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Entrepreneurship & Innovation

New Business Models for Electric Utilities

A Master's Thesis submitted for the degree of
"Master of Business Administration"

supervised by
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Affidavit

I, **GÜNTER REISE**, hereby declare

1. that I am the sole author of the present Master's Thesis, "NEW BUSINESS MODELS FOR ELECTRIC UTITILITIES", 100 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

Vienna, 25.06.2017

Signature

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete."
R. BUCKMINSTER FULLER (1895-1983)

Abstract

Inspiring and driving innovation is a principal task of companies and management and an entrepreneurial mindset and the capabilities to innovate are traits to promote in the corporate culture. Business Model Innovation is understood as one of the significant components for the success of a company and is therefore of exceptional importance for businesses. Just as established companies in other industries, electric utilities, i.e., companies that are active in the field of electricity generation and sale of electricity to customers, struggle to innovate their still profitable Business Model, whose future potential is questioned by technological, social, and regulatory changes.

This Thesis gives an overview of the definitions for the concept of Business Models that is used in a variety of disciplines, such as economics, business management, strategy, and technology. The typical elements of a Business Model are presented and the differences to Business Strategy are explained. Then, reasons for and opportunities created by Business Model Innovation are presented, followed by a systematic approach to the process of Business Model Innovation. After discussing current technological and social trends as well as regulatory changes influencing the business environment of electric utilities, their traditional Business Model is explained and new Business Models are elaborated based on the presented process of Business Model Innovation and well-known Business Model patterns used in other industries.

Acknowledgments

I would like to thank the people who made the last two of this MBA program an amazing and unforgettable experience. I am grateful to all my colleagues and lecturers at the University for the time we spent together in class and for the insightful discussions and collaboration on common assignments and projects. It was a truly amicable and enriching environment that helped me not only to grow my knowledge but also build new friendships. Prof. Gruber deserves particular attention for agreeing to act as a supervisor for my Thesis. Last, but far from least, I would like to express my deep gratitude to my family and my fiancé Birke for their encouragement and support throughout the last two years.

Contents

1

Introduction

Humanity's energy needs are covered by a Total Primary Energy Supply (TPES) of around 573.5 exajoule (EJ)[1] per year in 2014 with an average annual growth of around 1.8 % since 2011 [International Energy Agency (IEA), 2016b, p. 6]. The largest part of 81.1 % of this energy is supplied through coal, oil, and natural gas. Biofuels have a share of 10.3 %, nuclear power a share of 4.8 %, and hydropower a share of 2.4 %. Other sources such as geothermal, solar, wind, heat, etc. make up for only 1.4 % of the primary energy supply (see Figure 1.1). The world's Total Final Consumption (TFC), the fraction of the world's primary energy that is used by humanity in its final form, amounts to 394.6 EJ per year in 2014 [International Energy Agency (IEA), 2016b, p. 30].

Electricity generation amounts to around 15 % of the TPES, i.e., 85.7 EJ or 23,816 TWh per year [International Energy Agency (IEA), 2016b, p. 24] with an average annual growth of around 1.9 %. The world's electricity consumption amounts to 71.4 EJ or 18.1 % of the TFC. Coal with 40.8 % and natural gas with 21.6 % are the main fuels used for generation of electricity, followed by hydropower with 16.4 %, nuclear power with 10.6 %, and oil with 4.3 %. Geothermal, solar, wind, and tidal energy amount for 4.2 % while biofuels and waste contribute 2.1 % to electricity production (see Figure 1.2) [International Energy Agency (IEA), 2016a].

[1] 1 EJ (exajoule) equals 10^{18} J (joule); 1 EJ = 23.88 Mtoe (megatons of oil equivalent)

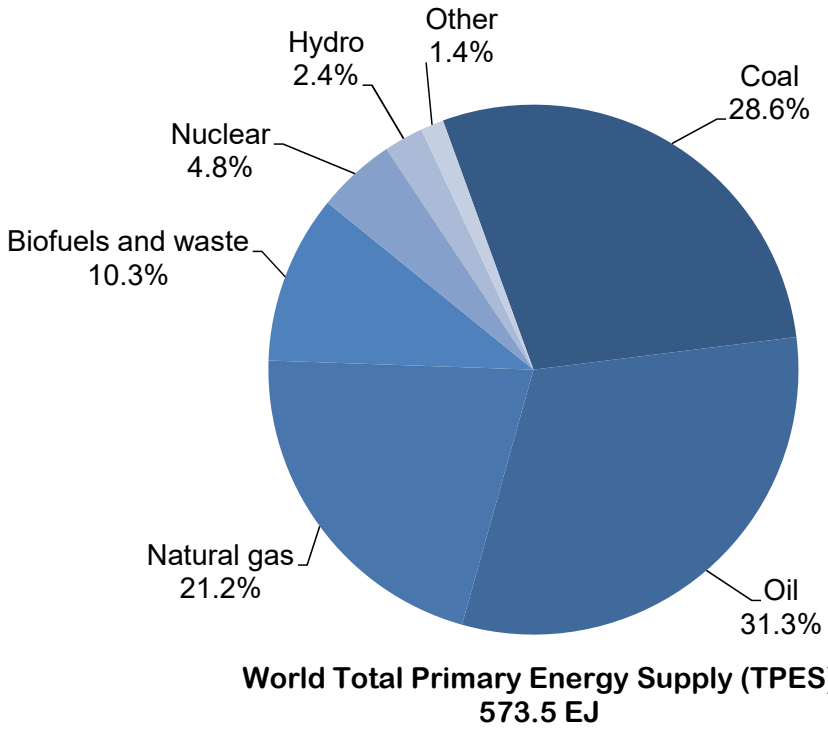

Figure 1.1: World Total Primary Energy Supply (TPES) by source, 2014; own drawing based on figures from [International Energy Agency (IEA), 2016b, p. 6]

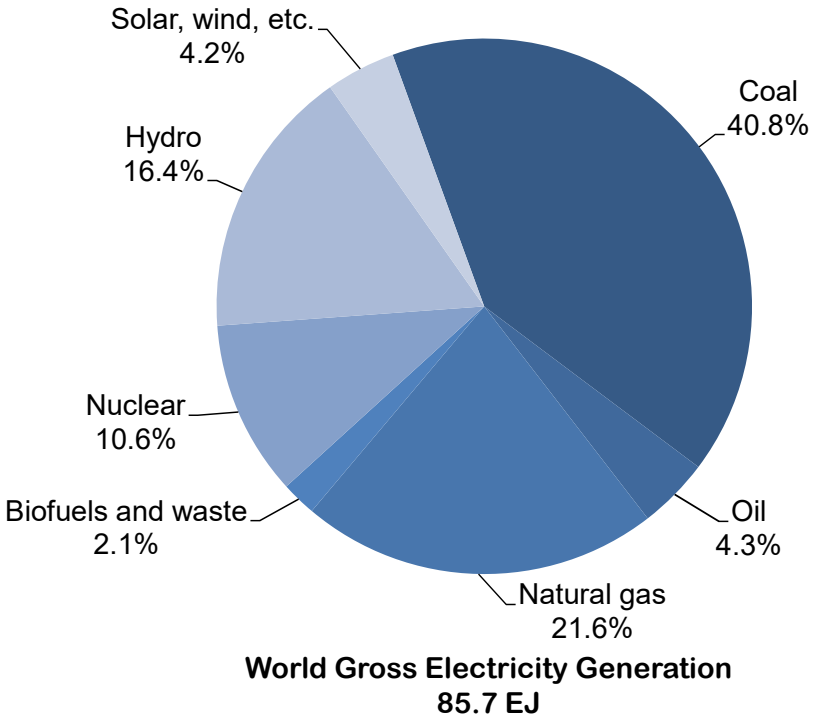

Figure 1.2: World gross electricity generation by source, 2014; own drawing based on figures from [International Energy Agency (IEA), 2016a, p. 3]

The figures show that the largest part of the world's energy needs is supplied by fossil fuels, also for energy in the form of electricity. Climate change caused by the human emission of greehouse gasses (GHGs) drives the world to save energy through raising efficiency and to pursue an energy transition from fossil fuels to Renewable Energy Sources (RESs). The global energy transition, emerging new technologies, and changing customer requirements create a significant challenge to the Business Model of utilities and capabilities for Business Model Innovation will be essential to master the changeover [Richter, 2013]. Nowadays for many industries more customer centricity is required as customers have more choices, manifold customer needs can find expression, and also alternatives for supply are more transparent. All these developments require businesses to re-evaluate the value propositions they propose to customers [Teece, 2010].

The current business of electric utilities, i.e., companies that are active in the terrain of generation and sale of electricity to private and commercial customers, relies on the volumetric sale of electricity to consumers [Gsodam et al., 2015]. Steady or increased volumes and hence sales are required in order to provide the revenue growth used historically to fund new investments. But this is not happening. Instead, energy consumption is reduced and electricity prices are going down as a result of competition and cheap prices for coal, natural gas, and oil [Konstantin, 2013].

On the one hand the traditional Business Model of electric utilities is getting challenged and puts them under pressure. Price volatility and demand fluctuations lead to declining Return on Invested Capital (RIOC) for large incumbent players, mostly driven by lower operating profits. On the other hand profits for the industry as a whole increased at a rate of 2.7 % per year between 2009 and 2014. A slowing demand growth in developed markets and a shift to renewable generation leads to a larger share of industry profits now being captured by those market players engaged in renewable generation and distribution, a trend that is expected to continue. New technologies for RESs – especially solar and wind power – enable non-traditional entrants to enter the markets challenging incumbents backed by billion USD investments. Investment into emerging technologies by both new entrants and incumbents and the unbundling of services across the entire value chain will most likely result in a major shift of value over the coming decade [World Economic Forum, 2016, p. 8].

For managers, the choices of how to design their business increased substantially based on availability and affordability of Information and Communication Technologies (ICTs), leading to fad-

ing and dissolving industry boundaries [Osterwalder et al., 2005]. Without well-developed Business Models, innovators – both disruptors or incumbents – will fail to capture value from their innovations. With technology evolving faster and faster and changing markets the innovation of Business Models becomes more and more important and is at least as important as the new technology itself for the acceptance of new technologies [Teece, 2010] [Osterwalder et al., 2005].

As a result, the interest in the concept of Business Models and Business Model Innovations has been steadily increasing in the recent years since these concepts provide solutions to changing market environments, new technologies, and changing customer requirements. Electric utilities and system operators must maintain stability of the electricity system while integrating ever increasing amounts of variable and distributed RESs and retiring coal and – in some countries – nuclear generation. The business of electric utilities is changing. In order to stay relevant, companies must remain observant to changes and work out new ways to address them [Johnson, 2010, p. 55]. Their goal must be to disrupt themselves before being disrupted by others. Innovation in general and Business Model Innovations in particular light the way to changing the way of a company's or even an entire industry's business. Experiences from other industries that have undergone this disruption are available to assist managers of electric utilities in this process [Richter, 2013] [Duncan, 2010] [Frei, 2008].

This thesis will be structured as follows. After the motivational introduction above, I will give an overview of the concept of Business Models in Chapter 2 as discussed in literature and introduce a definition that will be used throughout this Thesis. In Chapter 3, I will discuss the importance of Business Model Innovation and present its objectives followed by a systematic approach, the Business Model Innovation process, that can be used for innovating existing and creating new Business Models. Chapter 4 discusses current trends that have great influence on society in general and the business environment of electric utilities in particular. The Business Model Innovation process will subsequently be applied in Chapter 5 for electric utilities, reflecting on the traditional Business Model, presenting improvements to this model, and elaborate new approaches to creating value in the electricity sector. Chapter 6 will summarize the important aspects and results of this Thesis and provide ideas and suggestions for further research.

2

Business Models

The concept of Business Models is used in a variety of disciplines, such as economics, business management, strategy, and technology. It is understood as one of the important components for the success of a company and is therefore of exceptional importance for businesses. The term Business Model rose to prominence in the end of the 1990 with the advent of businesses based on the Internet and Information and Communications Technology (ICT) and was from then onwards mostly used in this context [Osterwalder et al., 2005]. Since then, its importance rose with the substantial increase in business design choices that comes hand in hand with the availability of cheap ICT. Despite its wide use the concept lacks a unique definition and all of above mentioned fields have a different understanding of the nature of Business Models and hence use their own definition of the term [Chesbrough, 2007]. Magretta ranks the term "Business Model" – together with "strategy" – among the sloppiest terms used in business [Magretta, 2002] and for Porter the available definitions are "murky at best" [Porter, 2001]. Therefore, to lay a basis for further discussions in the next chapters about Business Model Innovation, I will continue in the next Section with an overview of definitions of Business Models that can be found in the literature.

2.1 Definitions of Business Models

The term of Business Model is used in different contexts by different people. First, Business Models are mentioned as examples of real companies. The Business Models – or at least the larger part of it – of companies such as Amazon, Google, and Dell are often referenced describing how they conduct their businesses and especially what they did differently to successfully differentiate from their competitors. Second, Business Models of real companies that essentially resemble each other are abstracted and classified into archetypes of Business Models. Amazon and Zappos.com, for example, use the bait-and-hook (or razor-and-blade)[1], the pay-per-use[2], or the freemium[3] Business Model. The mentioned examples and further archetypes are described in detail in the books of Osterwalder and Pigneur and Gassmann et al. [Osterwalder and Pigneur, 2010] [Gassmann et al., 2014]. However, the classification of Business Models into actual archetypes depends on the literature used. Third, the archetypes of Business Models can be further generalized into an abstract concept. Some concepts only give an idea of the nature of a Business Model [Magretta, 2002, Drucker, 1994] while others provide meta-models for Business Models [Drucker, 1994] [Chesbrough and Rosenbloom, 2002] [Osterwalder and Pigneur, 2010] [Gassmann et al., 2014]. These meta-models describe patterns and essential elements to be found in a Business Models and can be applied as tools to analyze businesses, to innovate Business Models, and to motivate change in an organization. Hence, the meaning of the term Business Model is ambiguous. Which level of detail or generalization is meant and applied has to be explicitly described or to be understood from the context. This matches with the concept hierarchy for Business Models presented by Osterwalder et al. [Osterwalder et al., 2005]. As mentioned above, a common conceptual base for Business Models is missing. There are various definitions of the Business Model term, some of which are summarized in Table 2.1. For more comprehensive lists of definitions, refer to [Baden-Fuller and Morgan, 2010] and [Al-Debei and Avison, 2010].

[1]The bait-and-hook Business Model sells dependent products for different prices. One is offered at a low price – even below cost – while the other product that is required for the use of the first product is high-priced and responsible for the generation of revenues [Gassmann et al., 2014, p. 261] [Osterwalder and Pigneur, 2010, p. 88]. Ink-jet printers and corresponding ink are an example for this Business Model.

[2]In the pay-per-use Business Model, customers instead of a fixed rate pay for the actual usage of the product or service [Gassmann et al., 2014]. Pay-per-view television is an example for this Business Model.

[3]As the term freemium itself is a mixture of free and premium, the Business Model is a combination of a free and a premium offer. The free offer serves to establish a large customer base while the revenues are created from the premium offer that only a fraction of the large customer base will use [Gassmann et al., 2014]. The streaming service Spotify® is an example for this Business Model.

Author(s), Year	**Definition**
Amit and Zott, 2001	A Business Model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities.
Magretta, 2002	Business models [...] are, at heart, stories – stories that explain how enterprises work.
Seddon and Lewis, 2003	A Business Model is an abstract representation of some aspect of a firm's strategy; it outlines the essential details one needs to know to understand how a firm can successfully deliver value to its customers.
Osterwalder, 2004	A Business Model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams.
Osterwalder et al., 2005	A Business Model is a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm.
Casadesus-Mansell and Ricart, 2010	A Business Model [...] is a reflection of the firm's realized strategy.
Johnson, 2010	A Business Model defines the way the company delivers value to a set of customers.
Osterwalder and Pigneur, 2010	A Business Model describes the rationale of how an organization creates, delivers, and captures value.
Teece, 2010	A Business Model defines how the enterprise creates and delivers value to customers, and then converts payments received to profits.
Gassmann et al., 2014	A Business Model provides a holistic picture of how a company creates and captures value by defining the Who, the What, the How and the Why of a business.

Table 2.1: Selected Business Model Definitions (in chronological order)

Throughout this Thesis, the following definition for the term Business Model will be used [Osterwalder and Pigneur, 2010, p. 14]:

"A Business Model describes the rationale of how an organization creates, delivers, and captures value."

Another significant aspect is the difference between Business Models and strategy. Again, the difference is not really clear and the opinions about this issue differ widely [Osterwalder et al., 2005]. Business models are often confused with strategy; sometimes the two terms are even used interchangeably [Magretta, 2002]. Some might even argue that the terms are substantially the same, with nuances of difference [Seddon and Lewis, 2003]. Grant defines strategy as "a unifying theme that gives coherence and direction to the actions and decisions of an individual or an organization" [Grant, 2010]. Based on this definition and the definition for a Business Model above, one might be inclined to agree that the two terms are barely different. In Teece's opinion "a Business Model is more generic than a business strategy" [Teece, 2010]. For Margretta a Business Model describes "how the pieces of a business fit together" but ignores competition as one critical dimension of performance. A Business Model therefore has to be supplemented by a competitive strategy that determines how to achieve superior performance compared to competitors by being unique [Magretta, 2002]. However, Margretta's opinion depends on the elements considered part of a Business Model. For Chesbrough, for instance, competitive strategy is part of the Business Model [Chesbrough, 2007]. Chesbrough and Rosenbloom argue that the emphasis on capturing a part of the value created for the company is stronger in the realm of strategy. Also, in their opinion, strategy is based on mindful, analytic calculations and decisions based on the available reliable information while Business Models intentionally assume limited availability of information. Finally, they state that Business Models emphasize value creation for the business but leave out the financial domain and the value creation for the shareholders [Chesbrough and Rosenbloom, 2002]. Casadesus-Mansell and Ricart noted the missing clear distinction between the notations of strategy and Business Model. In their opinion the strategy, inter alia, comprises the choice of the Business Model that a company will use to compete in the market while Business Model "refers to the logic of the firm, the way it operates and how it creates value for its stakeholders". Ad-

ditionally, they define tactics as the remaining choices open to a company based on the Business Model it chose to employ [Casadesus-Masanell and Ricart, 2010]. Seddon sees a Business Model as an abstraction and generalization of a company's strategy and argues that for the sake of strategy design combinations of Business Models might be used [Seddon and Lewis, 2003]. For Osterwalder a company's strategy is translated into a Business Model as the blueprint of the company's rationale of "how an organization creates, delivers, and captures value" [Osterwalder, 2004].

