SMALL-SCALE, BIG IMPACT – UTILITIES' NEW BUSINESS MODELS FOR "ENERGIEWENDE"

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Abstract: The European electricity industry looks back on two decades of major changes: The liberalization has just been mastered, but the rising diffusion of renewable energy generation and especially small-scale distributed renewable energy generation (DREG) poses new challenges. Electricity from renewables has priority in the grid and is supported by feed-in-tariffs in many countries in order to realize the "Energiewende". Hence, big power plants have to be operated under partial load for long periods and therefore do not reach their full efficiency. Consequently, the classic utility business model (UBM) summarized as "invest in a plant, earn a return, and turn the meters" is seriously challenged and additional business models (BM) for DREG seem vital. This paper addresses the major challenges for utilities concerning "Energiewende" and presents five new utilities' BMs for small-scale DREG focused on optimized energy solutions for the customers and suitability regarding market potential and utilities' capabilities.

Keywords: Business Model, distributed renewable energy generation, renewable energy technologies, Energiewende

1 Introduction

"Energiewende"[1] has become a synonym for the process of successful conversion to renewable energy and the phase-out of fossil and nuclear energy. However, it is not only a European phenomenon; some 120 countries around the world have policies that support renewable energy and most of them are developing countries (REN21 2013). Nevertheless, opinions are divided and the term has become an emotive word, not only in public discussion, but even more so in the electricity industry. The European utilities have been facing major changes in their markets and environment throughout the last two decades. The formerly very regulated and monopolistic market situation was completely changed by the EU-directive on energy market liberalization. Further major drivers of change in the energy industry were the EU's "20-20-20 Goals" and the "EU Roadmap 2050" that started paving the way for a broad diffusion of renewable energy in the EU ("Energiewende"). These directives led firstly to the unbundling of the production and electricity distribution business from grid ownership and grid operation and secondly to the rise of DREG systems. During the last few years, the situation of the utilities has become increasingly complicated. Electricity from (distributed) renewable energy plants (wind power, photovoltaics, etc.) has priority in the grid and is also supported by feed-in-tariffs. The big power plants have to be operated under

[1] The term "Energiewende" goes back to the 1980's and a publication of the German Öko-Institut (Krause et al. 1980) which drew scenarios for growth and prosperity without oil and uranium.

partial load for long periods and therefore do not reach their full efficiency and earnings and specific electricity production costs (€/kWh) rise. Consequently, the classic utility business model (UBM) of producing electricity in large-scale, centralized plants and selling it over long distances to the customer is seriously challenged.

This paper addresses the questions of how utilities can cope the challenges of "Energiewende" and even benefit from the diffusion of renewable energy, which roles utilities can play in a combined centralized-distributed electricity generation, and which BMs could be suitable for small-scale DREG.

Therefore, I give a short introduction into the genesis of business modelling and the theoretical framework (Chapter 2) followed by a brief presentation of the qualitative research approach of developing BMs via morphological fields (Chap. 3). In Chapter 4 I introduce the major challenges for the utilities and their BM to show the necessity of integration small-scale DREG in new BMs, followed by a short overview of the literature on BMs and BM innovation in the electricity industry (Chap. 5). Chapter 6 presents the outcome of the study's analysis: Firstly, a generic approach for developing BMs based on distributed, renewable energy technologies (business model morphology) and secondly, five BMs for the utilities in the field of small-scale DREG. Finally, I discuss the results and address limitations (Chap. 7).

2 Theoretical Framework

Business Models' Origins, Definitions, and Conceptualizations

The first reference to the term business model dates back to the 1950's (Bellman et al. 1957). Especially since the expansion of internet businesses it became widely used in media, business and science, but it is still unclear what BMs are and what for they should be used (Günzel & Krause 2013; zu Knyphausen-Aufseß & Meinhardt 2002). Even the rising number of scientific and non-scientific publications did not change much about this lack of clarity (Zott et al. 2010; Ghaziani & Ventresca 2005). Another problem is that different scholars writing about BMs do not mean the same thing (Linder & Cantrell 2000; Osterwalder et al. 2005). Because of the disagreement about BM definitions, many different conceptualizations exist. Overviews of them are presented by various authors (e.g. Rauter et al. 2012; Bieger & Reinhold 2011; Wirtz 2011). Here, we only want to give a short impression of the range of conceptualizations over the last ten years (see Table 1). In our study we followed the definition of Osterwalder & Pigneur (2010, p.14) ("[..] *a business model describes the rationale of how an organization creates, delivers, and captures value.*") and their "Business Model Canvas" to describe and analyze the basic elements of BMs (Table 1).

