since 2012, EDP has launched "Community EDP", which provides customers with a variety of benefits, including discounts on services and associated products, in order to increase customer loyalty. As a reflection of customer relationship management, in 2017, EDP achieved a global customer satisfaction level of 74%, in line with the company's target.

EDP has experienced a 1% increase in the number of electricity customers, from 9.80 m in 2016 to 9.8 m in 2017. Also, from a financial perspective, EDP has achieved a net profit of €1.1 m in 2017, an increase of 16% over 2016 (€961 m), which is remarkable because the total generated electricity in 2017 has remained constant (70 TWh) in comparison with the previous year. in 2017, EDP has recorded a total investment of about €2 bn in Portugal alone. For the social component, it has invested €30 m in fields such as social integration, environment, education, innovation, art, and culture. Also, for the

period between 2016 and 2020, it has already achieved 84% of its engagement to invest €100 m in social areas. The investment value in the renewables area has increased significantly from €1.2 bn in 2016 to €1.8 bn in 2017. The other main investments are: €843 m in joint ventures and associates, €781 m in joint ventures, €180 m on environmental protection (booked as property, plant and equipment and intangible assets), €51.5 m in property, and €11.5 m in subsidiaries. Net cash flows from investment activities were €570 m in the year under review.

The essential costs related to amortization/impairment of property, plant and equipment (€1.3 bn), contracts (€1.4 bn), personnel (€680 m), and infrastructure costs. EDP makes a profit by electricity retailing, offering solar panels and energy storage systems, energy consulting, and also by providing e-mobility and smart home services [38, 39].

4.1.11 Good Energy

Good Energy was founded in 1999 in the UK, with the aim of increasing sustainability by supplying and developing renewable energies. As the main activity, Good Energy provides the residential customers with electricity from renewable resources. The company currently owns and generates electricity from several solar sites and wind farms and directly supplies the customers.

Good Energy creates channels to reach and inform its customers through their website, social media, and the press. In order to communicate with the residential clients, Good Energy builds customer relationships according to personal assistance including answering customers' telephone calls and email, a call center, and a customer portal. A Customer Care Team is responsible for the existing customers and sales inquiries for new customers.

The most important incomes of Good Energy are generated from the electricity retail market. In 2017, the total electricity sales has increased by 8.5% to 87.6 GWh (80.7 GWh in 2016); moreover, the revenue has grown by 16.6% to £104.5 m (£89.7 m in 2016, £1 = €1.12) resulting from the development of the supply segment with a growth in the domestic customers base. Gross profit increased by 8.2% to £29.3 m in 2017 (£27.1 m in 2016), whereas operating profit decreased by 9.8% (£6.2 m in 2016) to £5.6 m. This is reported due to the lower income in the supply segment, which carried £1.1 m of re-structuring and one-off costs. The total delivered energy to customers has grown by 5.4% to 1.06 TWh (2016: 1.01 TWh). The total number of customer meters supplied has increased slightly from 115,6 in 2016 to 115,7 in 2017. Good Energy has invested £41.7 m on the development and building of new generation sites, e.g. wind turbines and solar panels, and the net cash flows used in investment activities amounted to £3.8 m. The main costs incurred from the depreciation and amortization (£4.2 m), staff (£10.9 m), and administrative costs (£13.1 m) [40, 41].

4.2 Results from cross-case analysis

All the case studies are first analyzed according to the existing business patterns in the electricity retail market, products and other ancillary services related to electricity, and different value creation efforts. The results are presented in table 4.

Table 4. Business patterns applied by the companies investigated (group 1)

Company	Subscription	Pay per use	Open business	Layer player
E.ON	X	X	X	X
innogy	X	X	X	X
Vattenfall	X	X	X	
EDP	X	X	X	
N-ERGIE	X	X	X	
Sonnen	X	X	X	
GridX	X	X	X	
Greenpeace	X	X		X
Good Energy	X	X	X	X
Oekostrom	X	X	X	X
Fresh Energy		X		

Table 4 underlines that almost all the electricity retail suppliers within this study generally take up a subscription, pay per use, and open business model patterns. Through the subscription pattern, companies charge clients with a regular fixed cost on a monthly basis in order to provide customers with electricity access. Besides electricity subscription, E.ON offers the 'SolarCloud' as a service platform, which enables customers to store the generated electricity virtually by paying a fixed fee per month. Sonnen also offers the 'SonnenCommunity' membership thus exploiting a subscription system. This enables customers to share their surplus electricity together on the Sonnen platform.