It can be seen that there is no common understanding of the relation between strategy and Business Models which might be based on the still open agreed definition of Business Models and their nature. I don't support Teece's opinion of a Business Model being more generic than a strategy. Instead, I support the views of Casadesus-Mansell and Ricart, Osterwalder, and Seddon and Lewis, with regards to Business Models being an intermediary between the company's strategy and business processes. Hence, a company's strategy defines its Business Model. The tactics – as described by Casadesus-Mansell and Ricard – are then the multitude of options available for the implementation of business processes.

Now that we have developed an understanding of the definition of a Business Model, I will continue to describe the elements that form part of a Business Model.

2.2 Elements of a Business Model

Various Business Model concepts can be found in the literature with different numbers and types of elements. For Drucker a Business Model (or, as he called it, a theory of the business) consists of assumptions about the environment (e.g., technology, market, customers, society), about the specific mission (i.e., about reasonable results), and about core competencies needed to achieve the company's mission [Drucker, 1994]. Chesbrough presents six elements of a Business Model, which are value proposition, target market (i.e., market segment), value chain, revenue mechanism, value network (or ecosystem), and competitive strategy [Chesbrough, 2007] [Chesbrough and Rosenbloom, 2002]. Johnson specifies four interdependent elements for the basic architecture of a Business Model: customer value proposition, profit formula, key resources, and key processes [Johnson, 2010, p. 24]. For Gassmann et al. the elements of a Business Model are the customer, the value proposition, the value chain, and the profit mechanism [Gassmann et al., 2014].

It can be seen how over time the concepts evolved into nowadays widely used concepts of the Business Model Canvas [Osterwalder and Pigneur, 2010, p. 12] and The Business Model Navigator™ [Gassmann et al., 2014]. The two concepts are not necessarily better but they are presented as frameworks supplemented by easy-to-use tools that are additionally easy on the eyes for practitioners in the field of Business Model Innovation. In the remainder of this Thesis I – as a basis for further discussion – will use the concept of the Business Model Canvas – a tool to describe, analyze and design Business Models – and its elements of a Business Model [Osterwalder and Pigneur, 2010, p. 16]. Hence, the following sub-sections describe the elements of a Business Model as described by Osterwalder at al. and will blend in the Business Model concepts and elements from other sources to underpin their consistency and overlaps.

2.2.1 Value Propositions

The value proposition defines a product, a service, or a combination thereof and describes how the company caters for the needs of its target customers. It defines how a company creates value for a customer segment at a given price by helping them to solve an important problem or satisfy a need more effectively, conveniently, or affordably than any existing solution [Osterwalder and Pigneur, 2010, p. 12] [Gassmann et al., 2014, p. 6] [Johnson, 2010, p. 26] [Chesbrough and Rosenbloom, 2002] [Chesbrough, 2007] [Richter, 2013]. A company can obviously have several value propositions that target at different customer segments and different customer needs. However, a powerful value proposition is a keystone of a successful Business Model and should identify an important and unsatisfied problem and propose a focused solution at a given price, where the experiences of purchasing, using, and maintaining form an integral part of the value proposition [Johnson, 2010, p. 26]. In designing the value proposition sound understanding of the target customers and effort to define the solution to their unsatisfied needs are required. The actual value – and price as a key quantifier for value – of the value proposition depends on the importance of the solved problem for the customers, the satisfaction with other current solutions and how well the offering satisfies the need relative to other options [Teece, 2010]. A powerful value proposition can, for example, satisfy a customer need, create a customer need, improve product or service performance, or offer tailor-made solutions to customers. Value for customers can furthermore be created by helping them to reduce their costs

and risks, by more easily and conveniently accessible and usable products and services, by offering a more appealing design, or simply by offering a better price [Osterwalder and Pigneur, 2010, p. 24].

2.2.2 Customer Segments

Customers are the recipients of the value proposition. They are always – without exception – at the heart of any Business Model as they are required for a successful business [Osterwalder and Pigneur, 2010, p. 20] [Gassmann et al., 2014]. The customer segments element of the Business Model answers the fundamental questions posed by Peter Drucker: "Who is the customer? And what does the customer value?" [Drucker, 1954]. Knowledge about customers and their behaviour is of importance as missing knowledge and faulty assumptions can cause complete failure of Business Models [Magretta, 2002]. Customers differ in their needs, behaviours and other attributes. Consequently, as it is in general not possible to serve all customers in their own way, customers with the same attributes are grouped into customer segments. Customer segments may for instance differ in the offer required for them, the distribution channels to be used to reach them, the types of relationships they require, the profitability, and their willingness to pay for different aspects of the offer [Osterwalder and Pigneur, 2010, p. 20]. In the Business Model, the relevant customer segments for a company are described and it is differenciated between segments that will and won't be served by a value proposition of the Business Model [Chesbrough, 2007] [Chesbrough and Rosenbloom, 2002].

2.2.3 Channels

Channels are the touch point between the company and its customers and plays a crucial role in the customer experience. The channels element of the Business Model describes how customers are made aware of the company's offerings, how the customer is assisted in evaluating the value propositions, how customers can purchase and acquire the value propositions, how the latter are delivered to the different customer segments, and how after-sales support is provided to the customers. Channels can be divided into different types depending on their ownership and their directness. Channels can be owned by a company itself, by a partner, or be a mix of both. Channels can moreover be direct, like the company's website, or indirect, like retail stores of the company or distribution partners [Osterwalder and Pigneur, 2010, p. 26] [Gassmann et al., 2014, p. 6].

2.2.4 Customer Relationships

The customer relationship element of the Business Model describes the interaction between the company and its (potential) customer segments. Acquisition of new customers and retention of current customers are of vital importance for a company. However, different customers segments potentially require different ways of contact with them. The type of relation can be manifold, from personal relations in a retail store to a completely automated web-shop [Osterwalder and Pigneur, 2010, p. 28]. The type used for a customer segment depends on the expectations of the customers and is often influenced by cost decisions.

2.2.5 Key Resources

Out of all resources required by a business in its value chain, key resources are the critical bottleneck assets that the company uses to create and deliver value for customers and itself in a repeatable and scalable manner [Johnson, 2010, p. 39] [Teece, 2010] [Gassmann et al., 2014, p. 7]. Osterwalder and Pigneur group key resources into four categories, namely physical, intellectual, human and financial resources. Physical key resources comprise for instance equipment, facilities, and distribution networks. Intellectual key resources include technology knowledge, intellectual property, patents, copyrights, customer databases and brands. Unique people for the company's business – especially in knowledge-intensive and creative industries – are part of the human key resources. Cash, lines of credit and other monetary funds are financial key resources [Osterwalder and Pigneur, 2010, p. 35]. It is not required to own key resources, they can also be leased or acquired from key partners (cf. Section 2.2.7). However, given the importance of these resources, a company must ensure continuous access to them to not jeopardize its business. Hence, assets that cannot be easily substituted within a reasonable time should rather be owned by the company while easily replaceable assets can rather be acquired from outside.

2.2.6 Key Activities

Out of all processes employed to run the business, key activities are the critical actions and ways of working that the company uses to create, offer, and deliver value for customers and itself in a scalable, repeatable and manageable fashion [Johnson, 2010, p. 39]. Depending on the industry and Business Model, key activities will be different. For example, a car manufacturer's key activities comprise design, manufacturing, and supply chain management. For a parcel service key activities include delivery and distribution of goods while for a consulting company knowledge management and training are key activities.

2.2.7 Key Partnerships

Rarely does a company own all resources or can a company perform all activities in-house that are part of the value chain. It has to rely on partnerships, i.e., a network of companies to make the Business Model work. Partnerships can be simple buyer-supplier relations to acquire particular missing resources and activities and thus reduce costs or it can be a joint venture or a strategic alliance between companies with the goal to reduce risk and uncertainty in a competitive environment [Osterwalder and Pigneur, 2010, p. 38] [Chesbrough, 2007] [Chesbrough and Rosenbloom, 2002] [Gassmann et al., 2014, p. 7].

2.2.8 Cost Structure

The cost structure element of the Business Model characterizes the cost incurred when producing the offering with a given value proposition and value chain structure [Chesbrough and Rosenbloom, 2002] [Osterwalder and Pigneur, 2010, p. 40]. It is also seen as a part of the profit mechanism [Gassmann et al., 2014, p. 7] or profit formula [Johnson, 2010, p. 36] and is simply made up of direct, indirect, fixed and variable cost, taking into account economies of scale and economies of scope [Osterwalder and Pigneur, 2010, p. 41]. The cost structure is important for any business. However, not all companies are cost-driven to the same extent and have to minimize cost wherever possible. Companies that focus on value creation, such as companies selling luxury goods, follow a value-driven approach and are less concerned about cost [Osterwalder and Pigneur, 2010, p. 41].

2.2.9 Revenue Streams

The revenue streams element of the Business Model describes how the company captures a portion of the value created in the form of income for the company and its shareholders [Chesbrough and Rosenbloom, 2002]. Cost structure and revenue streams together outline what makes the Business Model financially viable and determine the operating profit [Gassmann et al., 2014, p. 7]. It is also seen as a part of the profit mechanism [Gassmann et al., 2014] or profit formula [Johnson, 2010, p. 36]. The revenue streams for each segment are built up by the offering price times the quantity sold. The former is closely related to the value proposition while the latter depends on the number of customers, the units per customer per transaction, and the number of transactions per customer [Johnson, 2010, p. 34]. Moreover, offering price and quantity sold are certainly interdependent and it is important to know the price a customer segment is willing to pay for a certain value [Osterwalder and Pigneur, 2010, p. 31]. A company can have one or more revenue streams with different pricing mechanisms for each customer segment, where prices can be fixed or dynamic, i.e., based on prevailing market conditions. Revenue streams can stem from one-time or recurring customer payments and might be generated by selling, lending, renting, or leasing of a physical product, by charging for the usage of or the access to a product or service, or by licensing intellectual property [Osterwalder and Pigneur, 2010, p. 33].

2.3 Business Model Canvas

The nine elements described in Section 2.2 form the basis for a Business Model. However, the whole is greater than the sum of its parts and often the strength of a Business Model lies in the interaction between its elements. The Business Model Canvas by Osterwalder and Pigneur shown in Figure 2.1 illustrates the nine elements and their connections and is a powerful tool to describe, analyze and design Business Models [Osterwalder and Pigneur, 2010, p. 16]. The tool helps to visualize and discuss the elements of a Business Model and their complex interdependencies [Johnson, 2010]. Changes in one element affect all other elements and the Business Model as a whole.

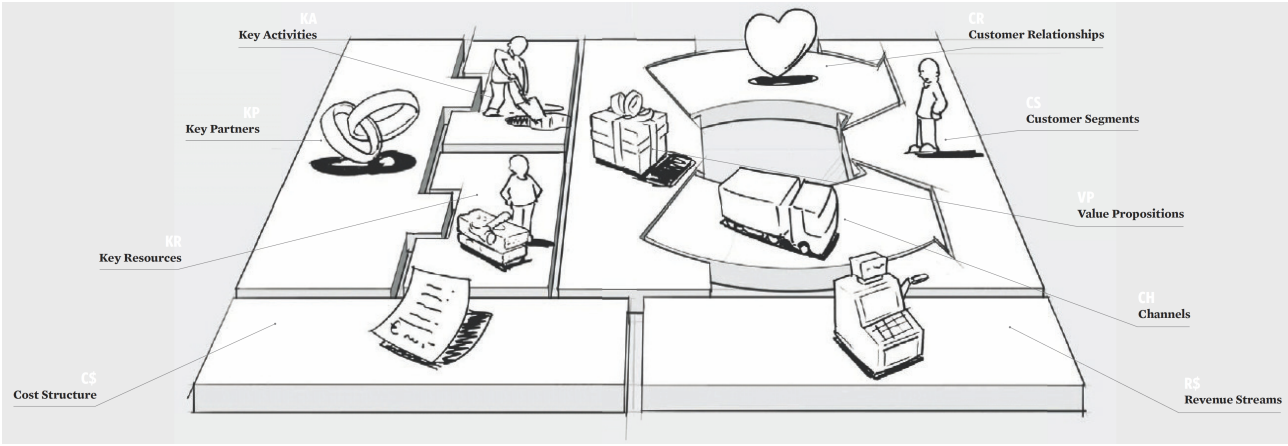

Figure 2.1: The Business Model Canvas including nine building blocks of a Business Model [Osterwalder and Pigneur, 2010, p. 18]

3

Business Model Innovation

Innovation is and has always been crucial in driving growth and competitiveness of a business. Over time, the rules of the game change in all of the industries. It is only a matter of time when a specific industry will experience changes of the underlying business environment and will be forced to react by changing the business logic applied.

Over the life cycle of a product, the basis of competition is shifted predictably, as depicted in Figure 3.1. Each shift emphasizes a different kind of innovation, namely product innovation, process innovation, or Business Model Innovation. At an early stage of the market development competition for customers is typically on the basis of functionality and performance. Customers pay a premium for product properties and functions that fulfill their needs better which is why companies work on Product Innovation to develop and produce products that satisfy customers' requirements. Shifting customer demands and new requirements can be successfully addressed by continuing innovations, i.e., new products, services, or features, that fit within the existing Business Model. In a further step, when product performance satisfies customers' expectations but are only a necessary requirement for customers but not sufficient to induce them to buy, the basis of competition shifts from performance to reliability. Customers request higher quality and reliability of the product, which is achieved by Process Innovation. Companies improve all the processes along the value chain with a special emphasis on quality assurance and control. When product performance and reliability requirements of customers are met, the basis of competition again shifts. Either to convenience and customization, where

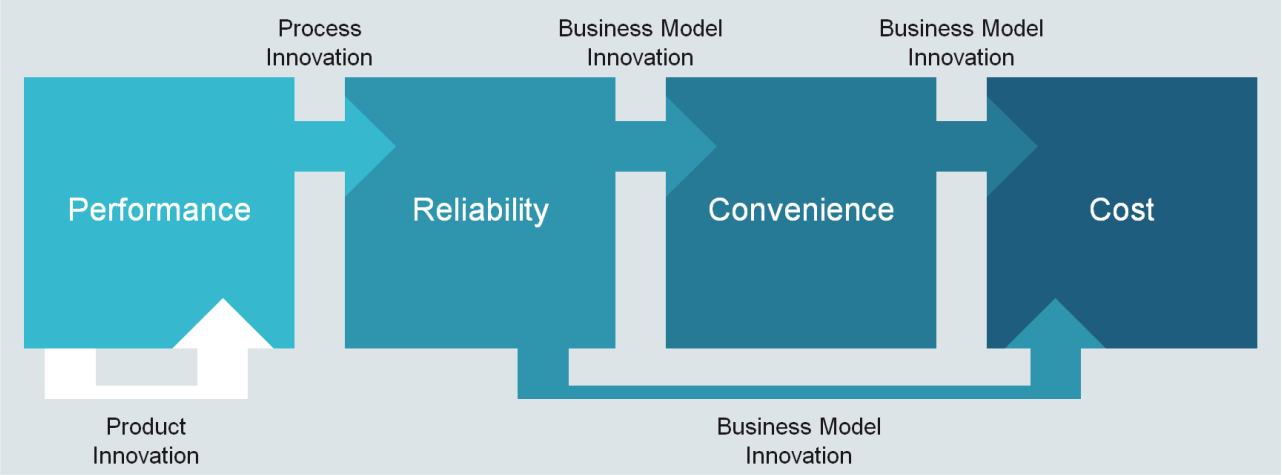

Figure 3.1: Shift in the basis of competition (own drawing based on [Johnson, 2010, p. 57])

customers demand solutions tailored to their specific individual needs, or directly to cost, crossing the competitive threshold to a fully commoditized stage where competition takes effect almost only on price. These challenges are to be faced by means of Business Model Innovation, which differs from product or process innovation in that it significantly affects at least two of the four components of the business model [Gassmann et al., 2014, p. 9].

3.1 Objectives for Business Model Innovation

The need for Business Model Innovation can be motivated by different reasons. Every company starts its Business Model Innovation from a different point, with its own context, and with its own goals. A start-up will, for instance, approach Business Model Innovation differently than a company planning to launch a new product or technology, or a company in a crisis situation. A few objectives that result in the need for Business Model Innovation will be described in the following.

3.1.1 Transforming Existing Markets

Transforming existing markets deals with transforming existing or developing new business models in support of value propositions aimed at current customers [Osterwalder and Pigneur, 2010, p. 244]. In the life-cycle of a product, as described above, customer's expectations on the product or service change radically when the basis of competition shifts to customization and convenience or directly to cost. With these expectations also the value proposition changes and the business model as a whole

is getting challenged. At this stage, business model innovation is required to adjust and redefine the elements of the business model (cf. Chapter 2) to meet changing customer expectations and to achieve transformational growth or renewal within existing markets [Johnson, 2010, p. 55].

3.1.2 Creating New Markets

Creating new markets deals with developing new business models in support of value propositions aimed at potential customers who are currently non-customers [Osterwalder and Pigneur, 2010, p. 244] [Markides, 2013]. There are different reasons for them not being customers, the four major barriers to consumption being wealth, skills, access, and time. The offering might be too expensive, it might be too complicated, customers might not have access to it, or they don't have the time to consume it [Anthony, 2008, p. 48]. New markets for a company can be opened up by developing value propositions that break through those barriers of consumption. Thereby the company's products and services are getting democratized, that means they are made accessible to large groups of potential consumers who have been blocked out of a market [Johnson, 2010, p. 75].

3.1.3 Using Opportunities caused by Industry Discontinuity

In contrast to the predictable and identifiable influences on a company's business, there are revolutionary, almost unpredictable forces that create massive industry disruption but also lay the ground for new opportunities [Osterwalder and Pigneur, 2010, p. 244]. Such radical changes could be tackled by sole adaption of the business model, but Business Model Innovation can be key to creating new opportunities well-suited to the radically changed business environment [Johnson, 2010, p. 51]. Among the many forces that can cause disruptive industry changes are radical and unpredictable shifts in market demand, development of revolutionary enabling technologies, or shifts in government policy and regulations affecting the business environment. Combinations of these forces require companies to radically change their business models [Johnson, 2010, p. 91].