Business Model Innovation

The uncertainty about BM definitions continues in the field of business model innovation (BMI). BMI can be seen as a process (Liedtka & Meyer 2009; Osterwalder & Pigneur 2010) or as a result of a BM-change. The object of innovation is also defined differently; some see BMI as an innovation of one (Sinfield et al. 2012), two or more BM-elements (Lindgardt et al. 2009); others argue that BMI stands for the innovation of the complete BM (Steenkamp & van der Walt 2004). For this paper we interpret BMI as the process of improvement and change of at least one element of the BM.

Table 1 Business Model Concepts (adapted from (Rauter et al. 2012)

Author	Definition	Elements of the Business Model
Osterwalder & Pigneur (2010)	„A business model describes the rationale of how an organization creates, delivers, and captures value."	• **Customer Segments** • **Value Propositions** - Bundle of products and services that create value for a specific customer segment • **Channels** - How a company communicates with and reaches its customer segments to deliver a value proposition • **Customer Relationships** - Types of relationships a company establishes with specific customer segments • **Revenue Streams** - The cash a company generates from each customer segment (costs must be subtracted from revenues to create earnings) • **Key Resources** - Describe the most important assets required to make a business model work • **Key Activities** - Describe the most important things a company must do to make its business model work • **Key Partnerships** - Describes the network of suppliers and partners that make the business model work • **Cost Structure** - Describes all costs incurred to operate a business model
Hamel (2000)	Business concepts and business models are composed of the same building blocks - a business model is nothing more than a business concept converted into practice.	• **Interface to the Customer** - Execution and support - Information and insight - Relational dynamics - Price structure • **Core Strategy** - Business mission - Product/market scope - Basis of differentiation • **Strategic Resources** - Core competences - Strategic assets - Core processes • **Value Creation Network** - Suppliers - Partners - Alliances
Bieger & Reinhold (2011)	A business model describes the basic logic of how an organization creates value. Thereby, the business model determines, (1) what an organization offers, that is of value for customers, (2) how values are created in an organizational system, (3) how created values are communicated and transferred to the customers, (4) how the created values in form of revenues are "captured" by the company, (5) how the values are distributed inside the organization and to shareholders, and (6) how the basic logic of the creation of value will be further developed to ensure the sustainability of the business model in the future.	• **Value Proposition** - Type of value proposition - Tangible and intangible products, services or a combination • **Value Creation** - Fulfillment of value proposition for the customer • **Value Communication and Transfer** - Type of exchange with the customers - Transfer of services • **Value Capture** - The way how revenues of the created value flow back • **Value Dissemination** - The way values or earnings are distributed inside the company and to capital providers as well as other stakeholders • **Value Development** - Dynamic aspects of the business model

3 Methodology

This paper is based on the results of a joint project with partners from academia and a large Austrian utility, which has already gained some experience in DREG, but wanted to establish a broader, more systematic approach in this field. Thus, we were interested in possibilities for integrating small-scale DREG units (< 250 kWel) into the value creation and proposition of utilities – two of the core elements of a BM. Therefore, we investigated the BM situation of selected utilities worldwide (n = 11), which are using renewable energy technologies at micro- or small-scale level (< 250 kWel) and conducted a brief literature research on BMI in the field of renewable energies. We took wind power, photovoltaics, hydropower, combined heat and power generation plants (internal combustion engine, gas turbine, Stirling engine, fuel cell and biomass gasification) as well as thermal and electric storage systems into consideration.

