*local **E**lectricity retail **M**arkets for **P**rosumer smart grid p**OWER** services*

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Executive summary

D2.2. consolidates the foundational work of business models in D2.1, the ongoing work on EMPOWER market design (WP6, e.g. D6.3), the learning from implementation (WP7) and the, feedback from exploitation activities of EMPOWER (WP8). Against these foundations and a review of major smart grid projects in the European Union D2.2. develops three ideal type business models for local smart grids, that fit the EMPOWER market design: the EMPOWER platform business model, the Our power business model and the DSO local business model. The development process of these ideal-type business models is as follows. First, a case collection of relevant cases has been compiled. The cases are discussed in detail and comprise cases that provide local energy market services as well as cases that outline the potential of digitalization based business model innovation. The case study collection provides a unique stock of services and business model elements that fit the EMPOWER market. Second, the services within these cases are decomposed and isolated to prepare them for recombination. In such, on the one hand D2.2. provides an overview of suitable business model elements and modules. On the other hand, D2.2. also provides intuition about the relational structure of distinct services for local energy markets in already existing business models. Third, the services are re-combined towards the three ideal-type business models. In guidance for the re-combination effort a unique concept for accounting for the quality of business models has been developed (with it available as a paper that is complementary to D2.2.). Each of the three ideal-type business models are described in details in regard to the market trends they respond to, to their relation to similar business models, their particular activities of value creation and value capture, their approach of monetization and their prospects. The ideal-type business models will guide the further work in WP2, the acceptance study, which will investigate into the drivers and barriers of acceptance of the single business models and the business model components in more detail. D2.2. will also benefit the ongoing work of EMPOWER in the other work packages and stimulate further refinement on the market-design level (WP6), the implementation (WP7), service requirements (WP5) and especially the exploitation of the EMPOWER project (WP8).

1 The work towards D2.2

1.1 Ongoing work in EMPOWER

Three especially important aspects of the ongoing work in EMPOWER need to find consideration in D2.2. First, WP6 progresses in specifying the market design with its mechanisms and functionalities. As outlined in D2.1 business models provide the supply of these services within the boundaries of the pre-defined market design. In such, WP6 defines the antecedents that provide guidance of which benchmark business models to select and which particular business models to design. Second, the ongoing work in WP7 of implementing the EMPOWER services on the ground provides important learning, which needs to be accommodated within the business modelling process. The learning concerns the distinct processes of how to integrate structures that are required to test EMPOWER, but also explicit learning on what the distinct requirements of the EMPOWER concept are (e.g. which components are exactly needed, which services are required) and what kind of flexibility is needed to account for the distinct contingencies of the actual sites in Hvaler, Malta and Wolpertshausen. Finally, the exploitation and dissemination activities in WP8 and WP 9 provide important feedback (e.g. from the business community) in how to improve business model innovation and provide suggestions in regard to promising business models. For instance, while the initial potential for attracting energy cooperatives with the EMPOWER concept has already been anticipated in D2.1, an important direction of feedback from WP 8 activities encourages the development of a respective business model that exploits EMPOWER potential for the narrow target group of energy cooperatives.

In deliverable 2.1., the focus has been on generic business models that provide flexibility services. It has been complemented by a research paper on timing-based business models, authored by Helms, Loock & Bohnsack and published in Energy Policy (see: Helms, Loock, & Bohnsack, 2016). As we revealed in the paper, several contingencies exist that drive the development of timing-based business models for local flexibility creation. In D2.2., we provide further scope in regard to EMPOWER and investigate the particular role of network based markets with their respective business models and digitalization for setting-up local power markets.

1.2 Goal of deliverable 2.2

As written in the GA, the WP2 followed action for developing D2.2: To attract local potential in the energy field more efficient, business models need to account for the distinct contingencies of the local social and economic environment (Huijben & Verbong, 2013). A set of 3-5 ideal-type configurations will be identified. These ideal-types will be utilized to develop business models for decentralized smart grids that build on the prior knowledge and that account for distinct situational contingencies of the EMPOWER project.

1.3.1 Overview of existing work in other EU-projects on ideal-type models

The work for 2.2. has been initiated by conducting extensive case studies of cases for decentral energy markets and their respective business models based on a thorough analysis of archival data on smart grid-related business. It is complemented with a QCA analysis of existing smart grid projects in Europe (Bauer, 2015). The goal was to synthesize and build on prior knowledge in the field. For that, we reviewed a number of overviews (reports and databases) that list smart grid-related projects in the EU. They summarize facts, activities and results of smart grid-related projects (BMWI, 2014; Covrig et al., 2014; Giordano, Gangale, Fulli, & Jiménez, 2011, 2014; Mulder, Kumpavat, Faasen, Verheij, & Vaessen, 2012). The JRC EC (Giordano et al., 2014) database is the most timely and comprehensive database. It comprises 459 smart grid projects, which took place between 2002 and 2014 within the 28 member countries, Switzerland and Norway and with a total volume of €3.15 trillion. Almost 75% of the projects are national projects and almost 25% are multinational projects with an average of six member countries. On average projects last 33 months and exhibit a budget of €7.5 million. Involved parties are: transmission network operators, distribution system operators, public utilities, energy traders, energy service providers, ICT companies, as well as companies from construction industries, consulting, and finally, universities, research centers, state, communal and public institutions or interest groups. States and private actors are the main investors for the projects. Also, many projects are funded through national and regulatory programmes or through the European Commission. The amount and diversity of involved actors create a real hype surrounding smart grids. Almost half of the investments in smart grid projects are done in France, the UK and Spain. Investment per person or per consumed Kwh are dominated by Denmark (Giordano et al., 2011). The JRC EC divides projects into two categories, research and development (R&D) projects (Giordano et al., 2014), as well as pilot and demo (P&D) projects.

Investments in P&D projects are three times higher in comparison to R&D projects (JRC EC, 2014, p.10).

The JRC analyzed the activities of all smart grid projects that have been started between 2002 and 2014 and proposed seven main areas of focus as the following Table illustrates. A project can be involved in one or more of the focus areas.

Area of application	Project description
Inteligent network management	The area comprises any measures that improve the operative flexibility of the electric network: e.g. automated data collection and intelligent control of electricity flows in the network. Typically, the network control is improved on the basis of bidirectional ICT and above all with the installation of smart meters.
Integration of decentral energy ressources	To be able to integrate an increasing number of energy producers into the energy network, one needs to test mechanisms for the intelligent control of a constant frequency and system voltage. With different hard- and software solutions, e.g. through virtual power plants, one tries to integrate increasingly decentral power plants into the smart grid, in order to stabilize the energy system.
Integration of renewable energy sources	Because of the irregular and weather-dependent electricity generation from renewable energy sources, instruments for the planning, control and operation of power plants are tested. The purpose is to foster their integration into the market. They comprise forecasting models in relation to the volume and timing of production, the immediate consequences of the fed-in for the other power plants. Also improved demand control systems should adapt the energy consumption, for instance, of the operation of cooling systems, heating systems or boilers, to the respective network situation.
Aggregation (demand response, virtual power plants)	Projects in this area focus on the aggregation of energy supply. The technical feasibility and scalability of demand response mechanisms for the optimal coordination of participating clients are at the center of this area. Depending on customer

	engagement and of their reaction to incentive signals, different business models can be imagined.
Intelligent client behavior and smart homes	Projects test the application of intelligent applications in the smart home area and based on different tariff models. The collection of client behavior data is the central objective, particularly, with respect to behavior change in response to increased transparency and in response to saving possibilities that result from financial incentives.
Electromobility and Vehicle2Grid	Projects in this area test the possibilities of including electro- and hybrid vehicles into the grid, without surpassing the peak load. The intelligent coordination of the charging and unloading of the electric batteries in relation with the network load is the primary objective. The battery loading should start, when there is energy surplus (favorable weather conditions and related high volumes of renewable energy). It is also tested to what extent the coordinated unloading of the energy reserves of the batteries can be an advantage for the network.
Smart meter	This final category comprises projects that are involved into the installation of smart meter infrastructure.