3.2 Business Model Innovation Process

Every project for designing a new Business Model is unique and motivated by different reasons. However, despite of different challenges, obstacles and success factors, it is possible to use a managed, systematic approach to innovating Business Models leveraging the creative potential of the organization [Osterwalder and Pigneur, 2010, p. 244]. Literature presents various systematic approaches to Business Model Innovation. Again, as for the definition of Business Models presented in Chapter 2, there is no process agreed between the authors. However, their presented approaches don't contradict, show consent in the major steps and differ only in minor points and in terminology. In the following, I will present the Business Model Navigator™ [Gassmann et al., 2014, p. 20] and blend in other popular systematic approaches to introducing a process for Business Model Innovation. For Gassmann et al., the process sketched in Figure 3.2 consists of two phases, which are the Design and the Implementation of a Business Model. For Osterwalder and Pigneur, the process consists of five phases which are essentially analogous to the model presented by Gassmann et al. [Osterwalder and Pigneur, 2010, p. 249]. Rather than a linear process of rigid execution, Business Model design and implementation is an iterative process involving testing hypotheses based on trial and error and applying lessons learned by feeding back one step's learnings into its predecessor to refine and improve the design of the Business Model [Johnson, 2010, p. 110]. Despite of the structured process, Business Model Innovation remains an unpredictable challenge that requires time, energy, and creativity.

3.2.1 Design of the Business Model

The design phase in the Business Model Innovation process, shown on the left side of Figure 3.2, consists of the three steps of Initiation, Ideation, and Integration which will be described in the following subsections. They comprise detailed tasks, from analysis of the business environment to the detailed description of the elements of the Business Model.

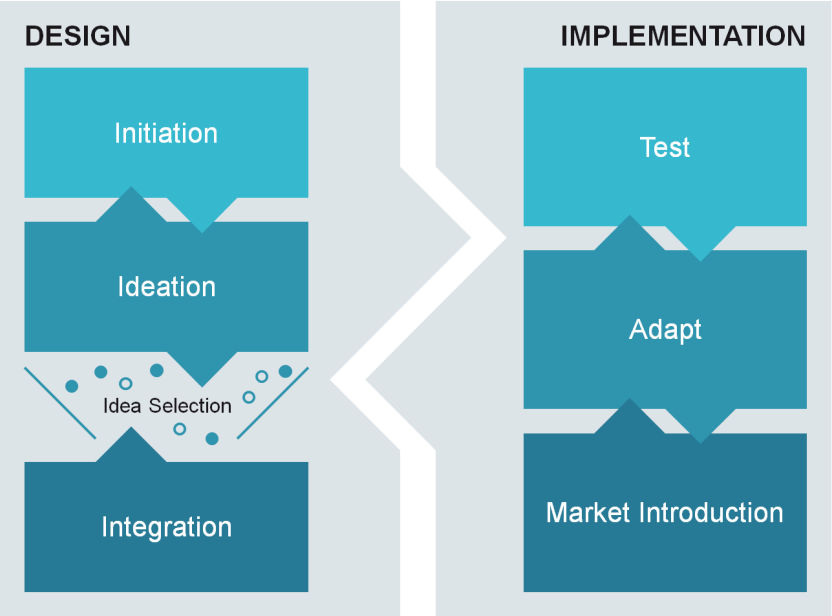

Figure 3.2: Business Model Innovation Process (own drawing based on [Gassmann et al., 2014, p. 21])

3.2.1.1 Initiation: Analyze the Business Environment

For Gassmann et al. the Business Model Innovation starts with the Initiation step in which the existing Business Model and the business environment are being analyzed in line with the nine elements of a Business Model described in Chapter 2. Osterwalder et al. call this step Immersion which follows a Mobilization step in which the objectives are set and the Business Model design team is established, motivated, and committed to the project [Osterwalder and Pigneur, 2010, p. 249]. A sound understanding of the existing Business Model, the industry logic, and the business environment including all stakeholders and influencing factors is not only the starting point for the further steps but also helps to identify weaknesses and inconsistencies that did not appear before [Gassmann et al., 2014, p. 26]. For Johnson, who describes the process for new business model creation only, this is also an important step but he sees the task of understanding the real customer's unfulfilled needs as a pre-phase to the actual design phase and not a part of it. When in search for those unfulfilled needs not only functional aspects but also social and emotional aspects have to be taken into account [Johnson, 2010, p. 110]. To develop a sound understanding of customers and their needs Osterwalder et al. suggest to use and present the Customer Insights technique [Osterwalder and Pigneur, 2010, p. 126].

In the analysis of the business environment a company should rely on a diverse group of people of industry insiders and outsiders to get a complete picture instead of only narrow, professionally

blinkered perceptions. By involving several people from the company itself at this early stage of the process, common understanding of the concept of Business Models and awareness for the need for Business Model Innovation can be created.

3.2.1.2 Ideation: Adapting Business Model Patterns

Radicalness of Business Models is relative as Business Model Innovations are often radical for a specific industry but not for the entire business world [Gassmann et al., 2014, p. 22]. For a new Business Model it is not necessary to reinvent the wheel. New Business Models for an industry can be created by reusing, adapting, and recombining archetypes of Business Models or existing Business Models in other industries [Baden-Fuller and Morgan, 2010] [Johnson, 2010, p. 130]. This is the objective of the Ideation step in the process presented by Gassmann et al. [Gassmann et al., 2014, p. 41] that Osterwalder et al. see as part of the design step [Osterwalder and Pigneur, 2010, p. 254]. However, the step is not about simply copying patterns but about gaining from the learnings and experiences of other companies and industries.

Osterwalder et al. present a creative technique to generate ideas [Osterwalder and Pigneur, 2010, p. 136]. Gassmann et al. propose two principles to systematically adapt patterns. First, the similarity principle departs from the own industry logic and gradually widens the radius to closely related industries and further to more dissimilar ones which are then adapted to the company's Business Model. This principle requires less abstract thinking and is more likely to lead to moderately radical Business Model Innovations [Gassmann et al., 2014, p. 43]. Second, the confrontation principle compares the company's Business Model with completely unrelated industries. The divergence between current and the alternative Business Model is meant to break typical patterns of thought to generate surprising and radical ideas for innovation [Gassmann et al., 2014, p. 45]. While the similarity principle moves from the inside – the current Business Model – to the outside – other Business Model patterns – the confrontation principle moves from the outside and advances to the inside.

From the extensive set of ideas generated by these systematic methodologies the most promising have to be selected for the next step in the process of Business Model Innovation, the integration into a new Business Model.

3.2.1.3 Integration: Shape the Business Model

The Ideation step results in ideas for a new Business Model that have to be cast and forged into a coherent Business Model in the Integration step [Gassmann et al., 2014, p. 53]. For Osterwalder et al. this step is, together with its predecessor, part of the design step [Osterwalder and Pigneur, 2010, p. 254]. Ideas to change one element of the model will usually affect one, more, or even all other elements of the model and will also influence the relations with stakeholders outside. Internal consistency between the elements of the Business Model and external consistency with the company's (changing) environment are imperative for a Business Model to work. Hence, the elements have to be adapted based on the selected ideas into a consistent, well-balanced system. If it is not possible to achieve this, it is necessary to go back to previous steps until a coherent system can be created [Gassmann et al., 2014, p. 53]. For completely new and sometimes even for renewed Business Models the revenue streams and cost structure will be based on basic assumptions and with them the financial success of the new model. Hence, during this step, the financial viability of the new Business Model should only be roughly sketched and should be tested during implementation. A too strong focus on financial performance of a Business Model will lead to disregarding the other elements of the model [Johnson, 2010, p. 129].

3.2.2 Implementation: Realizing the Business Model

One or more new Business Models are the result of the design phase described above. In the next phase these results have to be implemented which is the objective of the Implementation step, shown on the right side of Figure 3.2 [Osterwalder and Pigneur, 2010, p. 256] [Gassmann et al., 2014, p. 57]. A new Business Model is based mostly on assumptions. Hence, to roll out the new Business Model by turning the complete company and all its relations inside out would be a too risky approach. Instead, in order to reduce risk, Gassmann et al. and Johnson suggest taking a step-by-step approach in rolling out the new Business Model [Gassmann et al., 2014, p. 57].

The first stage of the implementation phase described by Johnson is Incubation which is about identifying and testing the critical assumptions for the success of the Business Model and about learning from the experiences made [Johnson, 2010, p. 136]. It starts with a first prototype that realizes the new Business Model in a small scale that allows for quick and economical testing with

low risk. By testing the prototype its underlying assumptions and all elements of the new Business Model can be verified and either success or failure increase the knowledge of your model and its environment. Also, the prototype serves as a demonstrator to internal and external stakeholders that can provide critical feedback and help to improve the first prototype. With the test results and the feedback one goes back to the steps of the design phase to incorporate the learnings into a new, more refined and enhanced prototype [Gassmann et al., 2014, p. 57].

Prototyping and verification of the viability of the Business Model reduce risk before continuing with the second stage, the Acceleration, in which the proven Business Model is refined and augmented by standardized processes, business rules to govern them, and by defining metrics that monitor the further development and growth of the business based on the new Business Model. This is done to maintain quality and customer satisfaction as well as to ensure that the elements of the Business Model are still in line with one another [Johnson, 2010, p. 145].

The implementation phase is finished for start-ups without an existing core business with the Acceleration stage. Established companies with an existing core business have another step to take, the Transition in which they have to decide whether the new Business Model is integrated into the existing core business or kept separate. The decision depends on the relation and interdependencies of the established and the new Business Model [Johnson, 2010, p. 147].

4

Current Trends

Companies must focus on the most important influencing factors and trends for both their industry and businesses. There is a variety of changes that influence the business environment of companies, from trends to changes in the regulatory environment, that have to be thought of on a regular basis to be able to react to them promptly or – in the case of market regulations – to some degree anticipate or even influence them. In the following, the most important current trends will be mentioned and their possible influence on electric utilities will be explained [Gassmann et al., 2014, p. 38-40].

4.1 Demographic Changes

In the mid of 2015 the world population was estimated to have reached 7.34 billion and current growth projections estimate a world population between 8.3 and 10.9 billion in 2050. Almost 90 % of the population increase are concentrated in Asia and Africa with India, China, and Nigeria alone expected to account for a third of global growth [United Nations, Department of Economic and Social Affairs, Population Division, 2015]. While the rural population of the world has grown slowly the urban population of the world has grown rapidly since 1950. Since 2007 the global urban population exceeded the global rural population for the first time. Currently, 54 % of the world's population reside in urban areas and one in eight lives in of the 28 mega-cities of at least 10 million inhabitants. The percentage of urban population is projected to rise further up to 66 % in 2050 [United Nations, Department of Economic and Social Affairs, Population Division, 2014]. Growth of both the world population and the world economy leads to an increase in the global energy demand at an expected 1.3 % on average per year until 2050 [BP, 2017a] [BP, 2017b]. The sustainability of further growth of the world population is in question given the growing pressure on the environment and scarcity of resources such as food supplies and energy [United Nations, Department of Economic and Social Affairs, Population Division, 2014]. With progressing urbanization, the challenges of sustainable development will be concentrated in lower-middle-income countries which show the fastest growth, but integrated policies are needed to improve the lives of both rural and urban inhabitants [United Nations, Department of Economic and Social Affairs, Population Division, 2014].

4.2 Fighting Climate Change

The average global temperature has increased over the past decades caused by the emission of carbon dioxide (CO_2) and other greehouse gasses (GHGs). Global warming is a result of the so-called greenhouse effect caused by gasses collecting in the atmosphere and absorbing the radiation emitted by the sun, thereby trapping the heat and causing the planet to get warmer. Global warming changes the Earth's climate and leads to extreme weather conditions such as heat waves, droughts, heavy rain, and thunderstorms. Moreover, glaciers and polar ice are melting, causing the sea levels to rise [MacMillan, 2016]. In 2015, at the United Nations Climate Change Conference, an agreement was reached to

strengthen the global response to climate change by "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" through reaching zero human GHG emissions during the second half of the 21st century [UNFCCC, 2015]. The goals set by the international community to conquer this most pressing global issue imply a shift away from fossil fuels toward clean and renewable energy. This shift will affect every industry by changing manufacturing and distribution systems and every consumer worldwide by changing consumption habits [Johnson, 2010, p. 99]. The energy industry is particularly under pressure to decarbonize as currently more than 75 % of global energy supply depends on non-renewable sources, contributing significantly to CO_2 emissions [World Economic Forum, 2016] [Bosco et al., 2015] [Bosco et al., 2016] [Bosco et al., 2017]. Electrification, i.e., changing over from fossil power sources to electricity, especially from renewable sources, is one of the answers to reduce the emission of GHGs in the energy sector and offers great opportunities for electric utilities. Allowing carbon-neutral generation of electricity nuclear power reactors are by some seen as a solution to reducing GHG emissions. However, accidents like Chernobyl in 1986 and in Fukushima 2011 cast doubts on the safety of nuclear power reactors [World Nuclear Association, 2017, World Nuclear Association, 2016] and the long-term isolation and containment of the spent nuclear fuel is costly and precarious. As a result, especially with other energy solutions emerging, nuclear power is getting unpopular and countries seek for a complete nuclear power phaseout (e.g., Germany, Switzerland) in combination with subsidies for development and installation of Renewable Energy Source (RES) to replace nuclear and fossil power sources.

4.3 Renewable Energy Sources

RESs are considered a main pillar in fighting GHG emissions and climate change. But RESs deployment is also driven by reduction of local air pollution, energy security, and the local value created [National Academies of Sciences, Engineering, and Medicine, 2016]. Continuing decline in prices for renewable energy technologies (especially for solar photovoltaics (PV)), rising power demand in most countries, and targeted renewable energy policies further promote the ongoing growth and expansion of RES worldwide [REN21, 2017, p. 20]. According to the definition in Directive 2009/28/EC of the

European Parliament and of the Council RESs are wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases [European Parliament and the Council, 2009a]. In 2014, RESs provided 14.1 % of the Total Primary Energy Supply (TPES), i.e., 80.8 exajoule (EJ) [International Energy Agency (IEA), 2016b, p. 6].

Of the yearly electricity generation of 85.7 EJ, 22.7 % were provided by renewable sources (see Figure 1.2) with hydropower providing the largest part of 16.4 % while solar, wind, geothermal, and tidal aggregate to 4.2 % and biofuels and waste to 2.1 % [International Energy Agency (IEA), 2016b, p. 24].

Renewable Power Source	**Unit**	**2013**	**2014**	**2015**	**2016**	**%**
Hydropower	GW	1,018	1,055	1,071	1,096	54.4 %
Wind power	GW	319	370	433	487	24.2 %
Solar PV	GW	138	177	228	303	15.0 %
Bio-power	GW	88	93	106	112	5.6 %
Geothermal power	GW	12.1	12.8	13	13.5	0.7 %
Concentrating solar thermal power	GW	3.4	4.4	4.7	4.8	0.2 %
Total renewable power	**GW**	**1,578**	**1,712**	**1,855.7**	**2,016.3**	**100 %**

Table 4.1: Installed Capacity for Renewable Power Sources 2013–2016 [REN21, 2015, REN21, 2016, REN21, 2017]

An overview of the capacity development of different renewable power sources over the recent years can be seen in Table 4.1. In 2016, the installed renewable power capacity increased by 161 gigawatt (GW), representing an annual increase of 8.6 %, and accounted for more than 50% of new additions to power capacity for the first time ever, overtaking coal in terms of installed capacity [International Energy Agency (IEA), 2017]. The majority of the newly installed power capacity in 2016 comes from solar PV with 46.7%, followed by wind with 33.6 % and hydropower with 15.6%, respectively [REN21, 2017, p. 20].

Where resources are abundant, well-established renewable energy technologies such as hydropower and geothermal energy have become cost-competitive with coal, oil, and gas. With technological progress and decreasing costs, solar PV and wind power join in challenging fossil fuels worldwide [REN21, 2017, p. 20]. However, in many parts of the world, coal remains the cheapest fuel for electricity generation, mainly because market prices for electricity do not include costs from pol-

lution and GHG emissions. Although all electricity generation technologies have some environmental effects, the emissions of air pollutants from fossil fuels have the worst impact on the environment, human health, and agriculture [National Academies of Sciences, Engineering, and Medicine, 2016]. In order to level the playing field for all power sources policies have to be changed in order to put an appropriate price on pollution and GHG emissions from power production. This would strengthen existing RESs further increase investments in innovative low-cost, zero-emission technologies.

4.4 Deregulation

The last decades have brought deregulation of several industries in countries worldwide. Formerly state-owned or state-regulated industries like the aviation industry, the telecommunication industry, and the energy industry have been deregulated to create open markets, ensure free and fair market access, stimulate competition, remove inefficiencies of governmental regulation, and open the industries for private participants. For the electricity industry in particular, deregulation and market liberalization are still not completed and in progress in many countries. More details on the deregulation of the electricity industry can be found in Section 5.1.

4.5 Decentralization

A general trend of decentralization can be observed in which systems and functions are redistributed from a central point or authority to a distributed system. It is partly motivated by a rising mistrust of people in governmental authorities. Geographically distributed systems have the advantage of transparency, openness, reliability, scalability and potentially higher performance. As there is no central point of control there is no central point of failure and the system is more resilient against political control or any outside attacks to the system.

The trend of decentralization also affects the electricity system with conventional power plants as centers of generation and geographically scattered distributed consumption. Technological development in Information and Communications Technology (ICT) and the introduction of new sources of power generation facilitate the creation of local and regional energy systems and a shift of intelligence

to the grid, reducing the balancing requirement of a centralized grid [World Economic Forum, 2016]. The future power grid will consist of a distributed network of Microgrids (see Section 4.6), i.e., small-scale Distributed Energy Resources (DERs) such as rooftop solar panels and wind turbines combined with traditional power plants. With rising dissemination of DERs, traditional power plants will be phased out with a transition to a clean electricity system. Such a smart grid based on Microgrids of DERs is expected to enable more affordability and consumer choice, greater economic benefits and a facilitation of the decarbonization of the electricity supply [SolarCity, 2016].