The outcome of this analysis was used (1) to illustrate the challenges of European utilities concerning "Energiewende", (2) to sketch utilities' real-world BMs with the help of Business Model Canvas (Osterwalder & Pigneur 2010) and (3) to develop the different characteristics for the BM morphology[2], a specific morphological field scheme (Zwicky & Wilson 1967). Using this tool, the results of the qualitative real-world BM research, and the literature base we (4) developed specific BMs for small-scale DREG. For validation we applied a recursive improvement and refining process based on two intensive workshops with the sales representatives of our project partner (also responsible for the firm's BM development). All these insights were integrated into the morphology, which gives a comprehensive overview of specific BM characteristics and their expressions for the application with distributed renewable energy BMs for utilities.

Marko et al. (2013) have already presented the closer details about real-world BMs and the methodological approach for BM design. This paper focuses on the challenges of the European Utilities and presents five new BM-approaches for integration of small-scale DREG.

4 Challenges for European Utilities

The following major challenges for the European utilities will show the necessity of rethinking the classic UBM and present the integration of small-scale DREG in new BMs as one possible solution.

4.1 Development Targets for Renewable Energies

In December 2008, the EU Parliament agreed on the "20-20-20-Goals" (Directive 2009/28/EC) – a package with measures on climate protection and renewable energy promotion – to increase the amount of renewable energy by 20 % (of the primary energy) by 2020. Another driver of change in the field of renewable energy usage is the "EU Roadmap 2050" confirmed on March 8, 2011. It discusses the feasibility and challenges of an 80 % greenhouse gas (GHG) reduction objective (based on 1990's level) and presents practical

[2] Morphological fields have already been used to structure and analyze BMs in other industries (Lay et al. 2009).

scenarios and solutions[3] (ECF 2010). These political visions of the energy future have led to a broader usage of renewable energies in the electricity industry and the amount of renewable energy promises to increase even further. This results in an ongoing change to the utilities' business environment. Electricity from renewable sources (distributed renewable energy plants of micro- and small-scale, as well as large-scale wind-power and PV-parks) has priority in the grid. But the volatility of their generation (wind and solar volatility) results in two problems: (1) balancing the demand with the generation and (2) operating the conventional power plants in part load. To address the first problem, the role of generation forecasts for renewables becomes increasingly important; a new capability for grid and power plant operation, and electricity trading is needed (Graebner & Kleine 2013). Another solution can be seen in smart grids and in the interaction of generation, storage, grid management and in particular demand-side management. But there are some crucial points still open (e.g. data security, ownership of the meter, metering as service, communication between grid and users' individual devices). The second problem is closely connected: When the renewable power plants start producing, the conventional power plants have to reduce their output. For the utilities this results in more part load phases, more starting and shut-down cycles, more wear and tear and at the same time less efficiency and revenue per year. These two problems are becoming more serious the more renewable energy is produced.

4.2 Cost Pressure and Aging of Conventional Power Plants

If the large, conventional power plants have to be operated under partial load or shut down for longer periods, they do not reach their full efficiency and their specific electricity production costs (€/kWh) rise. At the same time, the day-ahead trading prices for electricity at the power exchanges (e.g. EPEX - European Power Exchange in Leipzig) decrease, because of the high amount of nearly zero-cost renewable electricity[4] (Kemfert 2013; Graebner & Kleine 2013). This puts pressure on the fossil power plants, and many modern and efficient combined-cycle gas turbine plants (CCGT) are switched off, because the conversion of gas into electricity is too expensive. However, this is not only a current problem, but also one that will reach into the future. The energy efficient and lower GHG-emitting power plants have overly high production costs (without even taking carbon capture and storage technology into account). For this reason, only amortized, old, "dirty", difficult adjustable and less efficient coal and lignite power plants or amortized hydropower plants are able to compete. In Germany the lignite-based electricity-producing reached 2013 the highest amount since 1990 (162 TWh 2013, 171 TWh 1991) (Handelsblatt 2014). This in turn raises other specific problems next to the rising amount of GHG emission: the aging power plants (e.g. Germany, UK, France) and the phasing out of nuclear power plants (e.g. Germany) (Kemfert 2013). Hence, the utilities lose their amortized production capacities and are not able to operate their newer CCGT plants economically, nor to invest in new conventional large-scale power plants. This in fact has already weakened the utility bond ratings significantly (Lehr 2013). The US are also faced to the investment challenge: For

[3] The authors estimate an increase of electricity consumption in Europe (including Norway and Switzerland) of about 40 % (based on 2010), reaching 4,900 TWh per year. The share of renewable energy in the energy mixes should be between 40 % and 100 % (ECF 2010).