Table 1: Areas of application of smart grid projects in the EU (own illustration based on (Giordano et al., 2011, 2014)

To summarize, the diversity of smart grid-related projects is enormous. The aggregation of demand for generating flexible consumption is a key aspect in many smart grid projects. Yet, we lack a more systematic and fine-grained understanding of the existing players and underlying dynamics of successful business models in smart grids.

In the following Table, we present the results of a QCA analysis of ideal-type demand response business models as conducted by Bauer (2015). The results differentiate business models 1a, 1b, 2, 3 and 4.

Table 2: Factor configuration of ideal-type demand response business models (Bauer, 2015)

Business models 1a and 1b exhibit high customer involvement and a highly intelligent consumer behaviour. Because these two aspects are high in all business models, they may be considered as critical success factor. In business model type 2, five aspects are critical: the integration of decentral energy sources, the integration of renewable energy sources, intelligent consumer behaviour, intelligent network management, and client involvement. Business model type 3 is complemented by the integration of electric

vehicles as success factor, and business model type 4 further integrated the average yearly electricity consumption/ client, as well as the average yearly load transfer/ client.

1.3.2 Toward a refined understanding of business models for local energy markets

The purpose is to provide further scope on the case collection to find cases that support the EMPOWER concept, and to identify ideal-type configurations of business odels for local energy markets. The task at hand will conduct an analysis of world-wide projects on local smart grids to identify suitable ideal-type business model configurations. We will do so through a thorough analysis of archival data on smart grid-related business models, two intensive case studies of two exemplary business models.

A set of criteria to evaluate the cases needed to be determined. The criteria are based on the literature on business models and on an inductive, in-depth analysis of the cases of local smart grids within this project. A business model is defined as the designed system of activities through which a firm creates and captures value (Zott & Amit, 2010). A core emphasis is on identifying existing value creation logics and value capture logics. This analysis uncovers differentiating factors of existing business model configurations. It also provides an analysis of the competitive landscape that is relevant for the EMPOWER project. By looking at the value creation logics from a demand-side perspective, we uncover how existing cases create value as they address distinctive customer needs. This will be further elaborated in task 2.3.

In terms of output, a set of 3 ideal-type configurations is identified. These ideal-type configurations are illustrated with real-world case examples. A framework to differentiate the existing business models is provided to position these business models in a decentralized market place. As such, an analysis of major competitors and their logics of value creation and of value capture is provided for EMPOWER. An analysis of value-creating activities that address distinctive end-user needs and how they are addressed by existing cases is derived for EMPOWER. These ideal-types are utilized to develop business models for decentralized smart grids that build on the prior knowledge of selected cases and that account for distinct situational contingencies of the EMPOWER project.

Role of partners (demo sites, WP6, WP5): Feedback provider on the current situation at demo sites and market design and the WP5 programming status. Role of all partners: processing the ideal-type business models, provide feedback to the ideal types.

1.3.3 Structure of this deliverable

The deliverable is structured as follows: First, we establish a framework for looking into decentralized energy marketplaces and uncover opportunities for value creation that emerge from the digitalization of the energy marketplace. Second, we present a summarized analysis of worldwide smart grid-related business models and distil key learnings for "ideal-type business model in local smart grids". Third, we develop three exemplary business model ideal-types for EMPOWER. To conclude, we outline our current status with respect to T2.3 and the key measures undertaken for investigating into the prosumer acceptance of different technological regimes.

2 Digitalization and new business models for local energy markets

In line with the EMPOWER project goals, in this deliverable, we focus on business models for local energy markets. First, we outline a framework for decentralized energy marketplaces and opportunities for value creation that arise from the digital transformation. Second, we present a summary overview of our analyses of ideal-type business models with real-life business cases both in the energy industry and in parallel industries that have known a successful digital transformation.

2.1 Trends

2.1.2 Decentralized energy marketplace

A decentralized energy marketplace can be characterized by five areas of business scope: supply, demand, storage, trading/ sharing, as well as market enablers. As illustrated in the following Figure, we refer to these areas in terms of business model scope for decentralized energy markets.

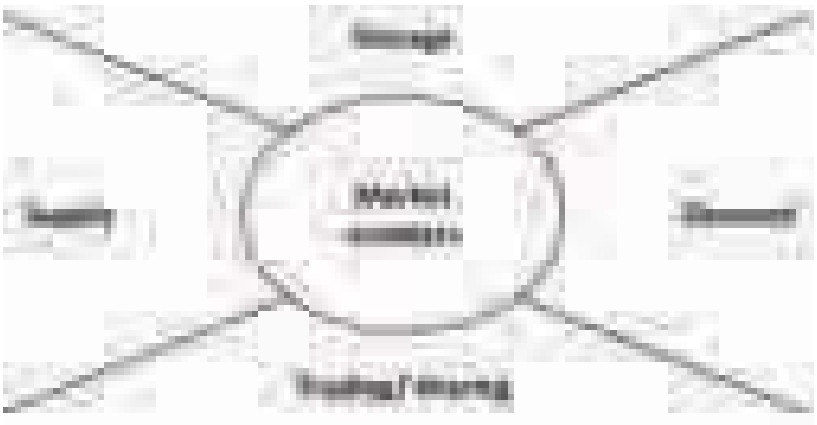

Figure 1: Business model scope for decentralized energy markets

In order to uncover in greater detail how these areas of business model scope are effectively seized by energy players, and what the effective business models are, the purpose of this deliverable is to disentangle, first, the opportunities for value creation in each of these areas of scope, and, second, the ideal-typical business models that arise in relation to these areas of scope.

2.1.2 Digital opportunities: An overview

During the last two decades the digital revolution has drastically disrupted established industries. The digital revolution is characterized by new business opportunities that are enabled by information and communication technologies (ICT). The digital revolution has hit the retail industry through such platforms like online retailers (such as the Appstore by Apple for IT services or the Amazon store for goods), transportation services through such platforms like UBER, payment services through such platforms like PayPal, investment services through such platforms like crowdcube, accommodation services through such platforms like Airbnb, etc. A core feature of this digital transformation in other sectors is that ICT technologies enable new opportunities for value creation and new business models. The digital revolution also hits the energy industry and offers novel opportunities for value creation in decentralized markets.

The purpose of this chapter is to uncover the types of opportunities that emerge in the course of the digital transformation (“digital opportunities”) in the energy value chain and to uncover the particular ways in which they enable new business models for local energy markets.