4.6 Microgrids

The global trend to distributed energy generation leads to the creation of Microgrids that are localized clusters of electric generation sources and electricity consumers that can operate independent and autonomously from a traditional centralized electrical grid but are usually connected to such a grid for electricity exchange and trading [Hebner, 2017]. Both generation and consumption in Microgrids is often in the hands of Prosumers. Microgrids also provide a solution for the first electrification of rural and underdeveloped areas of the world without any access to the grid such as sub-Saharan Africa. It allows leapfrogging development of traditional infrastructure by easy setup of local Microgrid that can work autonomously [Rocky Mountain Institute, 2017]. A quite famous example of a Microgrid is the Brooklyn Microgrid that generates renewable energy locally and sells it to the community on a peer-to-peer market. The Microgrid is connected to the traditional grid but can work independently of it in case of a breakdown. The Brooklyn Microgrid plans to extend the solar panel system, to install additional battery storage units, and to have 1,000 participants by 2018 [Brooklyn Microgrid, 2017].

4.7 Digitalization and its Consequences

Through Digitization, the transformation of information from analogue into digital form, information is made accessible to computers. The representation of information in Bits and Bytes allows capturing, processing, and storage of data with ease. Digitalization (or Digital Transformation) describes the technical change process undergone by society. It is a trend that affects individuals, business, and even entire nations. For individuals it changes their daily lives through new ubiquitous connectivity and availability of information. For businesses it fundamentally changes existing value chains across industries, making it imperative for companies to be aware of threats to and opportunities for their businesses.

The high-pace development of ICTs and its enabling technologies like photonics and electronics is driving innovation and provides new solutions. The Internet of Things (IoT) describes a network of Intelligent Electronic Devices (IEDs) that are embedded with electronics, software, sensors, actuators, and network connectivity to collect, process, and exchange data. IEDs can be integrated into things like appliances, buildings, and vehicles. In the industrial domain, the term Industrial Internet of Things (IIoT) is used to refer to the industrial subset of IIoT where the expected value created is foreseen to lead to the so-called Industry 4.0, the fourth industrial revolution. In the energy sector, energy management and optimization of consumption can be established by integrating IoT into devices that generate, distribute, control, and consume energy. For power plants, for instance, performance management and planning of maintenance allow to raise efficiency and utilization of plants, converting the existing grid into a smart grid. For homes, devices equipped with IEDs comprise switches, power outlets, light bulbs, and so-called smart appliances such as refrigerators and Heating, Ventilation, and Air Conditioning (HVAC), converting the house into a smart home. The IoT allows remote control of devices through mobile communication and scheduling functions like powering on/off a heating system or air conditioning. IoT does not only connect devices with users but also enables machine-to-machine (M2M) communication between devices equipped with Artificial Intelligence (AI) and machine learning algorithms to take autonomous decisions independent of human interaction. Directly connecting and communicating smart appliances with electric utilities then allows for instance (de-)activation of devices based on real-time electricity prices.

With the IoT connecting devices of any kind, vast amounts of data are gathered and communicated. Big Data describes sets of data that are too large or complex for traditional data processing and, hence, require appropriate algorithms and computation capacity. Cloud computing provides this capacity through shared computer processing resources and data on demand to computers and other devices over the Internet.

As the few examples above show, Digitalization does not stop short of the energy sector but assists in creating value in both the core business and at new frontiers [Bocca, 2016]. According to the World Economic Forum, there are four digital themes that are of importance for the electricity industry that have an aggregated value of USD 1,360 billion [World Economic Forum, 2016, p. 9]: Asset Life-cycle Management, Network Optimization and Aggregation, Integrated Customer Services, and Beyond the Electron. Asset Life-cycle Management comprises technology such as condition monitoring, predictive maintenance, and smart asset planning for extending the life-time and operating efficiency of assets. Grid Optimization covers all digital initiatives to tackle inefficiencies such as spare capacities in the grid through combination of a smart grid with analytics and IEDs and Aggregation combines locally generated power into virtual power plants for efficient operation and grid balancing. Integrated Customer Services addresses customers' expectation of additional reliable and personalized services. Beyond the Electron addresses the transition from electricity as commodity to the provision of a personalized, connected experience such as connected-home services.

4.8 Blockchain Technology

Blockchain technology is a distributed database that consists of a continuously growing chain of ordered blocks. It is well known from the Bitcoin cryptocurrency that has its foundation in a paper published by Satoshi Nakamoto [Nakamoto, 2008]. It represents a decentralized and highly efficient way to manage and keep track of transactions. Based on peer-to-peer transactions, no central institution is required to manage transactions. Cryptography and digital signatures are used to maintain authenticity and identity to ensure secure transactions, which makes central trusted authorities superfluous. Once the a transaction is recorded in a block, it cannot be erased but only sequentially updated in another block. Blockchain applications can be monetary as well as smart contracts, which are

computer protocols that are executed automatically once specific conditions are fulfilled [Mougayar, 2016] [Tapscott and Tapscott, 2016] [Wattenhofer, 2016]. Blockchain has the potential to offer a reliable, low-cost way for transactions to be recorded and validated across a distributed network without a central authority. The technology could even become the transaction layer for a M2M economy in which transactions are carried out between machines without human interaction [Basden and Cottrell, 2017].

The technology is gaining importance in the energy sector. Currently utilities are testing Blockchain applications for charging Electric Vehicles (EVs), for customers to sell power independently of a utility, for energy trading between utilities, for control of appliances in connected homes, and for a decentralized energy data exchange platform [Munson, 2017] [Grid Singularity, 2017] [Brooklyn Microgrid, 2017] [Buterin, 2013]. Enabling customers to quickly switch power suppliers could be another application for Blockchain technology [Basden and Cottrell, 2017]. The Blockchain technology can be both threat and opportunity for electric utilities. It has the ability to allow customers and companies to safely and quickly exchange energy services directly, thereby circumventing the traditional utility. However, it also serves to be part of the answer how to change the centralized electricity system into a network of DERs consisting of large and small energy-generation systems for homes, businesses, and communities [Basden and Cottrell, 2017].

5

Business Models for Electric Utilities

For decades, the supply of customers with electric energy relied on large, remotely sited power plants that predominantly burn fossil fuels like coal, oil, and natural gas [International Energy Agency (IEA), 2016b]. During this time period, utilities have relied on Business Models that incentivize using more power. However, the business environment has changed and it is therefore crucial to develop new Business Models that support the energy transition, are more customer-oriented, and give customers choices to both save money and reduce their environmental footprint.

In this Chapter, the business of electric utilities will be analyzed and new Business Models ideas will be created based on the Business Model Innovation process summarized in Section 3.2.

Figure 5.1: Electricity Value Chain (own drawing based on [Gsodam et al., 2015] [E-Control, 2013])

5.1 Initiation

As a first step, the transformation of the business environment of electric utilities will be analyzed in the Initiation step.

In the last century electric utilities where large, vertically integrated electric energy companies. They were natural monopolies that were state-owned for political and security reasons and their activities comprised the full spectrum of the electricity value chain shown, in Figure 5.1, from generation, over transmission, distribution, to retail. In the EU, liberalization of the energy market started in 1996 with Directive 96/92/EC [European Parliament and the Council, 1996], later repealed by directives 2003/54/EC [European Parliament and the Council, 2003] and 2009/72/EC [European Parliament and the Council, 2009b] in 2003 and 2009, respectively, with the motivation to introduce common rules for generation, transmission, distribution, and supply of electricity without discrimination or disadvantages, and to ensure a secure supply of electricity. The directives have consequently been transposed into national laws of the EU member states between the late 1990's and 2007. However, the markets in Cyprus, Malta, and Estonia are still closed markets [EMCE Consortium, 2010, p. 77]. Electricity markets are undergoing liberalization not only in the EU, but worldwide. Market liberalization enables consumers to freely choose their suppliers and all suppliers are free to choose their customers. However, switching of suppliers is still not common. From 2007 to 2009, across the EU Member States only 10.1% of consumers tried to switch and 6.2% actually switched supplier [EMCE Consortium, 2010, p. 77]

Market liberalization broke up the traditional value chain of electric utilities and unbundled energy suppliers from network operators. For transmission and distribution networks competition does not make sense as it would require the costly set-up and operation of parallel infrastructure. Hence,

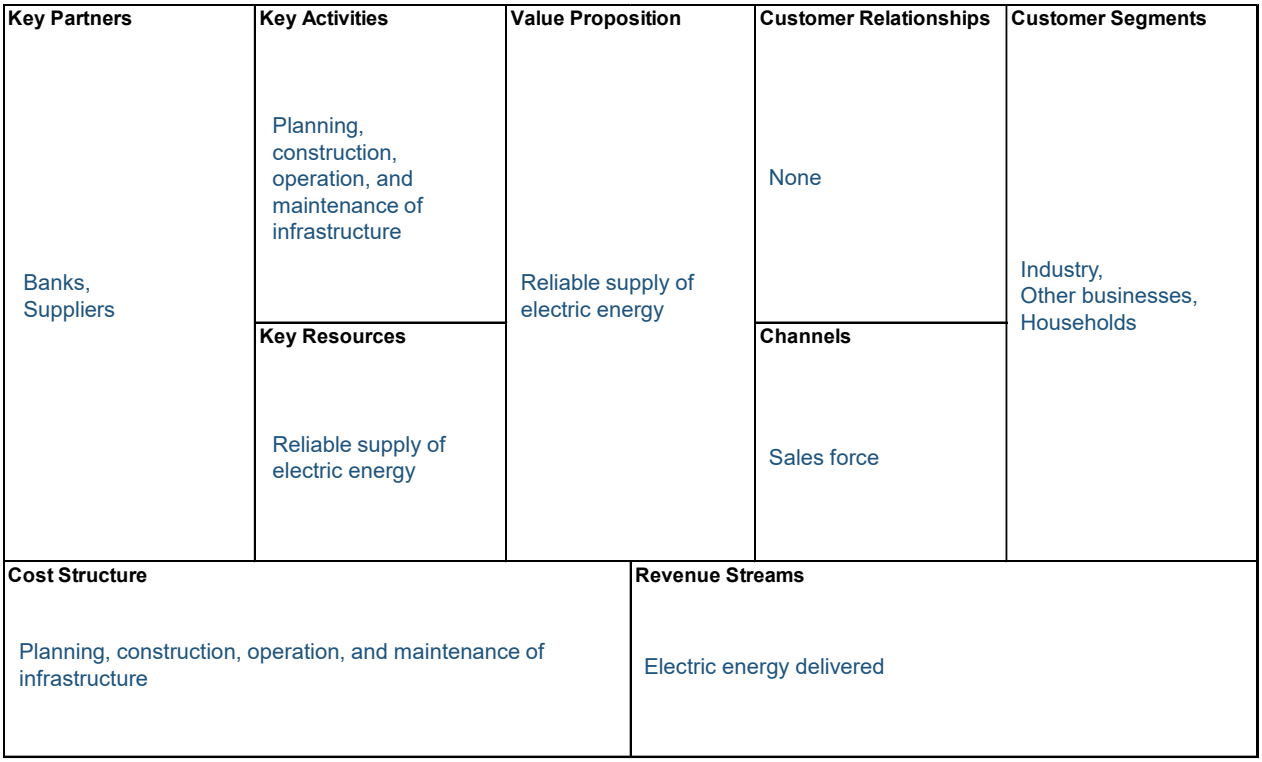

Figure 5.2: Outdated Business Model for Electric Utilities

network operators are kept as regulated natural monopolies. Operators of distribution networks are responsible for the safe and secure operation of the distribution grid, for providing access to the grid for all market players, for metering and the administration of user data, and for ensuring an equilibrium between generation and consumption at any time [E-Control, 2013].

5.1.1 Outdated Business Model of Electric Utilities

The Business Model that has prevailed during the last century before the liberalization of the energy market was based on monopolies of large, vertically integrated electric energy companies. The outdated Business Model of electric utilities is illustrated on the Business Model Canvas in Figure 5.2. For most of the countries – especially developed ones – this outdated Business Model is obsolete. However, in developing countries (e.g., Tajikistan, Kyrgyzstan, Indonesia) it is still the prevailing Business Model and it will require decades to create the regulatory environment for an open liberalized market.

The value proposition is the reliable supply of electric energy to their customers. Their customer segments are industry, other business customers, and households. The electricity delivered is the

same for all customer segments but the product packages (e.g., basic fee, rate per amount of electrical energy (in Joule (J) as per the International System of Units (SI) or, more commonly, in Kilowatt-hour (kWh)), availability) differ between the customer segments. Being a monopoly, customers have no choice in selecting their electricity suppliers. They have to choose the one available electric utility. As only channel, electric utilities usually use their own sales force to inform customers and conclude contracts with them. For the monopolist there is no necessity to cultivate customer relationships. Key resources comprise the complete infrastructure from power plants to transmission and distribution networks as well as the resources to run them, e.g., fossil fuels for power plants, access to water and rights to use it for hydropower plants. Key activities are planning, construction, operation, and maintenance of generation, transmission, and distribution infrastructure. Key partnerships are held with banks for financing their projects and suppliers of power plants and fuels. Revenue streams are created by charging the customers for the amount of delivered electric energy. The cost structure is made up by the cost incurred by planning, construction, operation, and maintenance of generation, transmission, and distribution infrastructure.

5.1.2 Traditional Business Model of Electric Utilities

With the market liberalization, the vertical integration of electric utilities was broken up. Electric utilities were forced to split into independent companies for generation and network for transmission and distribution (Transmission System Operators (TSOs) and Distribution System Operators (DSOs)). While transmission and distribution still remain regulated natural monopolies, the generation, trade and sale of electric energy is subject to competition on an open market (see Figure 5.1). The regulatory changes that came with the market liberalization influenced the Business Model of electric utilities, which is illustrated on the Business Model Canvas in Figure 5.3. The value proposition in the traditional is the production and sale of electric energy to their customers. Their customer segments are network operators, traders, retailers, industry, other business customers, and households. The electricity delivered is the same for all customer segments but the contract conditions differ between the customer segments (e.g., basic fee, rate per amount of energy, availability, time frame for delivery, minimum contract term). Customers are free to choose their electricity supplier and electric utilities usually use websites to inform customers and conclude contracts with them but the traditional channel

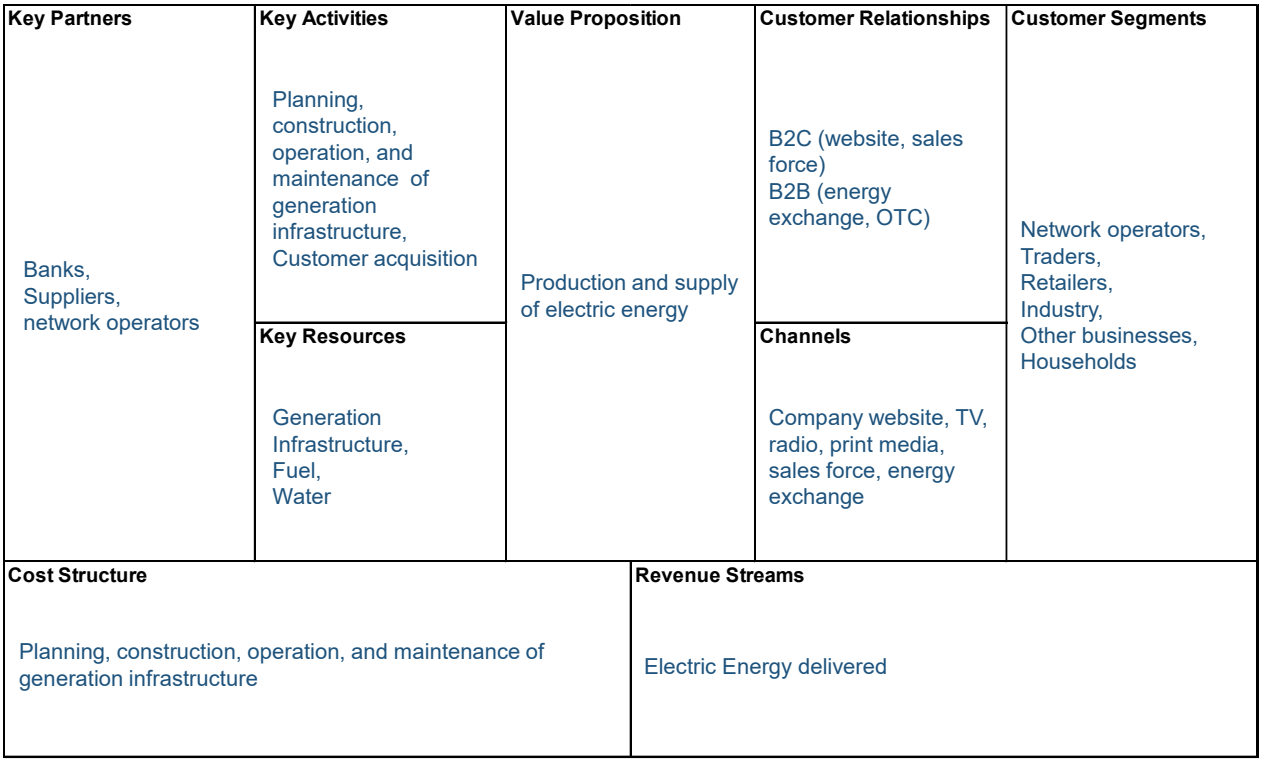

Figure 5.3: Traditional Business Model for Electric Utilities

through sales force is also still used. Customers are approached through television, radio, and print advertisements. In addition, energy exchanges are used providing both spot and derivatives markets. Customer relationships are either business-to-business (B2B) or business-to-customer (B2C) relationships either directly through sales personnel for over-the-counter (OTC) trading or automatically for exchange trading. Key resources comprise the generation infrastructure, i.e., power plants, as well as the resources to run them, e.g., fossil fuels for power plants, access to water and rights to use it for hydropower plants. Key activities are planning, construction, operation, and maintenance of generation infrastructure as well as customer acquisition. Key partnerships are held with banks for financing of projects, electricity network operators, and suppliers of power plants and fuels. Revenue streams are created by charging the customers for the amount of delivered electric energy or for Ancillary Services required for grid stability. The cost structure is made up by the cost incurred by planning, construction, operation, and maintenance of generation infrastructure, where operation includes fuels such as coal, oil, and gas.