[4] Trading prices orient themselves traditionally to variable cost per kWh (e.g. fuel costs)

generation reinvestment of $560 billion will be required over the 2010 – 2030 period (Fox-Penner et al. 2008). Thus, the BM of centralized electricity production in big plants is seriously challenged, what is confirmed by the actual Strategy Roadmap of German RWE: "The massive erosion of wholesale prices caused by the growth of German photovoltaics constitutes a serious problem for RWE which may even threaten the company's survival" (Beckmann 2013).

4.3 Change of Customer Interests and Their Bargaining Position

The biggest goal of the liberalization of the electricity market was the stimulation of competition. However, initially, this was not achieved , because in some states a regulatory authority was missing or had a weak position (e.g. Germany, France), therefore the monopolies changed mainly into oligopolies (Kemfert 2013, p.44f). Thus, the consumer did not see any price competition or price advantages, and their interest in changing the electricity supplier was low. However, with the upcoming renewable energies the situation changed. More players entered the electricity industry; we now have investors (pension funds, insurances, other capital investors) and operators of renewable power plants of different sizes (from a few kW up to MW) and we have both electricity traders and of course the traditional utilities as key players. This deconstruction phenomenon is leading to more fragmented competition (Schoettel & Lehmann-Ortega 2011). The former end consumer is today often a producer himself ("prosumer"), who actively participates in the energy marketplace. Consequently, the bargaining position of the utilities is weakened. The prosumer's main motivations for an investment in an own home power plant are (1) the desire for independence, (2) environmental awareness, (3) technology affinity, (4) energy affinity and (5) the image of the utility (Fischer 2003, p. 323; Leenheer et al. 2011). But this is not only true for owners of private houses; townspeople living in flats also use the possibilities of economic citizen's participation models to become shareholders of e.g. a local solar park. However, not only the end consumer is going his own way, but also the smaller business consumer in commerce, trade and small industry now has a more emancipative bargaining position. The global commercial solar energy storage market is predicted to overtake the residential and utility-scale by 2017 and will grow from 3.2 MW in 2012 to 2.3 GW 2017 (market share from 5 % in 2012 to 40 % in 2017) (Bayar 2013), what will further strengthen the commercial consumers' position. The competition with the new players in electricity business – especially in large-scale renewable energy generation often pension funds – additionally weakens the utilities' position (Downing 2013). Consequently, this situation requires adapted approaches in end consumer marketing of utilities, creative and sensible offers (e.g. energy services, service packages) and new value proposition in order to stay in business.