A number of digital opportunities for transforming the energy production and supply exist along the traditional energy value chain. Digitalization has the potential to transform all aspects of the traditional value chain ranging from energy production to energy

distribution. In this section, and at a general level, we synthesize such opportunities for digital transformation along the key steps of the traditional value chain (Schwieters, Hasse, vonPerfall, Maas, & Lenz, 2016):

1. Production & storage: Digital opportunities emerge for central powerplant control or for decentral virtual power plants.
2. Transmission & distribution: Digital opportunities emerge for predictive maintenance and for the optimization of network control.
3. Measurement: Digital opportunities emerge for increased introduction of mobile services for technical engineering, as well as for smart metering and related business models.
4. Trading & wholesale: Digital opportunities emerge for enhanced customer interfaces in distribution channels and for increased accuracy in forecasting through enhanced databases and new tools.
5. Distribution & marketing: Digital opportunities emerge for increased customer segmentation, individualized customer interactions, connections to smart home solutions, as well as new digital offerings, such as online distribution platforms.
6. Services & other solutions: Digital opportunities emerge in connection to electromobility, increasingly decentralized energy management and in connection to smart city offerings.

Furthermore, digital transformation impacts support processes, such as the enhanced use of business analytics tools for customer analysis, increased process digitalization in support functions, such as HR, ensuring the critical security of infrastructure, and the spreading of digital culture in the organization.

Based on this general synthesis of the opportunities for digital transformation in the energy market, we conducted 9 expert interviews with key players in the energy market. A key focus of this interviews has been on identifying what these experts view as priority digital opportunities in relation to smart grids, as well as the associated risks. To attract local potential in the energy field more efficient, business models need to account for the distinct contingencies and risks of the local social and economic environment (Huijben & Verbong, 2013). Key risks are seen in the areas of business, technology, and regulatory issues. Furthermore, a number of key action points arise that need to be undertaken for energy players to be able to seize the priority opportunities identified. The following Figure 2., 3. and 4. report these results next:

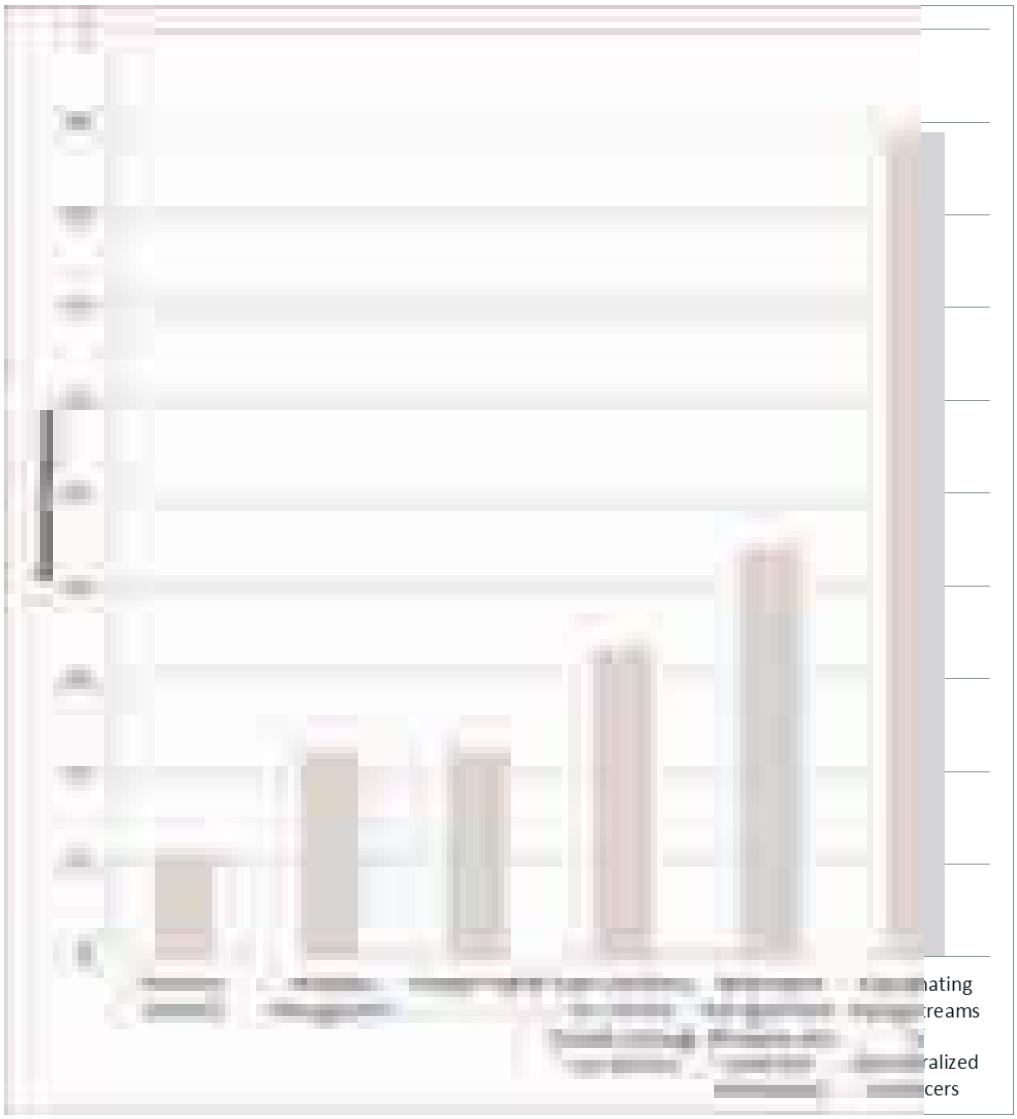

Figure 2: Priority opportunities in relation to smart grids

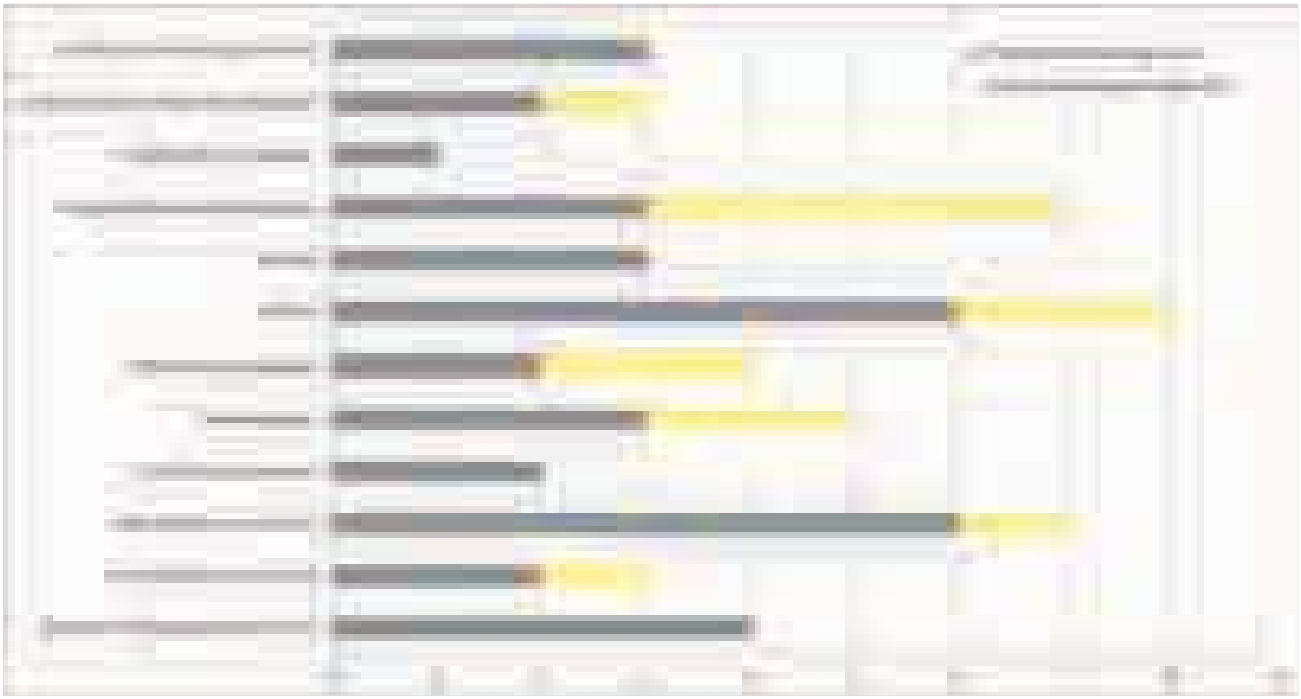

Figure 3: Key risks in relation to the identified opportunities

A number of key actions have been mentioned in our interviews. Experts with start-up background have predominantly mentioned trials and pilot projects and prototypes (19% of total respondents – 100% of start-up background – 17 % utility background) and focus on regulation (25% of total respondents - 100% of start-up background – 33% utility background). Experts with utility background have predominantly highlighted physical prerequisites (37% of total respondents - 100% utility background - 0 of start-up background), and the creation of a dominant software platform and interconnected devices (19% of total respondents - 0% of start-up background – 50% utility background). These statistical results are based on a small sample of interviewees and therefore may be generalized with caution.

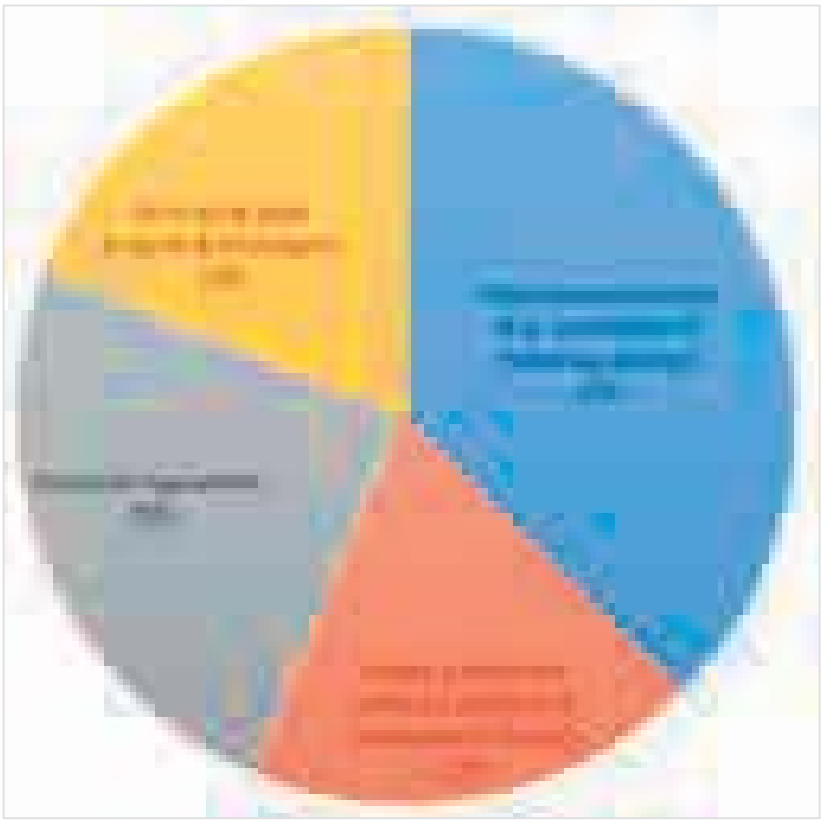

Figure 4: Priority agenda for action for realizing the identified opportunities

In the following of this deliverable, we broaden our focus to incorporate innovative *business models* that tap into these elicited opportunities in relation to decentralized energy markets. In particular, we conducted an analysis of innovative and real-world business model cases that we will spell out in greater detail next.

2.2 EMPOWER business model case collection

Over the last few years, a great number of innovative business cases seized the digital opportunity for transforming the energy industry. We analyzed the business models of >20 cases. The cases, that we outline in greater detail next, were chosen with respect to their relation to the EMPOWER market design (see WP6), their basis in the EU, Switzerland and the US, with respect to their innovativeness, and on the basis of the availability of public information on the company.

2.2.1 Case descriptions

In this section, we provide case descriptions for the selected case companies: Buzzn, Caterva, Change38, Clean Energy Sources (CLENS), CPower, Energie Pool, Enernoc, Flexitricity, GridSense, Kiwi Grid, Kiwi Power, Localpool, Lichtblick, Mosaic, Next Kraftwerke, Open Utility/Piclo, REstore, Sonnen, Strombank, TransActive Grid, Tiko, Trianel, Vandebron.

a. Buzzn

The Munich based start-up buzzn was initiated in 2009 and operates a decentral energy community. Prosumers with block-type thermal power stations, PV plants or wind power stations can share excessive electricity with other community members. Buzzn incentivizes renewable energy generators with higher electricity revenues. While consumers are enabled to source renewable energy from the community. Buzzn acknowledges as a major competitor the battery producer and community operator sonnen (buzzn).

b. Caterva

Caterva was founded in Munich, Germany in 2013 as a subsidiary of Siemens AG. The tech-start-up offers contracted management of large-scale virtual energy storage facilities, as well as the fully automatic marketing of networked plants in intra-day power trading. In cooperation with the SWARM project Caterva rents out energy storage systems (ESS) with PV plants. At first households can storage and time-independently use self-generated renewable energy. Additionally, the storage systems are interconnected and form a virtual power plant. Thereby the SWARM[1] community can provide resources. Caterva targets private households and intends to generate revenues with long-term memberships. Till today, it has sold about 46 batteries to private households. The start-up partners with Siemens AG, as a technical know-how partner, and with the utility company N-Energie. Caterva's customers engage moderately by supervising the energy management via a mobile app (Caterva).