Note that the described traditional Business Model is very generic and could be specified to special cases, such as sole generation of renewable energy. It will be used as a starting point to introduce

changes and adaptions to the traditional Business Model based current trends and changes in the industry presented in Chapter 4 and to propose new Business Models.

5.1.3 Current Business Environment

Basically, the traditional value proposition of electric utilities is still valid. Electricity is a commodity, customers are mature and have been experienced in using electricity for years and know exactly what they want, which is a reliable supply of electric energy. However, in the last decades, customers behavior has changed, requiring a refinement of the traditional value proposition. In general, customers are now more conscious of how, where, and by whom their products are being produced and demand a reduced or no impact on the environment. In the case of electric energy in particular, customers more and more demand electricity that is created from renewable sources and in their vicinity. They prefer suppliers from within their neighborhood or local community and want to know where and by whom their energy needs are satisfied. With the advent of affordable technology for small power plants, customers started altering their role from pure consumers of electric energy to Prosumer[1]. Typical Prosumers use small-scale power generation facilities with an electrical power in the range of a few kilowatt (kW) typically using technologies such as solar panels, wind turbines, or small hydropower plants. The rising number of Prosumers consumes the generated energy themselves and feeds the excess energy into the grid. In many countries, such as Austria, Prosumers are subsidized. The installation of small generation facilities is supported by investment grants and regulations ensure that the energy provided by Prosumers has to be taken over by the grid at a guaranteed infeed tariff (in Austria by the Ökostrom-Einspeisetarifverordnung [Bundesgesetzblatt für die Republik Österreich, 2016]). Prosumers and their Distributed Energy Resources (DERs) change the grid from a centralized to a distributed system, cause Load Defection [Rocky Mountain Institute, 2015] or even Grid Defection [Rocky Mountain Institute, 2014], i.e., they reduce the amount of energy a traditional electric utility can sell to them or even abandon their utilities and the electricity grid, or they enter as competitors to the traditional electric utilities by selling their excess energy. In the former case they erode the utilities' traditional business model and in the latter they alter the traditional value chain shown in Figure 5.1 by adding additional generation on the consumption side. Customers very much

[1] A Prosumer is an actor in the energy market that is both a consumer and a producer of electric energy.

value the source of their energy and pay a premium for sustainable, renewable sources. In addition to electric energy for light, television, and household appliances, electric energy will be used more and more to substitute other forms of energy such as coal, oil, and natural gas that have a poor environmental footprint. Heating for homes fueled by oil or gas will be replaced by highly efficient heat pumps and cars fueled by gasoline and diesel will be replaced by Electric Vehicles (EVs). All these new consumers are an opportunity for additional value propositions that comes with changing business environment. New technologies enable the provision of additional services to customers. The possibilities offered by digitalization, IoT, artificial intelligence etc. as described in Chapter 4 are astounding. These technologies can assist customers to realize energy savings, profit from low energy prices without restrictions and live in comfort by allowing to gather data about consumption behavior and patterns, inform customers about their energy profiles, make predictions and recommendations about expected future energy requirements and potential savings they could realize. In order for customers to make the transition to a life with a lower carbon footprint, electric utilities can assist by offering services covering consulting and engineering in relation to energy topics as well as construction, operation, and maintenance of generation facilities.

In contrast to the traditional Business Model there are additional customer segments to the traditional ones. There are still the traditional segments of customers that just want electric energy and do not care much about where it comes from and how it is produced. They are price sensitive and don't expect any extra products or services. Then, for each of the traditional customer segments, there is a sub-segment that is conscious about the type of energy that is being supplied. They value electric energy from renewable sources – and are willing to pay a premium for it – and are also interested in additional products and services that assists them in evaluating and optimizing their own energy practices in order to reduce their environmental footprint. They are the customer segment interested in products to become Prosumers and generate their own energy and in services offered by smart metering and alike to save energy. Then there is the additional segment of Prosumers. They have their own production facility installed either for their personal use and/or to sell the generated energy to the grid. Parag et al. see three types of possible Prosumer markets. First, there are peer-to-peer markets in which energy generated is traded on market platforms between Prosumers and traders, retailers, or consumers and distributed over the existing grid. This is currently the predominant market as it

is the logical next step to an existing grid. Second, in a prosumer-to-grid market, Prosumers can be connected to Microgrids (see Section 4.6) that either work in an island mode or are islands connected to the grid. Energy generated within Microgrids will be either consumed within the Microgrids themselves or traded with the outside through a grid connection. Third, organized Prosumer groups are a mixture between the former two market types that is more organized than peer-to-peer markets but less structured than prosumer-to-grid models. This market type seems to be the most suitable one for small communities and smart-cities that want to manage their energy needs efficiently and dynamically [Parag and Sovacool, 2016]. Depending on the Prosumer market realized (see Section 4.6), the role for electric utilities is different. They can participate with their existing infrastructure in peer-to-peer markets just like any other Prosumer and compete with them for customers. In prosumer-to-grid markets and organized Prosumer groups, electric utilities have to engage locally as part of the Microgrids. Other stakeholders are governments and other bodies of municipalities, states, countries and international institutions. Typically, regulating authorities are appointed to act in their interest to establish, monitor and supervise electricity markets and administrate subsidies for Renewable Energy Sources (RESs).

There are state-of-the-art channels available for use in new Business Models. Traditional channels like sales personnel are being abandoned and potential customers are being approached by new means assisted by digitalization. Many electric utilities still approach their customers through television, radio, and print advertisements. Websites have been common for quite some time to inform potential customers, to conclude and manage existing contracts, and to handle customer requests. Social media (Facebook, Twitter, LinkedIn, Pinterest, Tumblr) more and more find their way into electric utilities and are used for branding and communication with customer. Moreover, advertising on search engines (e.g., Google AdSense) display banners on websites, and Blogs and platforms are gaining importance for customer engagement.

There are different customer relationships for new Business Models depending on the type of customer. In the case of B2B customers there are usually long-term relationships that are handled through OTC and do not require much attention. For RESs, prices are often even fixed by regulating authorities which limits the customer relationship only to the delivery of electricity. For B2C customers relations are different. Customers are generally free to choose their supplier for electricity

in many countries and they have to be actively acquired and convinced of the product. For environmentally conscious customers an offering containing RESs has a positive effects on their relationship to the end-customer. In order to ensure constant revenue streams, utilities should seek for long-term relationships with customers. Hence, customer retention is as important as customer acquisition. Also, new business models will be much more customer-centric than traditional ones. The role of customers will gradually evolve from the one of a pure customer into a role of partnership-type. For Distributed Energy Resources (DERs), utilities might use home owner's rooftops to install and operate decentralized generating facilities (e.g., for solar power) or customers are used to finance large-scale RESs [Wien Energie, 2017].

Traditional key resources remain important also for new Business Models but new ones enter the arena and outrank the importance of traditional key resources. Generation infrastructure is and remains the main key resource. However, the type of power plants and the resources to run them change. For incumbent utilities, coal, oil, and natural gas are still important resources and so are the power plants fired by them because investments in such assets is usually planned for a lifetime of at least 40 years. As more and more RESs are integrated into the generation systems, traditional assets are loosing and new ones are gaining importance. New entrants into the utility business often rely solely on RESs freeing them from environmental problems like CO_2 emissions that old power plants face and decouples them from volatile fuel prices.

Planning, construction, operation, and maintenance of generation infrastructure are still key activities for electric utilities. Also, asset management is important as for power plants reaching the end of their lifetime it has to be decided if the plant is to be phased out of the generation system or if a refurbishment is ecologically and economically worthwhile. With customers able to freely choose their supplier for electricity in many countries, customer acquisition and retention are also key activities for electric utilities. As mentioned above, interactions with customers are getting more intense and are even evolving into partnerships at times. Hence, the establishment of long-term relations with customers is crucial.

The traditional partnerships with banks, electricity network operators, and suppliers of plants and fuels remain important key partnerships. With the gradual transition to RESs, the importance of fuels will decrease and with it the importance of partnerships to fuel suppliers. Partnerships with

Prosumers, however, will become more important in a decentralized grid. They own the generation facilities or provide their property for it and trade electric energy with utilities. Moreover, they might also require additional services like operation and maintenance of their facilities and are therefore customers for additional services. Long-term agreements are advantageous for both sides, the utility and the Prosumers. The required knowledge for services around smart metering, smart homes, and artificial intelligence is nonexistent in traditional electric utilities and therefore has to be either acquired from outside or built up internally. Given the urgency of this topic, it might be better to establish partnerships with IT companies.

The cost structure for traditional generation facilities remains the same and includes planning, construction, operation, and maintenance. For new facilities, mainly RESs, cost for the same categories apply but the cost incurred for the different categories are different. For instance, the initial cost for planning and construction of a solar power plant is higher but operation and maintenance cost are lower as the facility does not require any fuel to operate and does not have moving parts that have to be maintained and replaced due to wear and tear. The additional value propositions of offered services mentioned above are personnel-intensive and hence will incur additional personnel cost. Additional services dealing with smart metering, artificial intelligence requires either the setup of IT infrastructure or the rental of this infrastructure from a specialized partner.

Revenue streams are created by charging the customers for the amount of delivered electric energy or for Ancillary Services required for grid stability. Additionally, revenue will be created by charging for additional services. Alternatively to charging for energy, all-inclusive packages can be bundled including installation, operation, and maintenance of generation facilities on customers' premises.

5.2 Ideation

In this Section new ideas for Business Models are gathered. The approach is neither strictly based on the similarity nor the confrontation principle presented in Section 3.2.1.2 but tries to apply Business Model archetypes to the electric utility business using both principles. In the following Subsections, Business Model patterns will be presented in alphabetical order and their applicability to electric utilities will be discussed.

5.2.1 Add-on

The add-on Business Model pattern consists of potentially numerous extra offerings that are provided as add-ons to a basic offering [Gassmann et al., 2014, p. 83]. The pattern is suited for markets that are hard to segment and allows to customize the basic offering to specific needs of a large number of customers.

As in other industries, this pattern might be used combined with the *no frills* pattern for electric utilities. Offering additional features to the basic product such as power from RESs or non-nuclear generation or for additional services such as consulting, engineering and additional products.

5.2.2 Cross-selling

The cross-selling Business Model pattern involves the offering of complementary products and services beyond the basic product and service range, thereby often leveraging existing resources, competencies and customer relationships to sell more goods [Gassmann et al., 2014, p. 113].

As nowadays customers are increasingly demanding one-stop solutions, electric utilities might use this pattern to offer additional products and services related to the energy needs of their customers besides electricity. These additional offerings might comprise consulting services, energy efficient home appliances, and other sources of energy such as natural gas for heating.

5.2.3 Crowd-funding

In the crowd-funding Business Model pattern the general public is used to provide funding for a project, thus widening the circle of investors and raising the chances or improving financing conditions for their project. Typical crowd-funders are – compared to professional investors – less interested in maximizing their returns. Instead, they want to see certain projects being realized and typically receive project-specific rewards [Gassmann et al., 2014, p. 117].

For electric utilities this pattern can be used to finance projects for new generating facilities. In fact, this pattern is already used to finance solar and wind power plants. The utility sells parts of the power plant (e.g., one or more solar panels or shares of a wind turbines) to their crowd-funders. It is responsible for the engineering, construction, operation, and maintenance of the power plant and leases back the parts during the financing term of 25 years, after which the utility buys the equipment

back [Wien Energie, 2017]. Besides the comparatively low interest rate of 1.75 % per year, crowdfunders get the chance to actively participate in the development of RESs in their community, thus fostering climate and environmental protection in their vicinity, local energy transition, and their quality of life.

5.2.4 Customer Loyalty

The customer loyalty Business Model pattern uses incentives to value loyal customers. The goal is customer retention and the development of long-term relationships. By rewarding loyalty with special offers or discounts, customers are voluntarily bound to the company and company's revenues streams are protected [Gassmann et al., 2014, p. 126].

Also electric utilities can use this pattern. Customer acquisition and retention is a topic that is gaining importance in the electricity industry. A lot of money is invested in reaching out to potential new customers and in winning new customers but in relation little efforts are made to keep current customers. Hence, they change to competitors to appreciate their benefits for new customers. Loyalty programs can help to avoid high churning rates and to save high cost for customer re-acquisition.

5.2.5 Digitalization

In the digitalization Business Model pattern an existing product or service is transformed into a digital variant [Gassmann et al., 2014, p. 131].

Obviously, electricity as a product cannot be digitized. But electric utilities can use the features offered by automation and Information and Communications Technology (ICT) to enhance and simplify many processes in the value chain and thus lower cost. In addition, digitalization allows to offer additional products and services enabled by Smart Metering and Internet of Things (IoT) (see Section 4.7) where physical products gain intelligence and become connected to one another.

5.2.6 Direct Selling

The direct selling Business Model pattern makes products or services directly available from the manufacturer rather than through an intermediary channel [Gassmann et al., 2014, p. 137].

In the electric energy sector, the energy generated in power plants is typically sold to traders and retailers based on bilateral contracts or by trading energy on the energy exchange. There is hardly a direct selling approach to users of the energy applied. The direct selling pattern can be used by utilities owning generation systems to directly sell their energy to end customers, i.e., users of energy, thus cutting out any intermediary channels. Especially for new entrants into the market and within local Microgrids this approach seems tempting.

5.2.7 E-Commerce

With the development of ICTs and especially the advent of the Internet, the e-commerce Business Model pattern was established in which products and services and the related customer service and support are delivered through online channels. This removes all overhead cost related to the operation of traditional brick-and-mortar stores and helps to lower cost [Gassmann et al., 2014, p. 141]. The pattern is related to the digitalization pattern (see Section 5.2.5 above).

This pattern is already used by electric utilities but not as extensively as in other industries. Since electricity is no physical product, it is predestined for e-commerce. Customers can obtain information about the company and its offering, can conclude contracts, and eventually additional products through the website.

5.2.8 Flat Rate

With the flat rate Business Model pattern uses a pricing structure in which a customers buys a product or service for a lump sum regardless of the usage. Typically, the usage of the product or service is naturally limited (e.g., a workout in a gym) or upper bounded by contract terms (e.g., included megabytes in a mobile data plan). The pattern has advantages for both companies and their customers. Companies can structure the pricing as required and customers have a known fixed price [Gassmann et al., 2014, p. 151].

For electric utilities this pattern has not been used yet and is currently not well-suited for the industry with quite high marginal cost. However, for electricity from RESs, marginal costs are low and there are opinions that electricity will not only become cheaper in the next decades but someday even almost for free. Then, when almost nothing can be charged for electricity, other products and services have to be found with which the required electricity might be included in a flat rate pattern.

5.2.9 Fractional Ownership

In the fractional ownership Business Model pattern customers acquire only a part of an asset instead of its entirety and share the usage of the asset with other customers. Fractional ownership allows customers to use products they otherwise would not be able or want to afford. Hence, more customers get access to the offering and demand grows [Gassmann et al., 2014, p. 155].

In the electric energy sector, this pattern could be used in form of customer-owned power plants. A power plant, for instance, requires a certain space and funds to be installed. In an urban environment the required space is usually not easily available and for individuals the required funds are hardly feasible. Customers could join forces to fund the installation, operation, and maintenance of a power plant – for instance outside of the city or on the rooftop of their joint building – and can use the generated energy themselves. Using all the energy themselves, depending on the laws and regulations in force, they might be exempted from fees for usage of the grid. This saves costs and raises the leverage of their investment. Any excess energy generated, can be fed into the grid and sold. The role of electric utilities in such a case could be the one of installation, operation, and maintenance of the fractionally owned power plant.

5.2.10 Freemium

The freemium Business Model pattern combines a free basic version of a product or service with a premium version offered against additional payment. The name freemium is a blend of the words free and premium, such as the Business Model is a blend of a free and a premium offer. It is suited for products and services with low marginal production cost and the benefit of external network effects, such as software or platforms, where the pattern is often used with limited features in the

basic version and additional or full features only in the premium version [Gassmann et al., 2014, p. 165] [Osterwalder and Pigneur, 2010, p. 88].

For electric utilities this pattern does not seem suitable for the product of electricity as marginal cost are high and a premium version of electricity certainly does not exist. However, with additional products and services offered, the use of the freemium Business Model pattern is possible. It could, for instance, be applied to any services related to smart metering and smart homes.

5.2.11 Guaranteed Availability

The guaranteed availability Business Model pattern ensures the availability of a product or service for customers to reduce cost incurred by unavailability and downtimes [Gassmann et al., 2014, p. 174].

Customers' expectations regarding electricity are clear. Most of the customers cannot imagine even a few moments without electricity. As a commodity ubiquitous availability at any moment is requested. Hence, this guaranteed availability is already part of the business model of electric utilities. For additional services surrounding the provision of electricity, guaranteed availability can be important to customers. A non-functioning heat pump, for instance, means no heating for the home and hence requires immediate and sometimes costly repair. An operation and maintenance service provided with guaranteed availability and different levels of response times might be possible.

5.2.12 Hidden Revenue

The hidden revenue Business Model pattern abandons the logic of selling a product or service and cross-finance the offering made to customers by revenues created from third parties. This pattern is typically used on websites that integrate advertisements. The website content is provided for free while the advertisement space is sold to advertisers. The pattern is hence related to the two-sided market pattern (see Section 5.2.30 below) [Gassmann et al., 2014, p. 179].

For electric utilities it is currently difficult to use this pattern, but through new technologies and the access to customers, new products and services become possible.

5.2.13 Integrator

The integrator Business Model pattern is based on integration of the entire supply chain or at least most parts of it to improve the company's economies of range and efficiency [Gassmann et al., 2014, p. 188].

Originally, electric utilities were entirely vertically integrated companies. With market liberalization the vertical integration has been broken up. However, except for the transmission and distribution grids as natural monopolies, electric utilities can and often still do control the largest part of the supply chain. The non-controlled part is the regulated grid, thus the playing field is leveled for all competitors. Many established electric utilities are indeed vertically integrated and control the complete supply chain, giving them an advantage over new entrants into the sector that lack the required knowledge. But with changing technologies for production and storage as well as the augmentation of the electricity system with ICTs, new opportunities open up that have to be seized before competitors do.