4.4 Industries' Cognitive Barriers Concerning Distributed Renewable Energy Generation

The electricity industry is of high strategic importance for a state and its economy. Therefore, the utilities created a stable system with security of supply as a main goal next to provision of safe, sustainable, and reasonably priced electric energy. Thus, the aspects influencing the integration of technological innovations and innovative BMs are more complex than in other industries. Now, the utilities are additionally to their classic role faced with the emergence of new, disruptive technologies, challenging their BMs. Consequently, delivering value from distributed, renewable energy technologies would often require a real paradigm shift. For utilities with long experience of operating a classic UBM under monopolistic conditions, this can be especially challenging (Nimmons & Taylor 2008). Although some renewables are relatively compatible with the traditional UBM (e.g. central large-scale photovoltaics), others, like distributed, small-scale biomass combined heat and power generation units (CHP), require real BMI. This paradigm shift is not trivial for “large and complex organizations with long and successful history of doing a different kind of business” (Nimmons & Taylor 2008, p.9). But in contrast to the argumentation of many scholars (Frantzis et al. 2008; Nimmons & Taylor 2008; Schoettel & Lehmann-Ortega 2011), practitioners do not expect the distributed renewables to threaten their current BMs at all (Richter 2011). This could be caused by cognitive barriers of the top management team (TMT), which restrict new ideas that do not correspond to the current BM (Chesbrough & Rosenbloom 2002; O’Reilly III & Tushman 2004; Richter 2011). Tripsas & Gavetti (2000) for example showed in an in-depth case study of Polaroid, how TMT cognitions about how Polaroid competed hindered the firm’s ability to develop the new capabilities needed for the company to compete selling software rather than hardware (cameras). Interestingly, Polaroid had developed an array of new digital imaging competencies, but the rigidity in existing processes and management’s inability to implement a new business model stopped them from successfully entering new markets (O’Reilly III & Tushman 2008, p.188). But this is not even true for consumer industry, Friedrich & Wüstenhagen (2012) applied the stages theory of grief (Kübler-Ross 1969) – a concept originally developed to illustrate the transformation process over time after a disruptive personal event – on organization level, to describe the reaction of a large German utility to the phase-out of nuclear energy and institutional support for renewable energies. They argue that organizations that are threatened to lose their legitimacy due to disruptive events in the organizational field, go through five stages of grief, from (1) denial to (2) anger to (3) bargaining to (4) depression till they finally reach the stage of (5) acceptance (Friedrich & Wüstenhagen 2012). Thus, the TMTs should learn from these insights and from the faults in other industries to lead their enterprises successfully through these times of dramatic change.

5 Utilities’ Business Models in Literature

Until now, the utilities’ role in DREG is mostly limited to buying and providing the grid connection for transmitting the electricity surplus that is not used locally. The utilities limit themselves to a passive role that simply fulfills the legal requirements. With a growing diffusion of DREG-units, they lose market shares and revenue. But not only that: Busnelli et al. (2012) see a very high reduction potential of the domestic energy demand from the grid, because of different technological innovations (the energy saving nature of buildings and electric devices, energy management, distributed generation). In the most dramatic scenario, the grid demand will decrease to 13% of what it was in 2010 by the year 2020. Thus, engagement in DREG seems vital. Consequently, a growing interest in BMI (Rauter et al. 2012) and in particular BMI in combination with renewable energy technologies can be seen. Some of these publications focus on BMs for specific technologies like photovoltaics (Nimmons & Taylor 2008; Graham et al. 2008; Schoettel & Lehmann-Ortega 2011; Allan &

Trivedi 2011; Busnelli et al. 2012) and others describe the differences between the classic UBM and new, customer-oriented BMs or possible combinations (Watson 2004; Sauter & Watson 2007; Richter 2012). In the following paragraphs we highlight a few papers, which are of particular relevance to small-scale energy units.

Sauter & Watson (2007) combine the spectrum of consumer's roles with the utility's roles in installation and operation of small-scale distributed generation. This results in three alternative deployment models ("Plug and Play", "Company Control" and "Community Microgrid"). The "Plug and Play" scenario is based on the willingness of the consumer to invest and operate a micro-scale unit to become partly independent of the utility. The "Company Control" scenario assumes that the utility operates a fleet of micro-generators in order to substitute a large, central power plant (virtual power plant). The consumer provides the site, but has only a passive role. Within the third model "Community Grid", consumers and institutions of a smaller geographical region build a micro grid of small-scale generation units and operate them. They have control over their units and are responsible for balancing production and demand in the grid. These deployment models span a field of possibilities, where the utilities may find their roles as partner for distributed energy supply of the future.

Richter (2012) provides "two generic business models for renewables energies" based on the actual research results. The first is the "utility-side business model" based on the operation of large-scale units (PV, wind power, biomass plants > 1 MW), which is quite similar to the classic UBM and the existing core competences (project management, administration of power plants). The second one is the "customer-side business model", which enables the customer to become a producer as well. It is suitable for micro- and small-scale units that are located on the property of the consumer. These circumstances result in a variety of uncommon value creation possibilities for the utilities. They are in the unusual situation of redefining their roles and value proposition, which can range from "simple consulting services to a full-services package including financing, ownership and operation of the asset" (Richter 2012, p.2486).