Over the pay-per-use pattern, customers pay for their electricity consumption. Typically, the German electricity retail market, utilities do not provide consumers with actual electricity consumption per month. As a result, customers simply pay a fixed cost for the electricity utilization which is proportional to the number of the family members. Fresh Energy and GridX have innovated around the pay-per-use pattern. It informs the customers about their actual energy consumption data and issues electricity bills accordingly. Therefore, customers pay for what they have actually consumed within the specified month.

Through an open business model, energy suppliers collaborate with customers and partners to create extra value. One way is to buy surplus electricity from prosumers. This also enables prosumers to actively participate in the energy transition and reduce the need for power grid expansion. Except for Sonnen and the start-ups, all the other energy suppliers in this study operate as layer players in terms of power generation from renewable energy resources and supplying their end consumers.

Table 5. Business patterns applied by the companies investigated (group 2)

Company	Direct selling	Energy solution	Digitalization	Cross-selling
E.ON	X	X	X	X
innogy	X	X	X	X
Vattenfall	X	X		X
EDP	X	X	X	X
N-ERGIE	X	X		X
Sonnen		X	X	X
GridX		X		
Greenpeace	X			
Good Energy	X			
Oekostrom	X			X
Fresh Energy		X		

Table 5 shows that according to the direct-selling pattern, most of the companies in this study generate renewable energies from their own resources (Sonnen is specialized in producing batteries) and directly sell to the end-consumers. With the exception of Greenpeace Energy, Good Energy, and Oekostrom, all the other companies afford energy solutions and offer products or services related to energy efficiency, consulting, generation, and management solutions.

Digitalization of the households is currently only realized by four of the eleven investigated companies: E.ON, innogy, Sonnen, and EDP. This has not only generated additional revenue for these companies, but it also has created more value for the customer due to developing energy independence; however, other electricity suppliers such as Vattenfall and N-ERGIE plan to operate smart meters and prepare the conditions to carry out households' digitalization. Table 6 depicts the companies who applied the cross-selling pattern in their portfolio with their offered products and services.

Table 6. Cross-selling applied by the companies investigated

Company	Photovoltaic	Energy storage	Smart home	E-mobility	Online store
E.ON	X	X	X	X	X
innogy	X	X	X	X	X
Vattenfall	X	X	X	X	X
EDP	X	X	X	X	X
N-ERGIE	X	X		X	
Sonnen	X	X	X	X	
Oekostrom	X		X	X	X

Table 6 reveals that except for Good Energy, Greenpeace Energy, and Fresh Energy all the other electricity retailers provide additional products or services besides electricity in their portfolios. Seven

companies in this study provide products such as solar PV systems, whereas eight companies offer solutions for e-mobility. According to table 6, only Oekostrom and GridX do not engage in energy storage systems. Except for N-ERGIE and GridX, smart home services are offered by the other companies. Only the multi-national companies and Oekostrom run an online store in order to advertize the other electric devices to the households.

Table 7 provides an overview of the other value creation efforts including smart meter installation, energy management app provision, and demand-side management. It is clear that extra value proposition is simply created for the households by operating with smart meters and visualizing the energy data via an energy app. Three of the established companies, i.e. Greenpeace Energy, Good Energy, and Oekostrom, do not exploit smart meters but have already planned to implement such devices. Quite the contrary, those organizations that applied smart meters also actively present energy management apps in order to visualize energy data and accomplish domestic demand side management faster.