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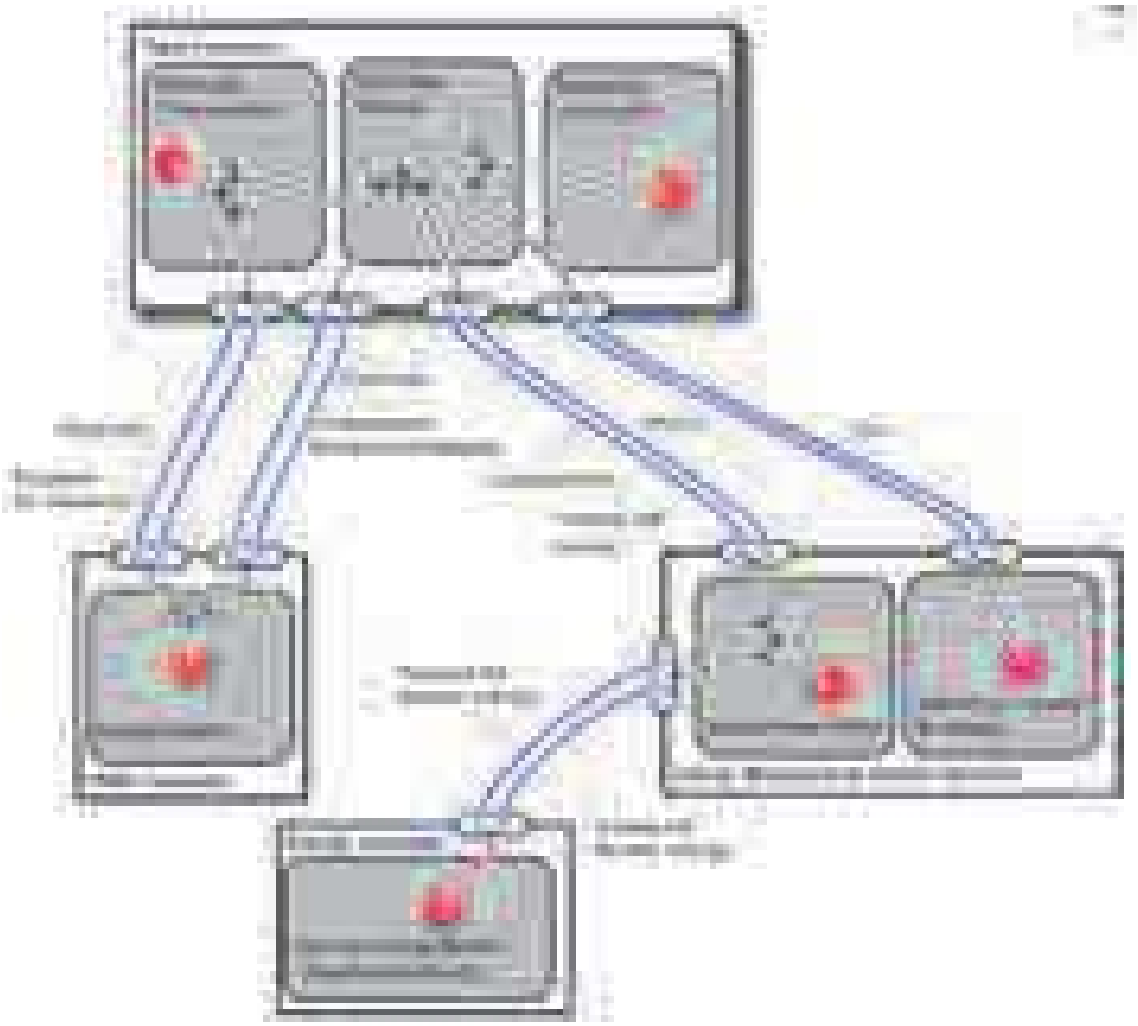

Figure 5: Detailed outline of business model – Caterva

c. Change38

The Swiss start-up Change38 was founded in 2013 and is an establishing local energy community operator. It focuses on private households and small-size commercial and industrial customers. It is active in B2B and B2C. Change38 proposes renewable and local energy supply and energy savings to its customers. In the community, prosumers primarily use their self-generated energy to fulfil their demand. If prosumers generate an energy surplus, the excess power will be automatically directed to the consumers in the community. The service of Change38 is primarily based on software: An energy center (“EnergieCenter”) collects the relevant data in private households and sends the information to the cloud. The cloud service

makes energy community decisions and directs energy. The single user can supervise transactions and personal usage and generation data via a mobile app. As a result customers of Change38 engage moderately. In the future the community operator probably intends to charge its customers with a service charge. Currently Caterva runs its first test phase in a Swiss village. Consumers and Prosumers formed a cooperative in order to try out a decentralised and self-contained energy community with the solutions of Change38 (Change38).

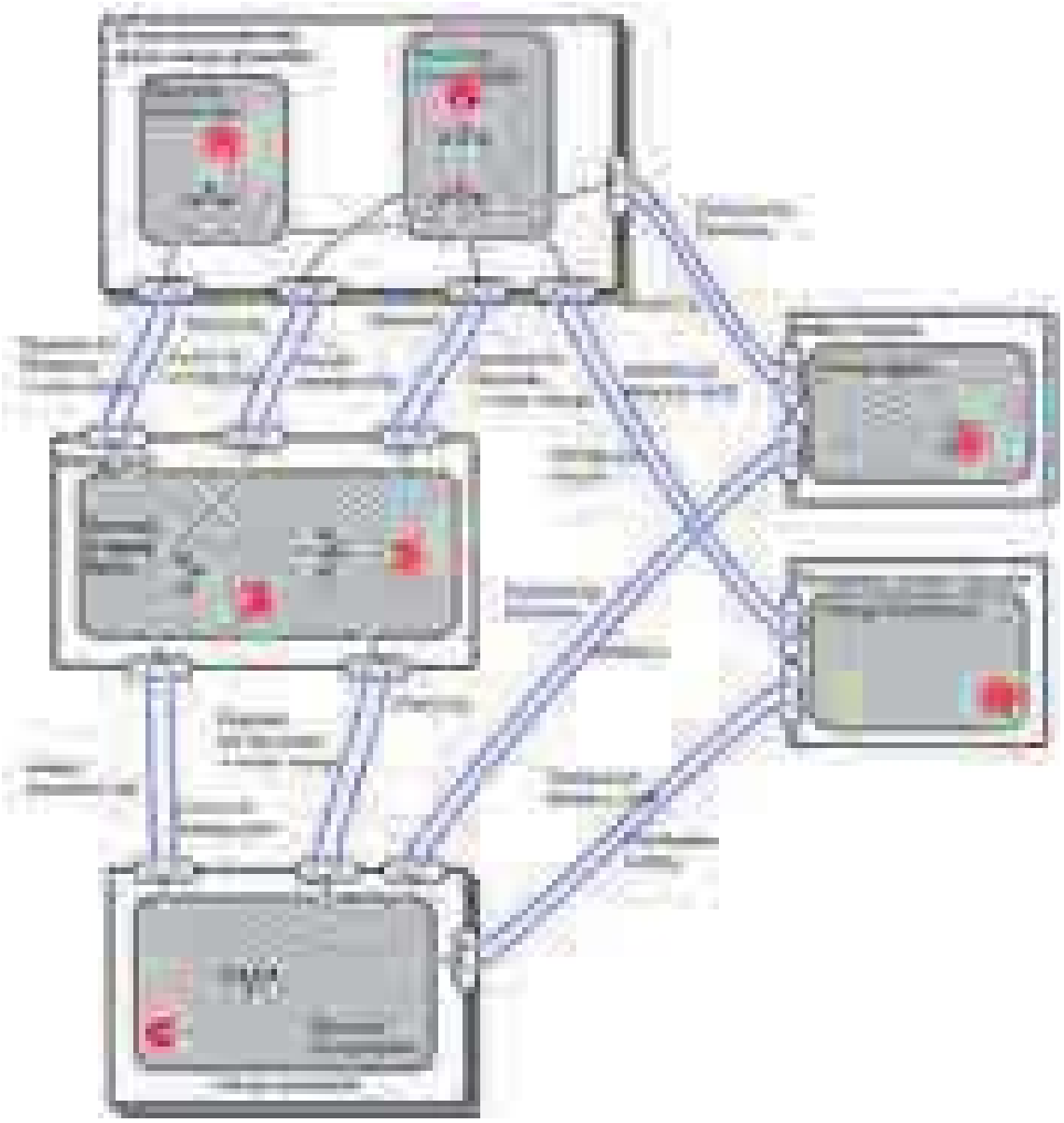

Figure 6: Detailed outline of business model – Change38

d. Clean Energy Sources (CLENS)

The German company Clean Energy Sources was founded in 2008 and is located in Leipzig, Germany. CLENS products can be categorized into three groups: supply, services and sourcing. At first CLENS supplies industrial, commercial and private customers with renewable energy. Secondly the company offers energy management services, such as trading or portfolio management. Additionally CLENS provides renewable energy generators and flexible energy generators with marketing services by operating a virtual power plant (Clean Energy Sourcing).