5.2.14 Layer Player

When applying the layer player Business Model pattern, a company focuses on one or just a few activities of the value chain. The company benefits from its high specialization in certain parts (e.g., payment, distribution) of the value chain applying special knowledge and intellectual property [Gassmann et al., 2014, p. 193].

Electric utilities specializing in generation of energy or in energy trading only are not uncommon. The European Energy Exchange in Leipzig [European Energy Exchange (EEX), 2017], Germany, for instance, is one of the leading energy trading centers. For new entrants to the energy sector, the level player pattern is a good opportunity to get in. An example is the Austrian start-up Grid Singularity that develops a decentralized energy data exchange platform based on blockchain technology (see Section 4.8) [Grid Singularity, 2017].

5.2.15 Leverage Customer Data

With the leverage customer data Business Model pattern companies try to sell knowledge about their customers. This knowledge is gathered through acquisition, analysis, and processing of data of and

about customers. This pattern is closely related to the hidden revenue (see Section 5.2.12 and two-sided market (see Section 5.2.30) [Gassmann et al., 2014, p. 197]. On the one side customers are attracted with a free or low-priced offering to allow collection of their data and on the counter-side of the two-sided market knowledge about and access to this customer base is sold to advertisers and other companies.

For electric utilities this pattern does not seem tempting at first glance. However, the further introduction of ICTs in the energy sector opens up possibilities to obtain data from the potentially large customer base that might be leveraged.

5.2.16 Lock-in

Using the lock-in Business Model pattern customers are locked-in to the products or services of a company by a high switching hurdle. This hurdle may be high cost involved in the switching process or a cumbersome and time-consuming switching process itself [Gassmann et al., 2014, p. 207].

In many electricity markets worldwide, a lock-in is actually being prevented. The regulatory environment fosters open access electricity and free choice of suppliers. Hence, switching processes are often even standardized. Still, the lock-in may be used for additional products and services offered besides the electric energy. For instance, an installed smart home platform from a specific vendor cannot be replaced easily with another one as the sensors, actors, and other devices are usually integrated into the home.

5.2.17 No Frills

A well known Business Model pattern is no frills [Gassmann et al., 2014, p. 226]. It is based on pruning the value propositions to the possible minimum by removing all non-essential features to offer lower prices to customers. The model is nowadays well known for instance for its application by US-American Southwest Airlines or Irish Ryanair in the airline business but is also used in other businesses such as supermarkets, gyms, and hotels. It is often coupled with the add-on pattern (see Section 5.2.1).

For electric utilities this pattern might be used by trimming the value proposition to the low-cost generation of electric energy. Additional features like usage of RESs or avoiding nuclear power

generation will be cut out of the offering. However, this pattern can be applied successfully only if necessary cost savings can be achieved. Digitization could be a possibility to lower costs of operation and maintenance (see Section 4.7). In order to compensate for low margins on the basic no frills offering, a combination with other patterns, such as add-on, might be useful.

5.2.18 Open Business

The open business Business Model pattern opens up the value creation process for the outside and includes external partners. It tries to create business opportunities for the company itself as well as partners by allowing win-win solutions [Gassmann et al., 2014, p. 230].

The increasingly connected world leads to a convergence of industries and requires electric utilities to develop into (for them) unchartered space by employing new technologies such as ICT and IoT. Partnering up with other businesses helps to find answers to the questions raised by customers and their current and future energy needs. Hence, many utilities cooperate with their suppliers and even competitors for common research and development projects in order to ensure the money invested is well spent. To open up and to integrate new partners into the value creation process, especially from outside the energy industry, is a fundamental component for future growth [Poetz et al., 2014].

5.2.19 Open Source

The open source Business Model pattern is well known from the development of software. In this pattern, products are not developed by a company itself, but by a public community. The intellectual property gathered by the community during the development is made available for further participants to join the community and contribute to the development. Open source development uses the wisdom of the crowd and saves money for the development. However, as the created product is freely available, other opportunities for revenue than the product itself have to be found [Gassmann et al., 2014, p. 235]. The open source Business Model pattern is often combined with the freemium (see Section 5.2.10) and the crowdfunding (see Section 5.2.3) patterns.

In the energy sector the open source pattern is not very common. However, it bears great potential to conquer industry challenges for the new and further development of technologies, such as for

generation, storage, and trading of electricity. The more people are involved in the development, the more diverse the results are.

5.2.20 Orchestrator

Using the orchestrator Business Model pattern companies focus on their core competencies in the value chain and outsource any other activities to specialized sub-contractors. Hence, the company can source from best-in-class companies, thereby reducing cost and gaining flexibility, but at the additional cost of coordinating the sub-contractors [Gassmann et al., 2014, p. 240].

For an electric utility – as in any other industry – to use the orchestrator pattern, it has to be aware of its key strengths, focus on them, and outsource all other activities to sub-contractors that need to be actively managed. For instance, an electric utility could focus on the generation of electricity only and leave marketing, customer acquisition, and billing to partners.

5.2.21 Pay per Use

The pay-per-use Business Model pattern customers pay for a product or services per specific usage [Gassmann et al., 2014, p. 244].

This is the traditional pattern for electric utilities, where customers pay – apart from a basic service charge – for the amount of electricity used. Nowadays, consumption is metered and charged on a monthly, quarterly, or yearly basis with a constant tariff per amount of electricity. Sometimes a lower tariff is charged during the night. With the introduction of smart meters in the next years, the current consumption could be instantly charged, allowing tariffs using dynamic pricing.

5.2.22 Peer to Peer

The peer-to-peer Business Model pattern is based on transactions between private individuals (peers) where the company's business is the provision of a safe and efficient organizational framework for these transactions [Gassmann et al., 2014, p. 252].

With the advent of Prosumers in the energy sector, private individuals will sell their generated energy to other individuals. These transactions will be made on an energy exchange platform that

will handle the deals. The demand for this and other services prepares the ground for layer player businesses (see Section 5.2.14) that work hand in hand with peer-to-peer businesses.

5.2.23 Performance-based Contracting

The Business Model pattern of performance-based contracting charges for a product based on the services it renders. This pattern is the opposite to the pay-per-use Business Model pattern as the use-intensity is irrelevant for the pricing, relating it to the flat rate pattern (see Section 5.2.8) [Gassmann et al., 2014, p. 257].

In the case of electric utilities, a company could offer to take care of all energy needs of a business or household. The company would, for instance, install, operate, and maintain solar panels on the roof, battery storage and a heat pump in the basement to provide the required energy for lighting, appliances, heating etc. to the customers. This would relief customers from larger investments and the burden of operating complex systems in exchange for long-term contracts paying a monthly fee.

5.2.24 Razor and Blades, Bait and Hook

The bait-and-hook Business Model pattern incorporates two dependent products. One is offered at a low price – even below cost – while the other product that is required for the use of the first product is high-priced and responsible for the generation of revenues [Gassmann et al., 2014, p. 261] [Osterwalder and Pigneur, 2010, p. 88]. This pattern is closely related with the lock-in Business Model pattern (see Section 5.2.16). Once customers are locked-in on a system by baiting them with the low-priced offer, the higher-margin offer can be sold to them easier because of switching hurdles.

For electric utilities this pattern cannot be used for the product of electricity itself but for additional products and services offered in relation to the energy needs and energy management of customers.

5.2.25 Rent Instead of Buy

In the rent instead of buy Business Model pattern, as the name says, a product is rented instead of sold to customers. For them it bears the advantage of saving acquisition cost and leaves them with more flexibility, less complexity, and greater comfort. The pattern is similar to the pay-per-use pattern (see Section 5.2.21) but with the difference that rents are for a certain time and not per usage. Also,

similarities with the fractional ownership pattern (see Section 5.2.9) exist but with the difference that a rent does not include any ownership and related responsibilities [Gassmann et al., 2014, p. 265].

For the core product of electric utilities this pattern cannot be used as electricity cannot be rented. But with additional products this pattern can be used indeed. Solar City, for instance, leases DERs to customers without down payments and hence make the adoption of solar power easy and economical [SolarCity, 2016]. Also, with smart metering and IoT finding the way into buildings and homes, customers will require new equipment to be able to exploit their benefits. Appliances like washing machines, dishwashers, etc. could be rented instead of sold to customers.

5.2.26 Revenue Sharing

The revenue sharing Business Model pattern is based on the collaboration of individuals or companies and sharing of the revenues created [Gassmann et al., 2014, p. 269].

Electric utilities can use this pattern and partner up with IT companies for ICT to provide products and services related to smart homes. Additionally, as described above, Prosumers are potential partners in a Business Model based on revenue sharing.

5.2.27 Solution Provider

When using the solution provider Business Model pattern a company provides all-inclusive packages of products and services in a particular domain that takes care of their customers' tasks and problems [Gassmann et al., 2014, p. 299]. The pattern is related to the layer player pattern (see Section 5.2.14) but a solution provider might not only provide a solution to one layer in the value chain but complete and more solutions.

For electric utilities this pattern can for instance be used by becoming a solution provider for all customers' needs related to energy in their daily lives, including products and services in relation to heating, mobility and transport.

5.2.28 Subscription

In the subscription Business Model pattern a customers enters into a contract with a company defining frequency and length of the provision to receive a product or services regularly. This long-term

commitment between the two parties offers the advantage of a discount for customers and repeatedly, foreseeable revenues for the company [Gassmann et al., 2014, p. 304]. The pattern is related to the performance-based contracting (see Section 5.2.23) and the rent instead of buy (see Section 5.2.25) Business Model pattern.

For electric utilities this pattern can for instance be used for a charging service for EVs including a monthly quota (or a flat rate in the extreme case) of electricity used for charging at the company's charging stations.

5.2.29 Trash to Cash

The trash to cash Business Model pattern builds its business on resources someone else considers useless. Considered waste by the supplier, the purchase price is low or even zero. The company uses this waste as resource, sells it or transfers it into new products [Gassmann et al., 2014, p. 316].

For electric utilities this pattern has already been used for years in combined cycle power plants. Typically, in such plants a gas turbine fired by natural gas is combined with a steam turbine. The exhaust of the gas turbine, before lost and considered waste, powers the steam turbine and allows to extract additional energy, thereby raising the efficiency of the complete power plant. Additionally, the wast heat from these two cycles is used for district heating.

5.2.30 Two-sided market

The two-sided market (or multi-sided market in case of more customer groups) Business Model pattern brings together two interdependent groups of customers and creates value by facilitating interaction between the two groups. It has been used, for example, by Google and Facebook by giving a free offer to a large group of customers on the one side and subsidize it by an offer given to an other group of customers that pay for the access to the first customer group [Osterwalder and Pigneur, 2010, p. 76] [Gassmann et al., 2014, p. 321]. This pattern is closely related to the hidden revenue (see Section 5.2.12) and the leverage customer data (see Section 5.2.15) pattern.

In the electricity sector this pattern is already used for energy exchange platforms such as the European Energy Exchange in Leipzig, Germany [European Energy Exchange (EEX), 2017]. For

electric utilities this pattern could be used to become an intermediary connecting all stakeholders in the electricity sector, e.g., Generators, Consumers, Prosumers and Traders, on a platform.

5.2.31 White Label

In the white label Business Model pattern the product does not get a specific name, i.e, is not branded, and is sold on the market by different companies under different names [Gassmann et al., 2014, p. 334].

With a product like electricity that cannot be labeled at all, the white label pattern is used by many owners/operators of generating facilities. Often they don't have the capacity to market their own product, hence, the electricity is sold to retailers that further sell it in form of a branded product to users.

5.3 Integration - New Business Models for Electric Utilities

In the previous Section listed a multitude of Business Model patterns that can either be used alone or combined with other patterns. Most patterns can be combined creatively in one or the other way, some are even related and typically go hand in hand. But not all patterns can be combined as some of them are mutually exclusive, at least for the same value proposition and the same customer segment. For instance, a company cannot be a layer player and an integrator at the same time. Likewise, the pay per use and flat rate pricing structures cannot be combined. Table 5.1 gives an overview of the pairwise relations between the described patterns.

In the following, a few Business Models will be qualitatively elaborated based on the archetypes and combinations of them presented in Section 5.2 above.

5.3.1 Leasing of Distributed Energy Resources to Prosumers

The rent-instead-of-buy archetype forms the basis for this Business Model (cf. rent instead of buy, Section 5.2.25). It can be complemented by optionally using further archetypes, as described below. The core Business Model and the options are depicted on the Business Model Canvas in Figure 5.4.

The value proposition is the leasing of DERs such as solar panels and auxiliary equipment to customers, including a service contract for installation, operation, and maintenance. The model could

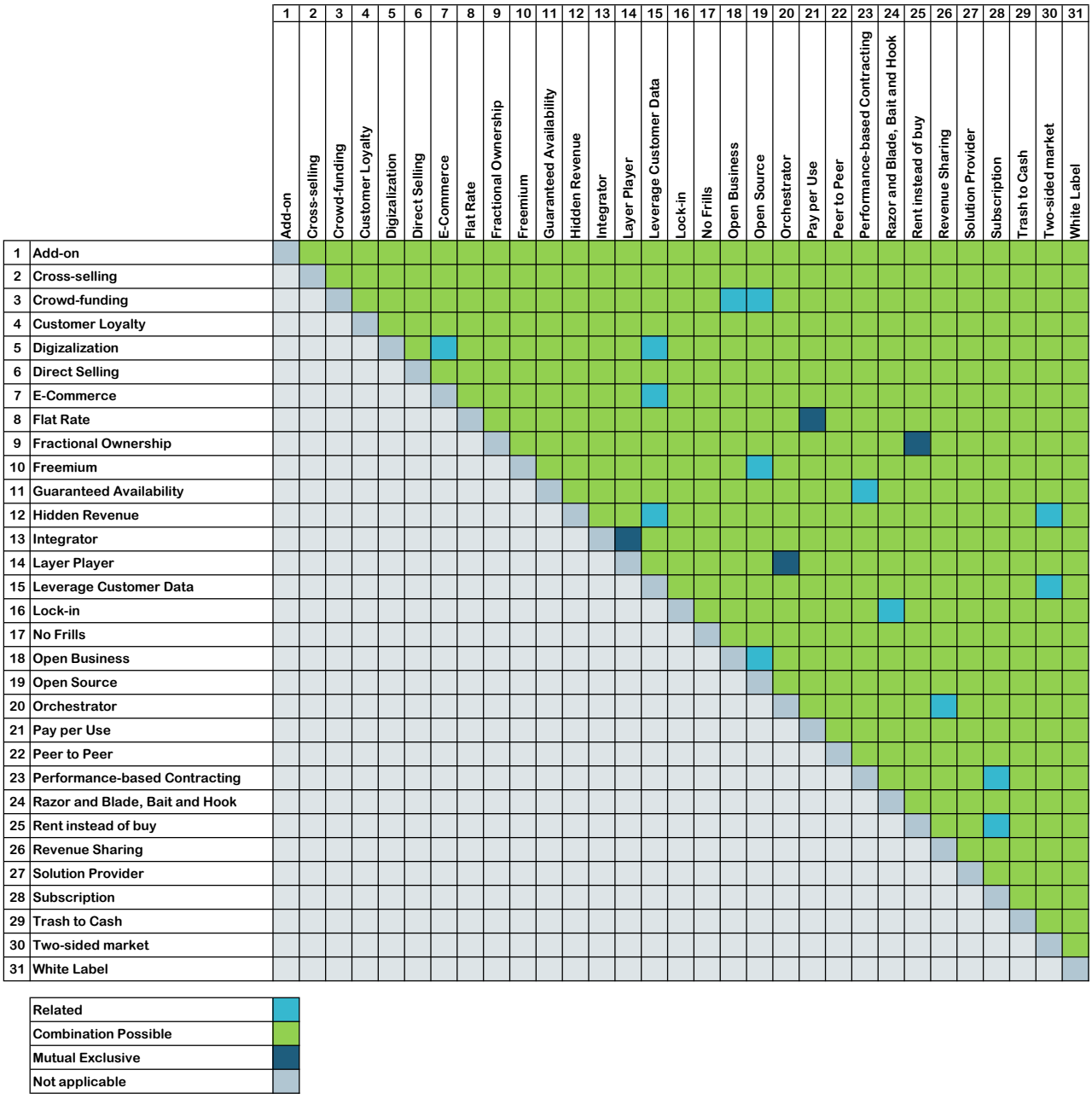

Table 5.1: Possible combinations of mentioned Business Model patterns

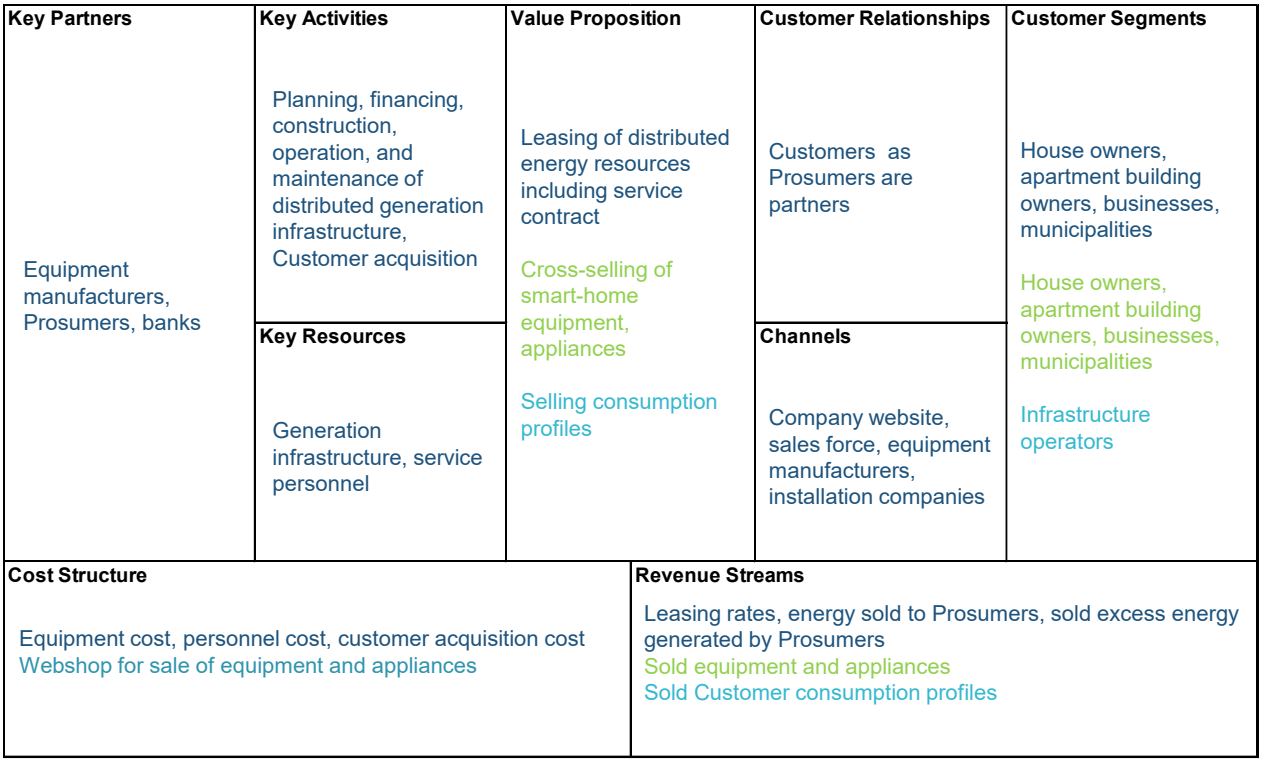

Figure 5.4: Leasing of DERs to Prosumers Business Model;
grey text describes the basic Business Model, green and turquoise text describe additional patterns applied