Table 7. Other values creation efforts applied by the companies investigated

Company	Smart meter	Energy app	Demand side management
E.ON	X	X	X
innogy	X	X	X
Vattenfall	X		
EDP	X	X	X
N-ERGIE	X		
Sonnen	X	X	X
GridX	X	X	X
Fresh Energy	X	X	

5 Discussion

According to a series of interviews conducted with representatives from the companies studied and other sources of data collection, the current study investigated how energy retailers can create value for residential customers. It can be concluded that most electricity suppliers have markedly extended and altered their business during the recent years in order to facilitate their customers' adaptation to the sustainable energy transition ('Energiewende'). Today, energy retailers not only supply households with electricity from the renewable resources but also provide different associated products and services through cross-selling and energy solution patterns. These include solar PV, energy storage units and energy management systems, solutions for electric vehicles, smart home devices, online store and energy management apps. Therefore, by offering these products and services to the customers, the customers' habit persistence may be mitigated and new ways of consuming energy and related services can be facilitated, including lifestyle changes.

Most of the electricity retailers only follow established patterns. However, in the electricity market

which has existed for several decades, energy suppliers need to think 'out of the box' to create value by applying particular business patterns from different industries and sectors to their current business model. For example, Sonnen has employed a "flat rate" pattern which is typically used in the telecommunication and media industry. This pattern enables prosumers to reduce the electricity costs even to zero. As a result, energy providers can apply solutions from other industries and make them compatible with electricity retail business.

Another way for electricity suppliers to create value is by exploiting new technology achievements in their business models. New technologies such as smart meters can make the electricity suppliers' business models more innovative and attractive. Smart meters measure the actual energy consumption of consumers in real time and send the energy data to the electricity supply company. With these energy data, energy providers can offer energy management apps in order to enable private households to manage their energy consumption in real time. In this regard, GridX has gone one step further and designed an energy management device (the so-called 'GridBox'), which can manage electricity generation and consumption and optimize energy consumption as well. Also, companies such as E.ON and Sonnen in this study have already made a platform which enables their customers to store their surplus electricity generated into a virtual electricity account and consuming it whenever it is needed - thus becoming 100% energy-self-sufficient. Thus, we suggest the following business model (see figure 2) to electricity suppliers as an advantageous business model during the sustainable energy transition era.