e. CPower

CPower was founded in New York, USA in 2014. It is one of the largest energy management companies in North America owned by the utility company Constellation Energy. CPower manages an energy volume of 2,269 MW at 7,700 sites and serves 1,700 customers. The company calls itself a “one-stop-shop” for demand management and offers a broad array of products and services large energy-consuming businesses need to reduce costs. It is fully integrated. CPower focuses on midsize to big commercial and industrial customers and sources revenues with service charges. It offers demand response, which means capacity and economic programmes, and demand management, which means energy efficiency improvements and peak load management. As a result, commercial and industrial customers can streamline their energy usage, offset their costs and reach sustainability goals. Customer engagement ranges from high involvement, during the installation stage, down to medium involvement, during the usage stage, where customers can supervise management services on desktops or mobile devices. CPower’s main partners are energy solution provider (e.g. Novar), facility performance software (e.g. Vedero Software) and hydropower technology companies (e.g. Lucid). Its major competitors are demand response aggregators, such as Flexitricity or PG&E (CPower).

f. Energie Pool

Energie Pool was founded in Zurich, CH in 2006 and functions as an expertise and information-platform for about 60 companies in the energy sector. Hence, Energie Pool is active in the B2B sector. Energie Pool primarily provides consulting services in grid affairs (e.g. efficiency improvements), energy data management (e.g. metering services) and in energy business affairs (e.g. customer focus). Customers (e.g. utility companies)

do also have the opportunity to become a member of the Energie Pool community, which functions as a know-how platform. This membership includes workshops, exchange of information and representation in political processes.

Energie Pool generates revenues by collecting an annual membership or service charges for specific consulting services. Customer engagement is ranked highly, because community members participate in events and interact with other members (EnergiePool).

g. EnerNOC

EnerNoc (Energy Network Operations Center) is a leading provider of energy intelligence software and energy services for commercial and industrial customers. Timothy Healy and David Brewster founded the company in 2003. Today EnerNOC is a listed company, generates about $ 470 Mio. in revenues and employs 1300 people. In 2009 EnerNOC provides for industrial customers energy services, such as Demand Response or Utility Bill Management. For utility companies it provides software to operate virtual power plants and handle demand side management. Consequently EnerNocs customers are utilities and companies with an energy-intensive production (EnerNOC).

h. Flexitricity.

Flexitricity was founded in 2004 as UKs first demand-response aggregator and operates today one of the largest demand-response portfolio in the UK. Today, the Swiss utility company Alpiq owns Flexitricity. Flexitricity focuses on midsize commercial and industrial customers (B2B). The company aims to increase asset reliability, reduce national CO^2 emissions and to secure energy supplies. Flexitricity offers a broad variety of services: frequency response; footroom services (system of making use of excess wind power); short-term operating reserve services (system of reserve energy for National Grid) and triad management. In the end, businesses can save energy, improve usage efficiency and source new revenues, whereas the National Grid can secure grid stability.

Flexitricity sources their revenues with service charges and trading profits. Customer engagement ranges from high involvement, during the installation stage, down to medium involvement, during the usage stage. Flexitricity`s partner are primarily major customers, such as hospitals (NHS) or warehouses (Norish cold storage), or utility

companies. Major competitors are the demand response aggregator Kiwi Power and REstore (Flexitricity).

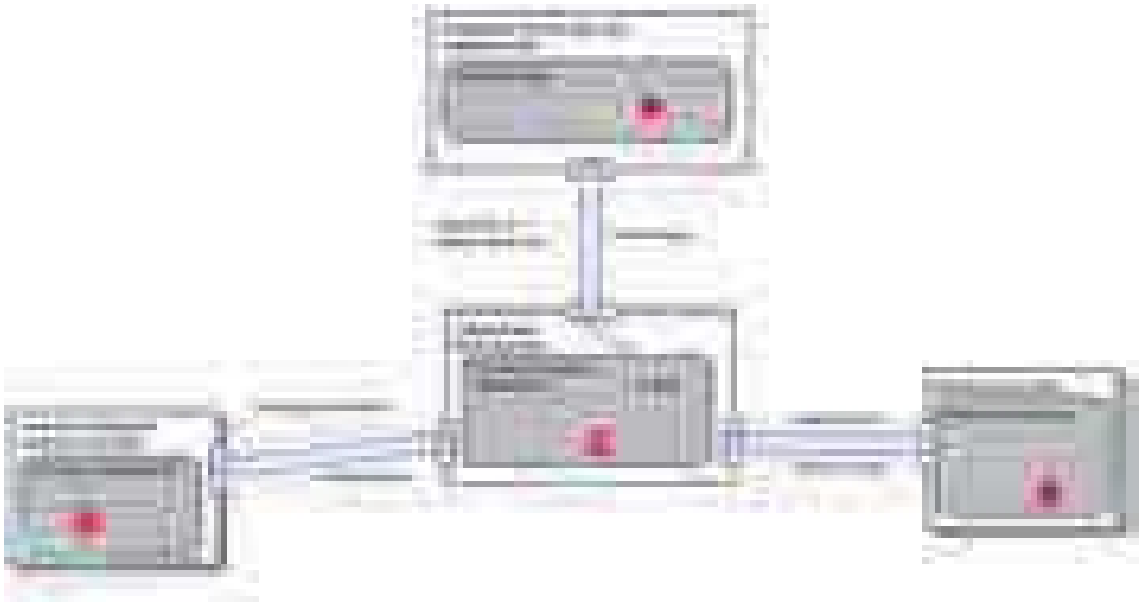

Figure 7: Detailed outline of business model – Flexitricity

i. GridSense

The Swiss company GridsSense was founded in 2013 and is a subsidiary of the Swiss utility company Alpiq. GridSense develops soft- and hardware to analyse and optimize technical household equipment. Gridsense integrates their algorithm in the relevant appliances, for example, heat pumps or battery charging stations. Using artificial intelligence, GridSense learns about and anticipates user behaviour. It ensures optimum integration of photovoltaic systems and wind turbines, balances out loads within a building, and helps to level out grid load. GridSense can integrate external signals from energy providers, smart meters or weather forecasts, optimises cost effectiveness and uses energy efficiently. Via the GridSense app, users can control energy consumption.

In general, Gridsense proposes energy usage reduction and transparency to private households. As customers only control energy consumption via an app, customer engagement is ranked low. Gridsense started its first pilot project in March 2016 and intends to generate revenues either by selling its hard- and software or licensing the product to appliance producers. Its major partners are utility companies (e.g. Alpiq), technical companies (e.g. Helion Solar) and the government (GridSense).

j. Kiwi Grid

Kiwi Grid was founded in Dresden, Germany in 2011 and provides Smart Grid and Smart Meter solutions. In 2014, it reached over € 2 Mio. in sales and 65 employees. High-Tech investors, Aqton and Innogy Venture Capital invested into the company. Kiwigrid is a modern platform operator for Smart Grid as a Service. It owns an energy cloud and a SaaS computation platform. With the open platform, the company enables the connectivity of producers, consumers, storage, and e-mobility within the Smart Grid. Just like the rays of white pulp in a kiwi connect its seeds to each other, the platform builds a communication system to connect a vast number of devices. It offers a broad range of systems: Home Energy Management System, Metering System and an Energy Cloud System. Kiwi Grid also sells products like the Energy-Manager Rail, an industrial computer to connect technical systems, the Energy Service Gateway, a smart meter, and the Energy-Manager Wall, which displays energy flows.