Busnelli et al. (2012) suggest an engagement of utilities in the distributed energy market, because of a high substitution potential of energy savings and distributed energy generation. They present four BMs for utilities: Distributor (leverages customer relationship to distribute energy efficient products and services), After-sales specialist (provides different maintenance services), Lead generator (provides leads to other companies which provide energy efficient product or services for a fee) and Aggregator (single point of contact for the customer, which provides full range of products and services). The authors sketch the BM more than they outline them in detail, but they provide a feeling of possible alternatives to the classic UBM.

So, the basic possibilities and most important boundary conditions for BMs in distributed energy supply have already been sketched but details for operation and examples in practice are rare. What we can see clearly is that some of the possible activities in the distributed energy business are closely linked to diffusion of infrastructural systems and technological improvements (e.g. smart meters, smart grids, information systems, storage systems) as well as third party partners providing services that are not related to utilities' consisting core competences (e.g. financing, installation, maintenance).

6 Findings

The findings were twofold: Firstly, we developed a generic tool for BM development based on morphological fields, to define BMs in the field of small-scale DREG. Secondly, we applied this tool to develop five specific BMs, which could be generally applied in the electricity industry.

6.1 Business Model Morphology for Small-Scale Distributed Renewable Energy Generation

We used the morphology as an approach to structure and present the constitutional elements of BMs and their variants. Approaches based on morphological fields have already been used for BMs in other industries (Lay et al. 2009; Kley 2011). We followed Osterwalder's & Pigneur's (2010) conceptualization of BM and developed the expressions for the characteristics by analyzing the existing generic BM concepts and real-world BMs. The results were recursively discussed in workshops with the project partners to create the final morphology (see Figure 1). Osterwalder's & Pigneur's (2010) conceptualizations were bundled to four characteristics (see Figure 1), easier understandable and applicable for the daily business of our utility partner. We want to explain the choice of the most important sub-characteristics and their expressions in detail.

Customer segments: For the micro- and small-scale distributed energy generation, we distinguish between mass customers (B2C) and individual customers (B2B) and point out different possibilities for each group (Figure 1). As we are discussing distributed energies not only in the context of electricity supply but also in the context of heat supply (e.g. micro CHP units) new business possibilities are arising which combine these two. Thus, they are of special interest for combined heat and power generation as well as dual- or poly-technological energy generation systems (combination of e.g. PV, biogas combustion CHP, and electrical storage). The municipalities play a special role in this context. They typically have a pool of different buildings (heat and energy demand), and they also operate different kind of public facilities (water and wastewater treatment plants, dumps, local heat networks etc.) that could be integrated with energy recovery or waste-to-power systems into an overall distributed energy concept. Especially, if they want to follow the trend of regional energy autarchy, they would need integration partners to set up a sustainable local energy system. This could be provided by a utility.

Value proposition: We present these in an order of rising complexity (Figure 1). The supply of power and heat, as well as providing service & maintenance and insurances for plants can be seen as extensions of the actual BM with low complexity. The required economies of scale for service & maintenance could make additional customer acquisition necessary. But also a partnership with a service company could be possible. At the level of medium complexity we classify technical consulting, provision of facilities, planning and installation (turnkey projects). Provision of facilities stands for a model, where the customer can make a choice from a number of preselected standard plants, sold and installed by a number of local partners for an attractive price. The responsibility of installation lies in the customers' hands. We assign Ownership / Contracting and Operation to a level of high complexity due to the fact that it encompasses the complete responsibility for planning, financing, installing and operating over the whole life time.

Key activities: Here, we point out the activities that differ greatly from the current ones (Figure 1). The most important competences are related to the operation of large numbers of distributed energy devices (facility operation and energy management): We understand demand dependent controlling of the plants, capacity forecast, virtual power plant (VP) operation and the optimized fitting of energy supply to the individual demand (planning of energy systems) as well as the primary energy carrier management (biomass, biogas logistics) as significant activities for successful BM operation.