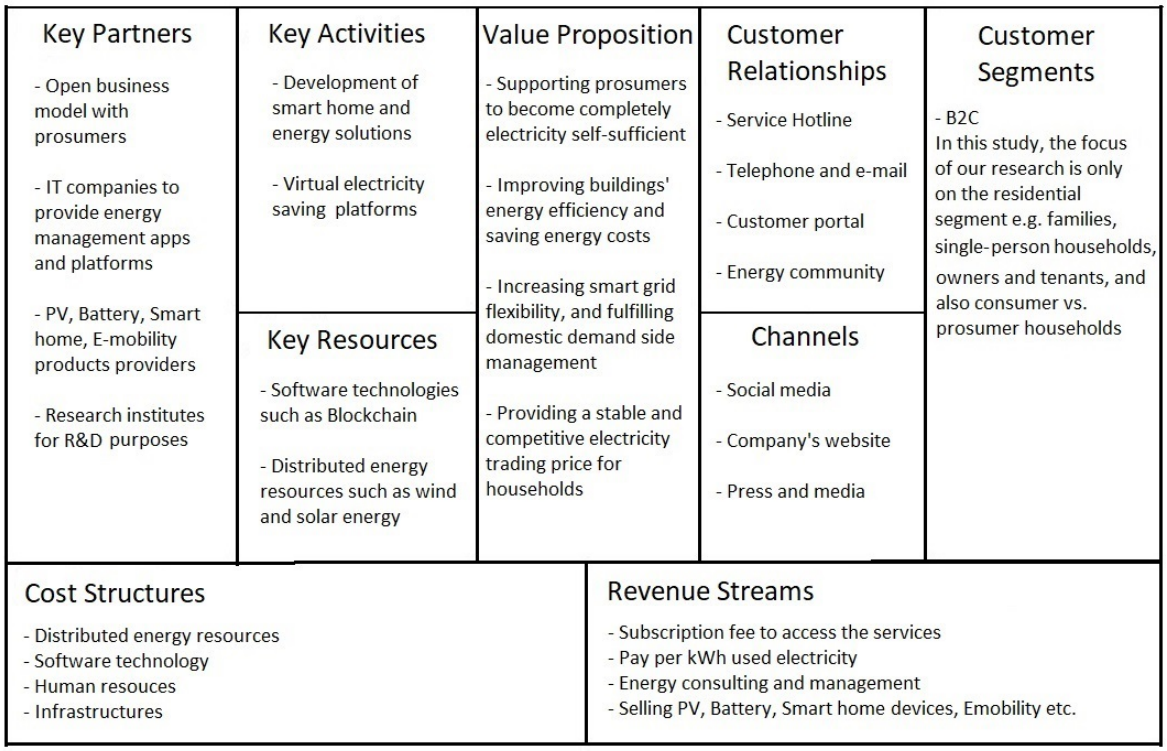

Figure 2. A potential business model for the retailers according to the business model canvas.

6 Implications and limitations of the study

6.1 Implications for social science and research

It can be implicated that business model innovation is able to take pressure off the need for (smart) grid expansion and thereby prevent extra costs. For instance, a virtual battery storage pool can absorb or deliver excess power when it is needed and reduce smart grid developments, especially when there are bottlenecks. Nevertheless, domestic energy storage systems and distributed energy resources can be integrated in order to improve energy efficiency and the grid's flexibility. This can also be done by the implementation of smart meters and energy management apps. Thus, households can get information about their actual energy consumption and be enabled to avoid consuming expensive electricity during peak hours. Consequently, grid overloading can be avoided and more flexibility can be added to the system.

In order to promote the sustainable energy transition, households should shift from being relatively uniformed energy consumers into producers of household energy (services), e.g. from renewable energy sources, or so-called 'prosumers' [49]. This can happen faster with the support and realization of the digitalization process. Consequently, households may redefine their needs and change their behavior, aiming to become more electricity self-sufficient and use less and less grid electricity from their suppliers. Moreover, smart home and smart energy solutions have to be used more in order to improve the energy efficiency of buildings and make them more climate-friendly. Furthermore, government policy-makers need to concentrate more on households' energy consumption and behavior, and pave the way for digital solutions enabling a more sustainable and efficient use of energy on the demand side. Therefore, energy efficiency can be raised and the impact of retail customers on the climate and on energy import dependence reduced.

Another implication of this study would be that CO_2 emissions could decrease significantly if private customers pay more attention to the source of the electricity they use and switch from traditional energy providers to renewable energy suppliers. This would not only have a positive impact on the environment including climate change, but will also strengthen countries' economic growth. For instance, Inglesi-Lotz [50] estimated that a 1% rise in renewable energy utilization will lead to a growth in GDP by 0.1% (and GDP per capita by 0.1%).

6.2 Implications for practice

Companies' policy-makers need to innovate on their business models and exploit new digital solutions in their portfolio in order to accelerate the sustainable energy transition. Several patterns can support them to promote the Energiewende. Extending business through cross-selling, innovating around the existing patterns, digitalization, and implementing new technologies in the business model have to be coordinated in a way that lead to an increase in the efficiency of household's energy use.

The results also have suggestions for government policy-makers. Since business model innovation is highly subject to the regulatory framework, politics is able to make a solid effect on sustainable business model development. For instance, new regulation ought to encourage electricity suppliers to offer new services such as energy management apps, energy optimization as well as e-mobility solutions to their residential customers. Moreover, they need to pay more attention to the start-ups and support them in order to increase the market competition and prevent forming a monopoly by incumbents and other large companies.

6.3 Limitations and future research

Due to the fact that the case studies were selected across Europe, the possibility of interviewing representatives of all of them was not available. The secondary data were mainly gathered from the company's website. Nevertheless, all the information published on their websites and brochures are for informing the customers and stakeholders. As a result, the secondary data is still valid and reasonably accurate.

Since the Energiewende is in progress and requires more research in the field of business model innovation, future research could relate to the business models for the prosumers' households, energy-sharing platforms, and market designs for enabling peer-to-peer (P2P) business models.

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