It proposes Smart Grid management platforms and IT solutions to its customers and generates revenues by selling custom-fit solutions or standard systems. Customer engagement ranges from high involvement, during installation, down to medium involvement during usage. It partners with utility companies (e.g. Lichtblick), chip producers (e.g. Gemalto) and other electronic manufacturers (e.g. Steca) (KiwiGrid).

k. Kiwi Power

Kiwi Power is a London-based demand response aggregator and was founded in 2009. The company provides grid stability services and energy savings for commercial and industrial customers (B2B). It offers full suite of grid balancing services. Based on proprietary technology (own hardware and software for both smart metering and demand aggregation), Kiwi Power offers a variety of solutions: Frequency response, capacity reserve service, network constraint management (reducing system operators charges) and smart meter hardware. These solutions aim at improving energy consumption, reducing energy costs and bringing new revenue sources to commercial and industrial customers.

Kiwi Power generates revenues by collecting service charges from commercial and industrial utility users and generates trading revenue with the grid by aggregating demand. Customer engagement ranges from high involvement, during installation, down to medium involvement during usage. Kiwi Power partners mainly with network partners and system operators, such as National Grid, UK Power Networks, Shell, SSE, Swanbarton. Its major customers are for example frozen food producers, renewable electricity generators or water recycling services. Its major competitors are demand response aggregator, especially Flexitricity.

l. Lichtblick

Lichtblick was founded in Germany in 1998 and is Germany's largest independent provider of green electricity and gas. Today, it generates approximately €700 Mio. in sales, provides about 650,000 customers with electricity and gas and employs approximately 460 employees. The company is privately owned.

Lichtblick sells energy to private households and small-size industrial and commercial customers (B2B and B2C). Besides regular energy supply, Lichtblick offers an energy community, involving approx. 1 million "LichtBlickers". Private households, which generate energy, can be part of this community and share or source energy with other community members. In general, Lichtblick proposes 100% renewable energy and support for autarky solutions to its customers. The "Schwarmstrom®" creates individual household virtual power plant for prosumers. "SchwarmBatterie®" is an on-site battery storage system, which stores electricity from solar panels – e.g. at supermarkets – and provides power grid security within the cluster. The "SchwarmDirigent®" platform optimizes generating facilities.

Lichtblick generates revenues by selling renewable energy and collecting a service charge for specific services, such as the energy community. The majority of customers have low engagement. After the registration, consumption happens automatically. Lichtblick conducts partnerships with the battery producers Tesla and Sonnen, the NPO WWF and with the car manufacturer Volkswagen (Lichtblick).

m. Localpool

Localpool is a service of the German start-up buzzn and enables multi-party houses or complex of buildings to form a local energy market. Localpool provides services so local

energy generators, such as house owners with a PV plant, can sell energy to various consumers in a house or complex of buildings. As a result consumers and generators reduce grid costs and source energy independently from utility companies. Both the consumer and generator sign a power supply resp. power purchase agreement with the energy community operator buzzn. Localpool generates revenues by charging the generator for the installation services (Localpool).

n. Mosaic

Mosaic is the nation's leading peer-to-peer lending marketplace in the residential solar power industry. The company was founded in 2010 in Oakland, California and has received $ 220 Mio. in funding. Mosaic has been named a top-ten most innovative energy company by Fast Company in 2013 and 2014 Initially Mosaic began as a crowdfunding platform for PV plant projects. Today Mosaic connects investors with homeowners, which intend to install a PV plant. Homeowners sign up, undergo a credit check and sign a loan contract. In order to finance the plants, Mosaic provides financial products based on investors. The company indents to democratize the social and environmental benefits of clean energy and empower private house owners to generate renewable energy (Mosaic).

o. Next Kraftwerke.

Next Kraftwerke is one of the biggest German virtual power plant operators joining biogas, biomass, combined heat and power, water-power, wind-power and PV plants. It was voted one of German weekly business magazine Wirtschaftwoche's "30 Most Innovative Green Start-ups" in 2012. The company was founded in 2009 and is located in Cologne, Germany. Next Kraftwerke has a self-developed hardware "NextBox" for sensing and controlling of energy input and output. Next Kraftwerke is a certified power trader. It distributes the generated green energy on the short-term energy market at the energy exchange EPEX Spot. More than 2,500 renewable energy plants are already interconnected via remote access modules, which allow data exchange between the decentralized plants and the central control system of the Next Pool VPP. In addition, Next Kraftwerke balances grid versatility by linking different sources including solar, biomass, wind, etc. (VPP capacity). It offers grid-balancing services on the balancing energy markets by connecting flexible energy consumers, emergency backup generators and power-to-heat plants.

Next Kraftwerke focuses on small to big commercial and industrial customers and generates their revenues by sharing the profit of the sold energy. During the installation customer engagement is ranked high, whereas during the usage phase engagement is ranked lower. Next Kraftwerke primarily conducts partnerships with hardware producers, such as the automation technology producer ABB, the biogas technology producer PlanET, and the utility company Satkraft. Today, Next has interconnected more than 2,900 renewable energy plants and has reached over €180 Mio. in sales and traded in 2015 9 TWh. The virtual power plant operator employs over 110 employees and is represented in 8 cities. The company has entered the Austrian, French and Belgian Market. The unique feature of Next Kraftwerke is the capacity of the virtual power plant and that the trading option opens another income stream for customers instead of only saving on utility bills.

For the future Next Kraftwerke intends to be an international aggregator of flexible and constant renewable energies and generate their revenues also with service charges (Next Kraftwerke).