Key partners: The utilities have to build up new competences or need to choose the right partners for offering DREG-BMs. Which capabilities should be developed in house and which should be provided by a partner depends on the individual competence base of the utility and the addressed BMs. We provide an overview of the relevant partners (Figure 1). This overview could also be used to brainstorm about potential competitors arising from the diffusion of DREG.

Characteristic	Subcharacteristic	Expression								
Customer Interface	Customer segments	Mass Customers			Individual Customers					
		One-family dwelling	Flat	Agriculture	Trade and small Industry	Multiple dwelling	medium-sized Property	Hotel industry	Municipality	Local heat network
	Distribution channels	Own						Partner		
		Sales force		Online		Events		Partner stores	Online	
	Relationships	Customer acquisition			Customer retention			Upselling		
		Personal assistance	Key Account	Automated	Personal assistance	Key Account	Automated	Personal assistance	Key Account	Automated
Value Proposition	Products and services	low complexity				medium complexity			high complexity	
		Power	Heat	Service / Maintenance	Insurance	Consulting	Provision of facilities	Planning and Installation	Ownership/ Contracting	Operation
Infrastructure Management	Key activities	Energy management	Primary energy carrier management	Risk pooling		Consulting	Facility sales	Project management	Facility administration	Facility operation
	Key resources	Know-how			Manpower				Facility	Financing and Funding
		Operation	Market	Technology	Consulting	Operations	Services	Sales		
	Key partners	IT companies	Agents / consultants	Financier	Facility manufacturers	Installers	Operators	Service partners		
Financial Aspects	Revenue model	Product-related			Product- and service-related			Service-related		
		Feed-in	Base rate	Output-related fee	Facility sale	Facility contracting	Performance contracting	Consulting	Operation	Service/Mainten-ance/ Insurance
	Cost structure	IT costs	Infrastructure costs	Primary energy carrier	Total facility costs	Shared facility costs	Consulting	Operation	Service/ Maintenance/ Insurance	Sales and Marketing

Figure 1 Business Model Morphology for Small-scale Distributed Renewable Energy Generation

6.2 Business Models for Small-scale, Distributed, Renewable Energy Generation

In our study we worked out several BM suggestions and now present these, which could be generally applied in the electricity industry. During the project we took a closer look at different renewable technologies and evaluated their technological and economic potential as well as analyzing different customers and generated customer profiles. The customer profiles and the technology evaluation act as “filters” for developing BMs based on the input of the BM morphology, the already existing real-world BMs and BM-literature. Consequently, five BMs are presented in Figure 2. For the BM development we took specific technologies (PV, wind power, CHP, etc.) and technology combinations into consideration. We suggest two BMs for mass customers and three BMs for individual customers. These shall be explained in more detail.

BM 1 Combined Heat and Power Plant Contracting: This BM is based on the financing of a biomass/biogas fueled CHP plant by a contracting model. The customer pays for the obtained heat and power from the CHP plant operated by himself on his site. The costs for installation, fuel, service and maintenance are included in the price. Thus, the utility gets a long contractual binding with the customer and also reaches economies of scale in primary energy carrier management (purchase and logistics). With regard to the plant operation we distinguish between a customer operation at the first level and an automated VP operation variant at higher complexity level. In addition to the technical capabilities, new capabilities in financing and primary energy carrier management would be needed.

BM 2 Fuel Cell Contracting: This model focuses on customer segments with a higher technological or ecological awareness and the willingness to use a high-tech-device for their heat and power supply. It is also based on a contracting model but the utility provides a full service, including operation, because of the system’s technological complexity. For the VP operation the system should integrate a large thermal storage for buffering the produced heat to allow for an electricity optimized output. For this BM a multi-technology system could be possible (FC + PV + electrolyzer (H2 as buffer material)).

BM 3 Complete Service Package: This model includes all services from energetic analysis and adequate planning of the energy system, to project management and installation up to operation, monitoring and maintenance. Additionally, consulting activities in the legal, financial and economical field could be offered. However, the package’s composition needs to be arranged with the customer individually. The potential customers are companies operating medium-sized properties, multiple dwellings, trade and small-industry as well as municipalities.