be similar to the leasing of cars with the difference that the leasing rates can be partly repaid with generated energy or, if the regulatory environment provides for it, with energy certificates or certificates for carbon dioxide (CO_2) savings. With the leasing contract, customers also contract the utility for the supply of additional electricity that cannot be supplied by customers' equipment themselves. This excess energy could be provided on a flat-rate basis (cf. flat rate, Section 5.2.8). The customer segment targeted are owners of single family houses or apartment buildings, businesses, and municipalities. These segments have a high interest in keeping their usually high utility bills predictable and as low as possible. Also, customers' interest in contributing to the fight against global warming is rising but they cannot afford the initial investment and don't have the know-how to install, operate, and maintain the required equipment. Channels to contact and inform customers about the offering can be a company website, dedicated sales force, equipment manufacturers, and installation companies for DERs. The latter could offer the leasing package when selling the equipment. Also, additional products and services can be sold over these channels. Customer relationships are important in this Business Model. Converting consumers into Prosumers converts original customers into partners. Also, the leasing contract is only an entrance to the possibility of offering customers additional prod-

ucts such as Intelligent Electronic Devices (IEDs) and appliances for a smart-home in a webshop (cf. digitalization, Section 5.2.5; cross-selling, Section 5.2.2; e-commerce, Section 5.2.7), perhaps also on a rental basis. Assisting consumers transform their homes into smart-homes can help them to consume electric energy more efficiently and hence save electricity and money. The reduced consumption can be converted into revenue by selling the generated and not self-consumed energy to others and sharing the revenue (cf. revenue sharing, Section 5.2.26). A smart home environment in customers' houses can additionally be used to measure real-time energy consumption and infer from monitored patterns to consumption habits. These customer data can be leveraged by using it for optimization of own infrastructure and by selling it to grid operators for optimizing their infrastructure (cf. leverage customer data, Section 5.2.15; hidden revenue, Section 5.2.12). Also, the data Key resources are, as in the traditional Business Model, the generation infrastructure. However, the generation infrastructure in this case consists of distributed generation facilities. Also, qualified personnel is a key resource for the service business offered. Asset management, assisted by digitalization (cf. digitalization, Section 5.2.5) is important to ensure a high utilization and lifetime of the equipment. Key activities are the planning, financing, installation, operation, and maintenance of the generation infrastructure. Additionally, customer acquisition is important because without a sound customer base, economies of scale cannot be properly ex ploited. Key partnerships are held with equipment manufacturers and customers. If the funding for the equipment does not come from the utility itself, partnerships with banks or other financing institutions are necessary. Revenue streams are the monthly leasing rates for the equipment. Also additional energy sold to customers and generated excess electricity fed into the grid bring about additional revenues that might be balanced with the leasing rate. Revenues from cross-selling of smart-home equipment and appliances and from selling consumption profiles add additional revenue streams. The largest chunk in the cost structure is made up by the equipment cost. Standardization of the equipment is important to guarantee low cost for procurement and to keep personnel cost for installation, operation, and maintenance low. The Business Model saves cost for renting space required for deploying the DERs that would be necessary with other approaches. Additional cost are incurred by operation of the webshop for the sale of the smart-home equipment and appliances. The sale of real-time consumption profiles can be established at almost zero marginal cost.

5.3.2 Layer Player for Charging Electric Vehicles

As the name suggests, the layer player archetype forms the basis for this Business Model (cf. layer player, Section 5.2.14).

The value proposition in this Business Model is the supply of electricity for EVs at quick-charging stations. Normal electricity outlets are indeed capable of charing EVs but the power they are able to provide is not appropriate for fast charging. Customers require quick charging in a time comparable to refilling gasoline or diesel to a car with combustion engine. The number of EVs is steadily increasing but there is currently a lack of charging infrastructure. The targeted customer segment are owners and drivers of EVs. Channels to contact and inform customers about the available charging stations can be a company website and a smartphone app. The latter could also be used for clearing of the energy supply. Customer relationships can be established through both the website and the app. In order to retain customers and keep them using the network of charging stations a customer loyalty program is advisable. Key resource in this Business Model is the charging infrastructure. Key activities are the construction, operation, and maintenance of the charging stations and the procurement of the electricity sold. Key partnerships are held with equipment manufacturers and manufacturers of EVs for possible flat-rate contracts for charging sold with the vehicle. Additionally, partnerships should be developed with property owners of locations for the charging stations. The revenue stream is generated by the sale of electricity to drivers of EVs. Cost structure is composed of the the cost for construction and operation of charging infrastructure and the cost for the electricity sold.

The location of the charging stations has to be selected carefully. Like for gas stations, they have to be at highly frequented spots such as to attract the maximum possible number of customers. With current technological limitations for the speed of charging, the locations for charging stations will differ significantly from traditional gas stations. Charging stations should be located along highways just like gas stations but additionally at parking areas of shopping centers and supermarkets. There, customers can use the charging time to do their shopping or, vice versa, use the shopping time for charging their EVs. Hence, this Business Model is of particular interest for shopping centers, supermarkets, and parking garages. The Business Model with alignment to shopping centers and supermarkets is depicted on the Business Model Canvas in Figure 5.5. Supermarkets and shopping centers already occupy spots with high customer frequency and just have to convert some of the park-

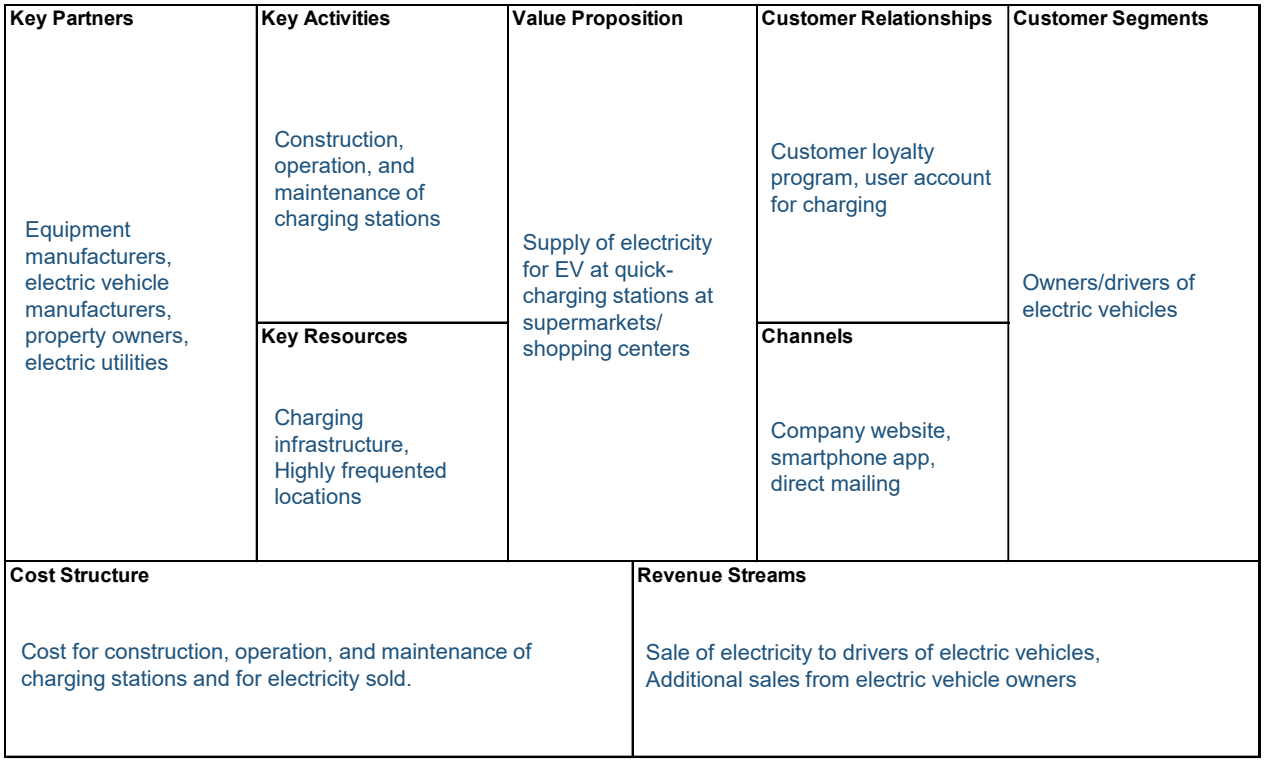

Figure 5.5: Supermarkets/Shopping Centers as Layer Player for Charging EVs Business Model

ing spots into charging stations. Also, a grid connection with a sufficient power rating is available. Supermarkets and shopping centers can cross-sell electricity for EVs (cf. cross-selling, Section 5.2.2) or they offer charging services for free as reward in a customer loyalty program (cf. customer loyalty, Section 5.2.4) or as special services to all their customers during their shopping (cf. lock-in, Section 5.2.16). For shopping centers and supermarkets this Business Model has unique advantages. They have an advantage over other competitors in the cost structure as they already own/rent the highly frequented locations. Cost for installation, operation and maintenance of the charging stations are relatively low and outsourcing of these activities would be advisable. Also, supermarkets and shopping centers already have high customer frequency and offer additional products and services to attract owners and drivers of EVs.

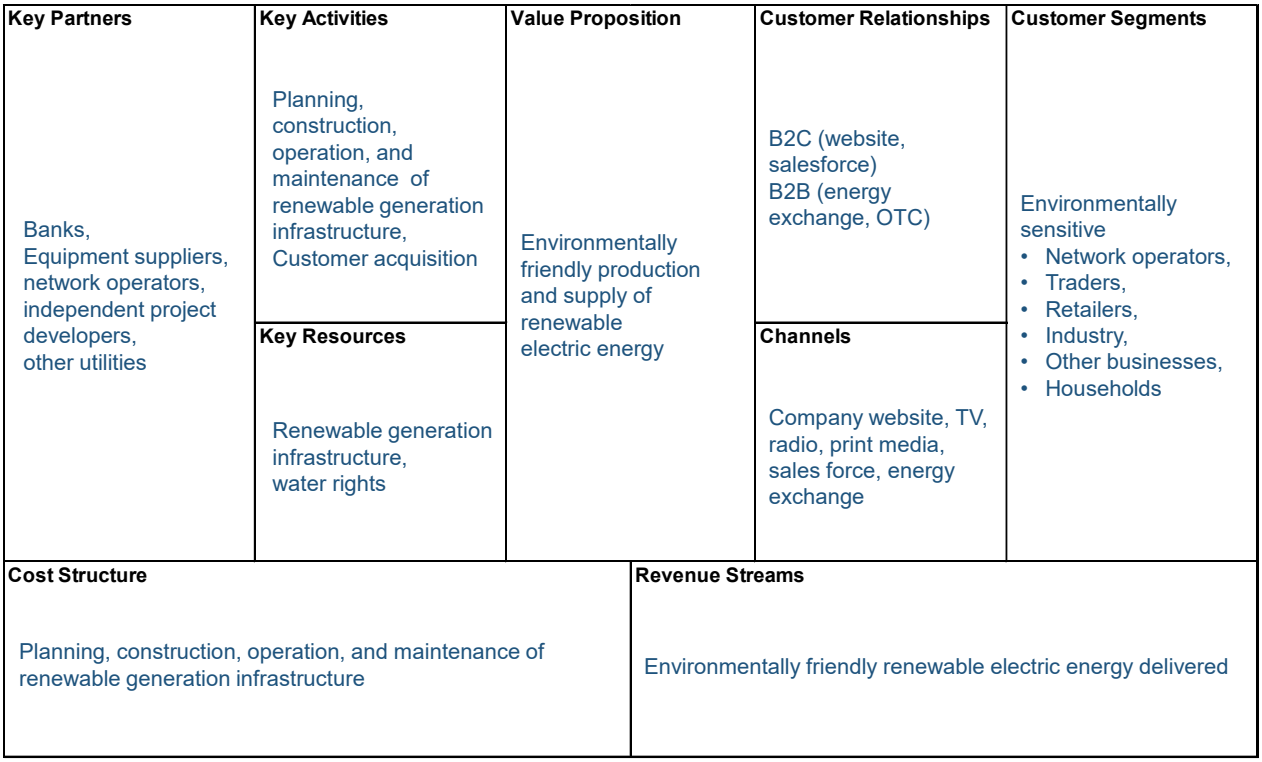

Figure 5.6: Large Scale Renewable Energy Business Model

5.3.3 Large Scale Renewable Energy

This Business Model is based on the traditional one for electric utilities. The value proposition, however, is qualitatively different by offering electricity that is produced environmentally friendly and renewable [Richter, 2012] [Nimmons and Taylor, 2008]. The Business Model is depicted on the Business Model Canvas in Figure 5.6.

The value proposition is the bulk production of renewable electric energy. The enhanced quality of the electricity which is its environmentally friendly production and renewable source is a value added for customers for which they are willing to pay premium prices. The targeted customer segments are environmentally sensitive network operators, traders, retailers, industry, other business customers, and households. It is important to identify the environmentally sensitive share of the mentioned groups that are willing to pay a premium for renewable energy to target them with new electricity tariffs. Channels used to inform customers are television, radio, print advertisements, the company website and social media. Traditional media are more costly and less targeted but allow to reach as well older customers. Conclusion of contracts with B2B customers is done mainly through the company websites or through sales personnel. For B2C customers OTC trading and energy exchanges

providing both spot and derivatives markets are used. Customer relationships, as in the traditional Business Model, are either B2B or B2C relationships either directly through the website, through sales personnel for OTC trading, or automatically for exchange trading. Key resources comprise the infrastructure for renewable generation, i.e., RESs as well as the resources to run them. Sun and wind are for free, but water rights for hydropower plants have to be acquired. Key activities are planning, construction, operation, and maintenance of renewable generation infrastructure as well as customer acquisition. Key partnerships are held with banks for financing of projects, electricity network operators, and suppliers of generation infrastructure. Also, as not all utilities have the capabilities for large-scale renewable energy infrastructure development projects, independent project developers might be essential partners. Finally, other smaller utilities might be partners in the joint development of large-scale projects for development of RESs. Revenue streams are created by charging the customers for the amount of delivered environmentally friendly, renewable electric energy. The cost structure is made up by the cost incurred by planning, construction, operation, and maintenance of generation infrastructure.

5.3.4 Renewable Electricity without Frills

This Business Model is in its core based the no frills pattern (cf. Section 5.2.17). The idea is to generate electric energy for the cheapest possible price possible without offering any additional products or services and is well known from the airline business. The Business Model comes in two flavors. On the one hand there is a B2B type and on the other hand there is a B2C type of this model. The Business Model with its two types is depicted on the Business Model Canvas in Figure 5.7.

The value proposition is low price, renewable electricity. This applies to both the B2B and the B2C type. For the latter, the value proposition additionally contains dynamic pricing based on supply and demand. Additional products and services can be offered as add-ons (cf. Section 5.2.1), if required. The two types of this Business Model target different customer segments. The B2B type sells the generated energy at the energy exchange or to traders, retailers, etc. based on long-term OTC purchase agreements. Here, the Business Model can integrate the white label pattern (cf. Section 5.2.31) selling renewable electricity to customers that further sell it in form of a branded product to their customers. In that case, the company would act as a layer player (cf. Section 5.2.14), specializing

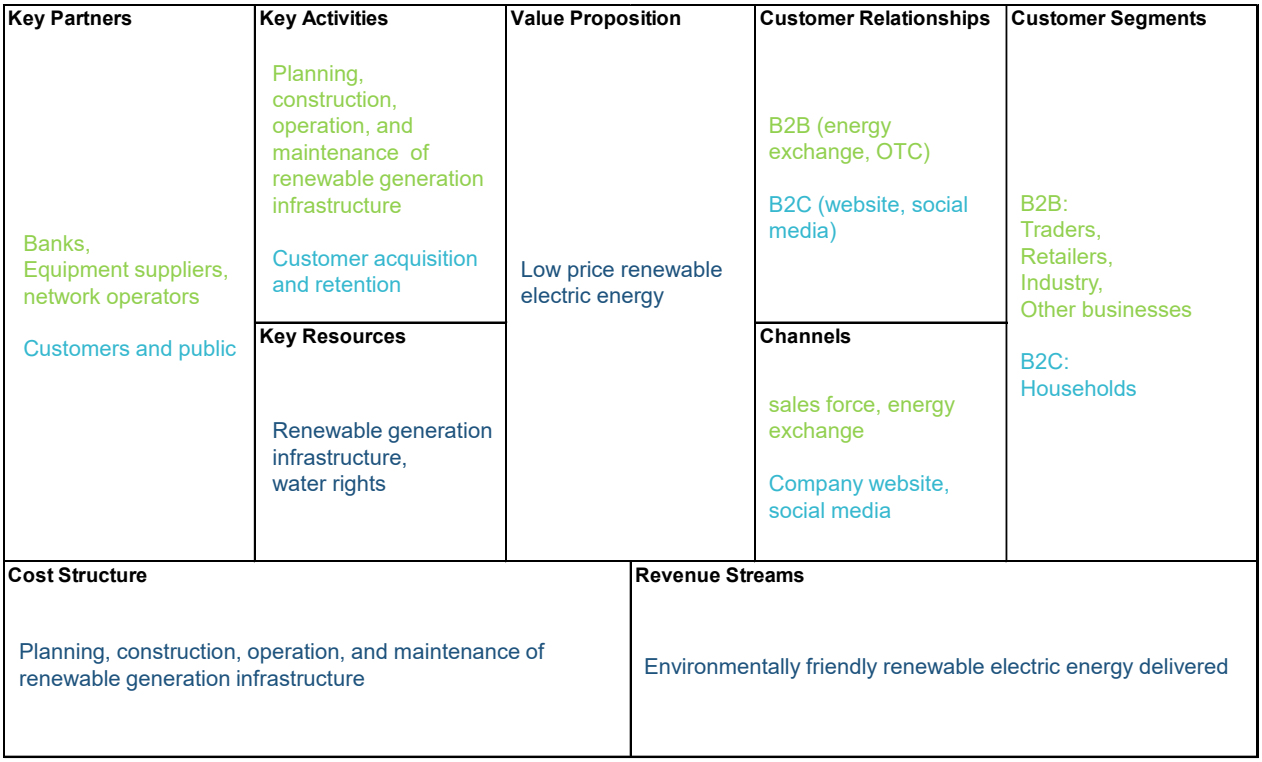

Figure 5.7: Renewable Electricity without Frills Business Model;
green text applies to the B2B type, turquoise text to the B2C type, and grey text to both types of the Business Model

on the generation of renewable electricity. The B2C type sells the generated energy to customers like households under the company's own brand. As channels, the B2B type Business Model uses an energy exchange or sales force for OTC trading of electricity. The B2C type uses low cost approaches such as the company website and social media to inform customers about the offering. Customer relationships are either on a personal level for OTC trading or very limited for energy exchange trading in the B2B type Business Model. The B2C type will use targeted and low cost means to establish a relationship with customers such as the company website and social media. Key resources are the renewable generation infrastructure and are the same for both types of this Business Model. As it is based on the no frills pattern, utilization of the generation infrastructure should be as high as possible. Planned outages should be as short as possible and unplanned outages should be avoided at all. Digitalization (cf. Sections 4.7 and 5.2.5) can assist through predictive maintenance to achieve this goal and to ensure the maximum possible lifetime of the infrastructure. Key activities are the planning, construction, operation, and maintenance of renewable electricity generation infrastructure. For the B2C type of the Business Model customer acquisition and retention are additional key ac-

tivities. Key partnerships are held with banks and other financing institutions, equipment suppliers, and network operators. In case of selling the electricity under an own brand in the B2C type of the Business Model, customers and the general public can be used to finance development projects for the generation infrastructure through crowd-funding (cf. Section 5.2.3). The return expected from the crowd is different and is less financially focused than for institutional investors. Instead, the crowd want to see certain projects being realized. Hence, capital could possibly be raised at lower cost for development projects for renewable energy generation. Revenue streams are generated through sold renewable electricity on a pay-per-use (cf. Section 5.2.21) basis. On energy exchanges in the B2B type Business Model the electricity is traded for a price based on current supply and demand. A similar dynamic pricing should be applied in the B2C type provided that customers/consumers have smart meters installed. This could allow for higher margins to be gained in high-demand periods. Like in the airline industry, where customers change their travel arrangements in order to take a cheap flight, customers of the electric utility can be motivated to change habits in order to get low electricity prices. An adaption of customer behavior isn't even required with the advent of IoT and smart appliances that could exploit low-priced electricity periods automatically. The cost structure is of utmost importance in this Business Model. In order to achieve low prices, the cost have to be kept low. The cost incurred arise from planning, construction, operation, and maintenance of renewable generation. For construction of infrastructure, crowd-funding can be utilized, as mentioned above. Predictive maintenance can be used to maximize the utilization of infrastructure and extend its lifetime.

5.3.5 Energy Solution Provider

With this Business Model a company can provide products and services related to energy out of one hand. There are two options for a company to provide the full spectrum of product and services to its customers. The first option is to have all the capabilities in house and to base the Business Model on the integrator pattern (cf. Section 5.2.13). The second option is to focus on core competencies and to serve additional products and services to customers using an extensive network of sub-contractors, basing the Business Model on the orchestrator pattern (cf. Section 5.2.20). Sub-contractors are layer players (cf. Section 5.2.14) specialized on certain parts of the value chain. Both options are viable for electric utilities depending on their level of integration along the value chain and on the competi-

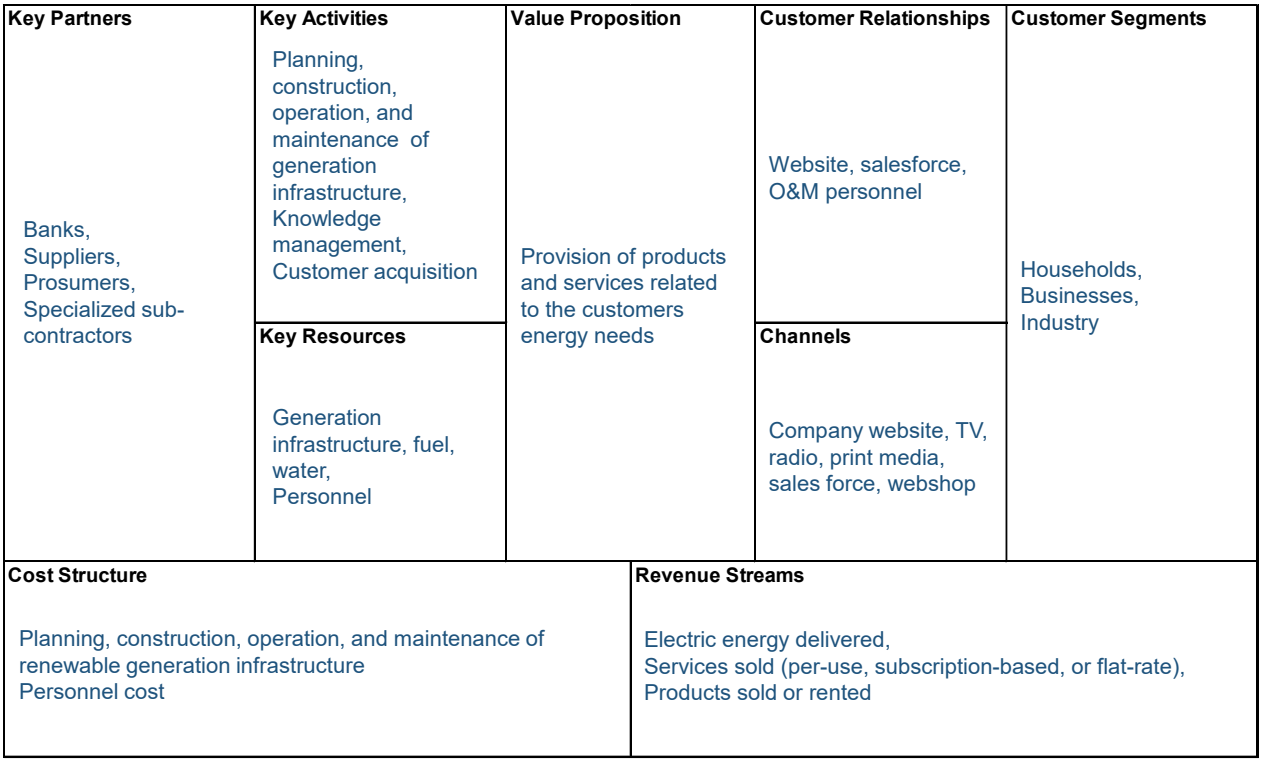

Figure 5.8: Energy Solution Provider Business Model

tiveness of certain areas in the company. Also a middle course between both options is possible. The Business Model is depicted on the Business Model Canvas in Figure 5.8.

The value proposition, generally put, is the provision of products and services related to customers' energy needs. Customers want to have their energy needs satisfied, are interested in a low electricity bill but usually don't want to change their consumption habits as a result of their lifestyle. As a reliable partner, the company serves as one-stop-shop for all energy needs. In addition to the traditional value proposition of generation and sale of electricity, utilities can provide consulting services to their customers helping them to lower their utility bills by assisting them to become Prosumers and to raise efficiency and save energy for instance by exchanging light bulbs with Light Emitting Diodes (LEDs), replacing and enhancing thermo-insulation, heating system, and windows of their homes. The utility can also provide financing for customers' infrastructure investments. Hand in hand with the mentioned services, the utility can provide products such as complete facilities for renewable energy generation, sensors, actuators, and control equipment for smart homes, smart appliances, and EVs (cf. cross-selling, Section 5.2.2). Products don't necessarily have to be sold but can also be rented to clients based on the rent-instead-of-buy pattern (cf. Section 5.2.25). Further services to

offer are installation, operation and maintenance of the sold products. Services can be provided on a pay-per-use (cf. Section 5.2.21), subscription (cf. Section 5.2.28), or flat-rate basis (cf. Section 5.2.8). The targeted customer segments are households, businesses, and industry. The three segments differ widely in the energy volume and power needed, the required services, and their financial capabilities. Channels used to inform customers are television, radio, print advertisements, the company website and social media. Traditional media are more costly and less targeted. However, in order to reach customers that are not active online such as elderly, traditional media are the only chance. Simple energy delivery contracts can be completed through the company website but consulting services as well as installation, operation and maintenance contracts will be made by sales personnel. Simpler, less complex products can be sold over a webshop such as light bulbs and smart home equipment. Products requiring substantial amount of explanation during the sales process like generation facilities for renewable energy will be sold through well-trained sales professionals. Customer relationships are either directly through the company website, through sales or operation and maintenance personnel. Customer requirements have to be monitored in order to modify the offering and sharpen it to current needs. As the utility still delivers electricity to their customers, key resources comprise the generation infrastructure together with required fuels. Well-trained personnel represents a key resource for the services offered. For the provision of electricity to its customers, the utility has to undertake the key activities of planning, construction, operation, and maintenance of generation infrastructure. Banks are partners for financing of projects, suppliers provide the equipment for new projects Additionally, for the service-based part of the business, knowledge management is of importance. Key partnerships are traditionally held with banks for financing of projects, electricity network operators, and suppliers of power plants and fuels. For all parts of the value chain, specialized sub-contractors can be used, which in that case are key partners as well. Additionally, partnerships can be held with customers for financing (cf. crowd-funding, Section 5.2.3; fractional ownership, Section 5.2.9) and with Prosumers for revenue sharing (cf. Section 5.2.26). Revenue streams are created by charging the customers for the amount of delivered electric energy, by the services sold (either on per-use basis, subscription based, or as a flat rate), and by products sold or rented to customers. The cost structure is made up by the cost incurred by planning, construction, operation, and maintenance of generation infrastructure, where operation includes fuels such as coal, oil, and gas. Additional costs are incurred by the person-

nel required for the services offered, regardless of the personnel being employed with the utility itself or by sub-suppliers.

As described and referenced above, this Business Model is a set of intertwined Business Model patterns for the provision of a variety of products and services related to customers energy needs. The various patterns each provide a plethora of available tactics to employ (cf. Section 2.1). The challenge is to distribute limited available resources within the company to the activities necessary to make the patterns act in concert. The key to discovering the right blend of patterns and tactics lies in the implementation step of the Business Model in which it is tested on a small scale.

5.4 Implementation

In a last step, the new Business Models presented above have to be tested in a real business environment usually by deploying them on a small-scale for testing the various assumptions made during the Business Model design (cf. Section 3.2.2). This happens either within an established electric utility (fully integrated, in a subsidiary, or a spin-off) or within a new start-up. In further steps, the Business Models have to be refined and integrated to the company's core business. The implementation step for Business Models for electric utilities is not scope of this Thesis. The challenge of testing the ideas on the market is left to electric utilities and start-ups with the necessary resources.

6

Summary and Outlook

In this Thesis, new Business Models for electric utilities were elaborated. In a short introduction in Chapter 1, the importance of innovation and Business Model Innovation in particular for electric utilities has been described. To clarify the concept of Business Models, an extensive overview of the available literature related to Business Models was given in Chapter 2. It was shown that there is no common understanding of the concept of Business Models among scholars and, as a result, and a definition for the use throughout this Thesis was forged. Further, Chapter 3 explained the motivation and objectives of Business Model Innovation and how it can help electric utilities to address challenges related to the energy transition and other market changes. A systematic two-phase approach for analysis and innovation of existing and development of new Business Models was introduced. The Business Model Innovation process shown spans all tasks from a thorough analysis of the business environment to the implementation of a Business Model. Trends that are currently influencing the business environment of electric utilities and will continue to further do so in the future were presented in Chapter 4 and their expected influence on electric utilities was set out. Finally, the Business Model Innovation process introduced before was applied in Chapter 5. After pointing out historical Business Models for electric utilities and analyzing their current business environment, existing Business Model archetypes used in other industries have been explained and systematically evaluated regarding their applicability for electric utilities. The investigated archetypes have finally be combined and integrated exemplarily into new Business Models for electric utilities.

Based on this Thesis, in a next step, the Business Models have to be implemented to test the assumptions made and make proper adjustments. Obviously, the presented Business Models are by no means exhaustive. Further and new combinations of the presented and other Business Model archetypes can be created to react to the changing business environment of electric utilities. Also, ever changing technology creates new challenges and opportunities every day that have to be addressed by companies – including by means of Business Model Innovation – in order to stay competitive in existing markets and to explore new market opportunities.

Glossary

AI	Artificial Intelligence. 31
Ancillary Services	Ancillary Services are necessary services in an electric power grid to support the transmission of electric power and to maintain reliable operations of the transmission system. 39, 44
B2B	business-to-business. 39, 42, 63–66
B2C	business-to-customer. 39, 42, 63–66
Business Model	A business model describes the rationale of how an organization creates, delivers, and captures value [Osterwalder and Pigneur, 2010]. vii, 3–15, 17, 20–24, 35, 37–67, 69, 71, 72, 77, 79
Business Model Canvas	The Business Model Canvas is a template for developing, documenting, and analyzing business models [Osterwalder and Pigneur, 2010]. 10, 14, 15, 37, 38, 57, 61, 63, 64, 67, 77
Business Model Innovation	Business Model Innovation is the alteration of an existing Business Model or the development of a new Business Model that is better suited to the modified business environment a company acts in. vii, 3–5, 10, 17–22, 35, 71, 72
Business Model Navigator™	The Business Model Navigator™ describes processes for the development of business models. It is an "action-oriented methodology that permits a company to break with its dominant industry logic and innovate its business model" [Gassmann et al., 2014, p. 20]. 20

CO_2	carbon dioxide. 26, 27, 59
DER	Distributed Energy Resource. 30, 33, 43, 55, 57, 59, 60, 77, *see* Distributed Energy Resource
Distributed Energy Resource	Distributed Energy Resources (DERs) are flexible, decentralized, and modular generation facilities that are located close to the consumer they supply with energy.
DSO	Distribution System Operator. 38
EJ	exajoule. 1, 28
Electric Vehicle	Electric Vehicles are vehicles that use one or more electric motors for propulsion.
Electrification	Electrification is the change to electricity from other sources of energy. Also, it means the process of powering by electricity. 27
EV	Electric Vehicle. 33, 41, 56, 61, 62, 67, 77, *see* Electric Vehicle
GHG	greenhouse gas. 3, 26, 27, 29
Grid Defection	Customer defect from their utilities and the electricity grid to supply themselves with power from their own local generation sources, e.g., solar panels or wind turbines [Rocky Mountain Institute, 2014]. 40
GW	gigawatt. 28
HVAC	Heating, Ventilation, and Air Conditioning. 31
ICT	Information and Communications Technology. 3, 5, 29, 31, 46, 47, 50–52, 55
IED	Intelligent Electronic Device. 31, 32, 60
IIoT	Industrial Internet of Things. 31
Internet of Things	The Internet of Things (IoT) is the networking of smart connected devices embedded with electronics and software to collect and exchange data. 31, 46, 74
IoT	Internet of Things. 31, 32, 46, 52, 55, 66, *see* Internet of Things

Kilowatt-hour	Kilowatt-hour (kWh) is a unit for energy usually used in practice in electrical power engineering. 1kWh is equivalent to 3.6MJ, where Joule (J) is the base unit of energy within the International System of Units (SI).
kWh	Kilowatt-hour . 38, *see* Kilowatt-hour
LED	Light Emitting Diode. 67
Load Defection	Customer Load Defection is the shift of customers from traditional grid supply to getting electricity from their own local generation sources, e.g., solar panels or wind turbines [Rocky Mountain Institute, 2015]. 40
M2M	machine-to-machine. 31, 33
Microgrid	A Microgrid is a group of interconnected loads and distributed energy resources (DERs) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode [Office of Electricity Delivery and Energy Reliability Smart Grid R&D Program, 2011]. 30, 42, 47
OTC	over-the-counter. 39, 42, 63–65
Process Innovation	Process Innovation is the implementation of improved processes in a company with the objective to increase product or services capabilities and cost. 17
Product Innovation	Product Innovation is the improvement of a existing product or the development of a new product or service with the objective to create improved versions of previous goods or services. 17
Prosumer	A prosumer is an actor in the energy market that is both a consumer and a producer of electric energy. 30, 40–42, 44, 53, 55, 59, 67, 68, 77
PV	photovoltaics. 27, 28

Renewable Energy Source	Renewable Energy Sources (RESs) are wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases according to Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources [European Parliament and the Council, 2009a].
RES	Renewable Energy Source. 3, 4, 27–29, 42–46, 48, 51, 64, *see* Renewable Energy Source
RIOC	Return on Invested Capital. 3
Smart Metering	Smart Metering is the use of digital devices for measuring and recording the energy consumption at regular intervals. They can be remotely read and thus allow instant information about the current consumption of a customer. 46
TFC	Total Final Consumption. 1
TPES	Total Primary Energy Supply. 1, 2, 28, 77
TSO	Transmission System Operator. 38

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