BM 4 Heat Intensive: We developed BM 4 for individual customers with a high heat demand and who also produce biomass waste and waste heat (e.g. small or medium timber processing industry, horticulture, commercial laundries). The BM has two basic variants: Firstly, a variant where the utility acts as planner, installer, electricity and additional primary energy carrier supply partner and secondly, a complete service variant (based on plant contracting) with an electricity and heat supply contract (additional contracts for taking the purchase of waste heat or biogas into account). The aim is to set up a distributed multi-technology energy supply system optimized for energy efficiency including storage and energetic waste (heat) usage.

BM 5 Power Intensive: This BM is a concept for electricity intensive businesses in the field of trade and small-industry as well as commerce. We are thinking of firms operating machine tools, production and handling equipment, but also firms that need process heat mainly powered by electricity (e.g. metal-working industry) as well as bakeries, or department stores and supermarkets (cooling and lighting). For these businesses the energetic consulting and planning is the basis for a solution with two variants as in BM 4. The usage of waste heat should be addressed in the planning phase. The main advantage for the customer is the optimization of the firm's energy system and the reduction of electricity purchase through self-production.

Customer Segment / Business Model / Technology	Mass Customers		Individual Customers		
	BM 1	BM 2	BM 3	BM 4	BM 5
	Combined Heat and Power Plant Contracting	Fuel Cell Contracting	Complete Service Package	Heat Intensive	Power Intensive
Combined Heat and Power Plant	✔		✔	✔	✔
Fuel cell		✔	✔		
Small Wind Turbine			✔		
Small Hydro Power			✔		
Photovoltaics			✔	✔	✔
Thermal Storage		✔	✔	✔	✔
Electric Storage		✔	✔	✔	✔

Figure 2 Small-Scale Distributed Renewable Energy Generation Business Models and their Technology Fit

7 Discussion

Despite the challenges, there are significant opportunities for utilities to capture value from innovations in the distributed energy systems. With these five BMs the utilities could extend their classic BM and grow closer to the customer, activate their role as energy partners and consequently support customer loyalty. We are of the opinion that the mass customer market involves greater complexity and more cost drivers (e.g. maintenance of hundreds of single plants) which makes it harder to reach margins. However, energy intensive firms in trade, small-industry or commerce and municipalities seem to be interesting customers, for this broader range of services. We favored those BMs with the highest overall energy efficiency and sustainable potential. For this reason, we do not present solutions where the utility acts more as a bridging partner for other vendors to bring their product and services to the customer. Some of our BMs will require the leverage of existing capabilities and resources into new areas (e.g. small project management, individual consulting); others will necessitate exploring new capabilities to successfully enter unfamiliar businesses (e.g. VP operation, installation and maintenance resources).

We see the presented morphology and the BMs as a concrete answer to the challenges of the classic UBM. It will be necessary to find new ways of staying in business. Thus, we suggested alternative approaches to providing customer's benefit with services around the optimization of their individual energy system and DREG-plants. However, success will not only depend on the right capabilities and partnerships presented in this paper, but also on the ability "to approach the challenge in a systematic fashion, informed by an understanding of the full range of available options" as Busnelli et al. (2012, p.50) have already noticed.

Finally, two important limitations need to be considered. First, we focused on the BM development phase of the project in the Austrian energy market, where there are some peculiarities in comparison to other European countries. Austria's amount of renewables is already very high (about 65 %) because of the traditional use of large-scale hydropower. There has also never been any use made of nuclear power. The electricity industry consists of only one big transmission grid operator and the large utilities in Austria are of medium size in comparison to other European countries and do not operate single power plants of many Gigawatts. Additionally, the mind-set of the electricity industry is not as opposed to renewables as is the case elsewhere. Second, we were not able to economically proof our suggested BMs in the project. The situations are very customer and project specific as well as utility specific. The individual market structures in which utilities serve have impacts on what new BMs might be relevant. Thus, the BMs have to be calculated individually and may not be economically feasible in some contexts.

Further working steps will cover an accurate description following the characteristics of BM Canvas to maximize practical benefit and applicability.

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