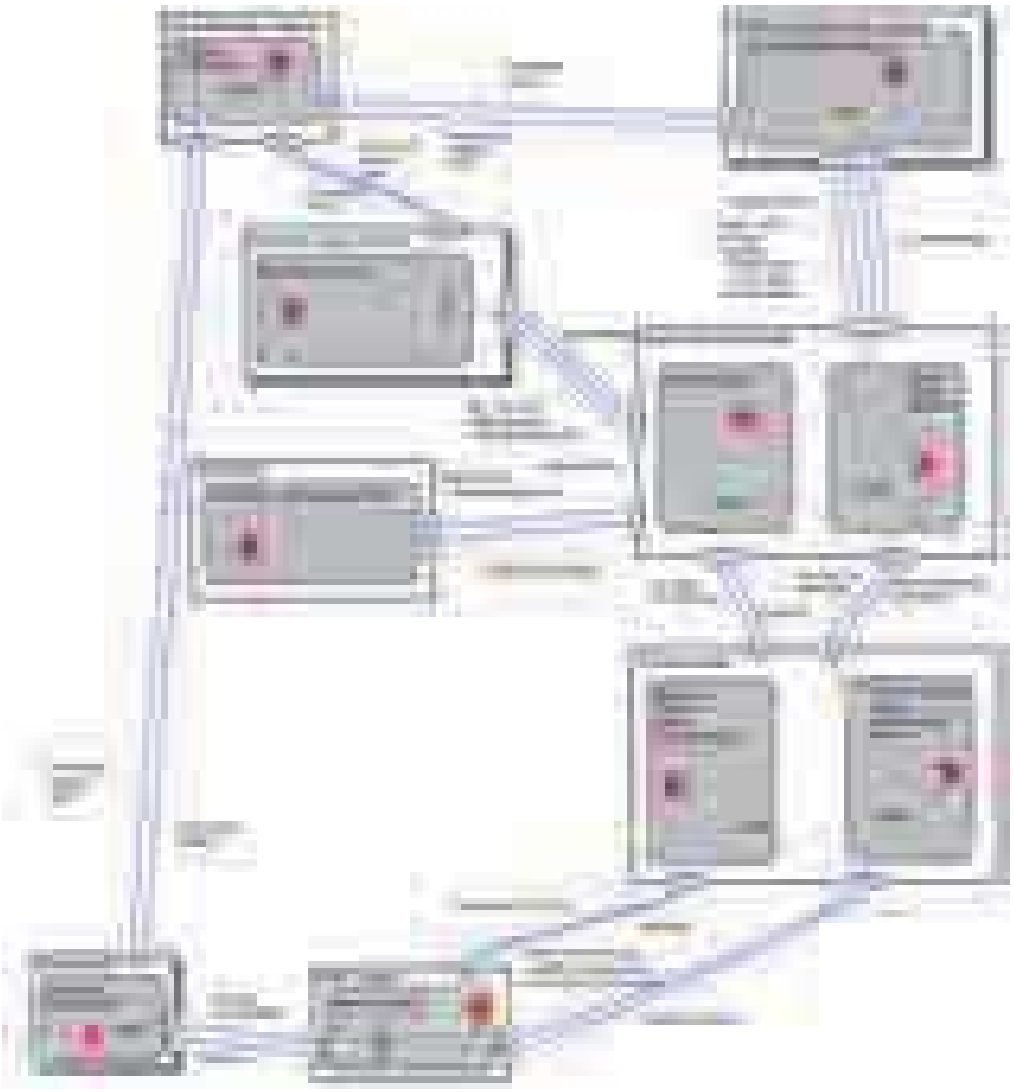

Figure 8: Detailed outline of business model – Next Kraftwerke

p. Open Utility/ Piclo

Piclo is UKs first online peer-to-peer energy marketplace and was voted as the startup of 2015. The digital service company "Open Utility" developed Piclo and intends to sell the platform to utility companies. Piclo enables consumers and renewable energy generators to form a local energy market by matching demand and supply based on user preferences. For sustainable consumers, Piclo is a tool to make conscious and active decisions about where they source electricity. Renewable energy generators obtain the control to set prices and get access to customer data. Good Energy, a renewable energy supplier, forms the framework by signing a contract with consumers and generators, balancing the marketpace and offering customer services. In October 2015 Piclo started its first trial period, which was provided

with grant funding by the UK government (DECC). For six months 37 business consumers and renewable energy generators from the UK consumed energy with the help of Piclo. On average all matched electricity travelled 177 miles to its consumers and users spent 20 minutes on Piclo each month. Since Piclo is a unique online market place, the users can be stated as early adopters with high engagement. In the future Open Utility intends to offer their platform to average customers and charge utility company to access their platform (Open Utility, 2016).

q. REstore

REstore is a leading European demand response aggregator, specialized in automated demand response. Pieter-Jan Mermans and Jan-Willem Rombouts founded the company in 2010. The team has grown significantly between 2010 and 2013, to serve clients in the UK and in Belgium. REstore has offices in the UK and in Belgium. Today the company manages over 540 MW flexible energy and has raised over $13 million in capital. Flexpond^{TM} is a proprietary, patented technology platform, developed to turn demand response into a virtual open cycle gas turbine. In 2015, REstore wins Frost & Sullivan Competitive Strategy Innovation and Leadership Award.

It proposes energy savings and grid stability with a cloud-based demand side management to commercial and industrial customers. FlexpondTM is REstore`s proprietary, patented technology platform, developed to turn demand response into a virtual open cycle gas turbine. REstore generates revenues by trading energy and charging service fees. Customer engagement ranges from high involvement during installation down to medium involvement during usage. It currently offers balancing capacity to the system operators Elia (Belgium) and National Grid (UK). Moreover, REstore conducts partnerships with major energy consumers, such as water treatment services or food services. Competitors are other demand response, such as Flexitricity(2016) (REstore).

r. Sonnen

The German battery producer Sonnen was founded in 2010 and is one of the leading intelligent home storage producers. The company's headquarter is located in Wildpoldsried in Bavaria (Germany). It has sold over 10.000 batteries in markets worldwide (e.g. Central Europe, USA, Philipines, Australia). The sonnenBatterie

eco is an energy storage solution for private households that uses intelligent software to manage energy throughout the day - enabling the use of solar power at night. The battery is linked to a renewable energy generator, e.g. a PV plant, that can store self-generated power. The sonnenBatterie includes weather forecasts and electricity consumption behaviour data into an energy management system.

Sonnen's value-creating activities can be separated into two areas: Producing intelligent energy storage systems and secondly operating a nationwide energy community. In this community, prosumers can sell excess power to other community members or buy electricity during times when there is no sufficient self-generated electricity. The user of the battery and community can control these processes on a desktop or a mobile device. In general, Sonnen proposes an intelligent energy storage, energy independency and usage transparency to its customers. Sonnen sources their revenues with battery sales and community memberships.

Customer engagement is moderate during product usage as they supervise the energy budget. In terms of the sonnenBatterie, Sonnen focuses on production, research & development and national marketing, whereas local licensed retailers sell and install batteries to private households. Sonnen's major partner is the PV solution provider Sungevity. Sonnen's major battery competitors are mainly Tesla, Samsung and Panasonic. Sonnen's major community competitors are Lichtblick and local energy community cooperatives (sonnen).

s. Strombank

Strombank (Electricity Bank account) is a research-project of the utility companies MVV Energie and Netrion, the University of Stuttgart and the battery producer ads-tec. The purpose of the project is to enhance private homeowners' use of electricity from decentralised generation, especially from private photovoltaics systems. Any excess electricity generated is stored in a central district storage facility and fed back into the grid when required. Starting in December 2014, a group of 14 single households and 4 commercial customers formed a virtual power plant community for a test phase of 12 months in the south of Mannheim-Rheina.

The participants sourced their electricity from own PV power plants or as a backup from block-type thermal power stations. In this system, members have an energy account. Via this account, self-generated and unused power can be shared with other community members. The Electricity Bank account is managed via an app that is installed on tablet

computers. Like with online banking, participants can view their account balances and latest electricity flows. This way, Electricity Bank customers can at all times check their account balances, see how much electricity their system is currently generating and check whether they are depositing or withdrawing electricity at any given time. Participants can control their energy usage and generation on a desktop or mobile device. A 16 kilowatt-hour lithium-ion battery forms the hardware centre. Since September 2015, the project participants have been able to sell their electricity on a virtual basis. As soon as their account is full and the participant continues to generate excess electricity, this surplus electricity is then supplied in a simulation to another resident in the district. The app presents the potential sales volumes and potential revenues. No real money changes hands. In terms of installation, the participants in the practical trials have been equipped with smart metering systems. These involve two smart electronic meters (one for electricity generation and one for electricity consumption) and a communications unit, comprising a router, gateway and a mobile radio antenna to transmit the encrypted measurement data. The measurement data serve as the basis for managing the storage facility and thus for determining the account balance. This information can be viewed via the Electricity Bank app.

Strombank focuses on private households and small-size commercial and industrial customers and will probably intend to generate revenues by collecting service charges. Customers engage during the usage moderately with the product as they supervise the energy budget. Strombank's major partners are the utility companies MVV Energie und Netrion, the battery producer Ads-tec, the University of Stuttgart and the Ministry of the environment. Major competitors are the sonnencommunity, Change38 and Tiko (MVV Energie).

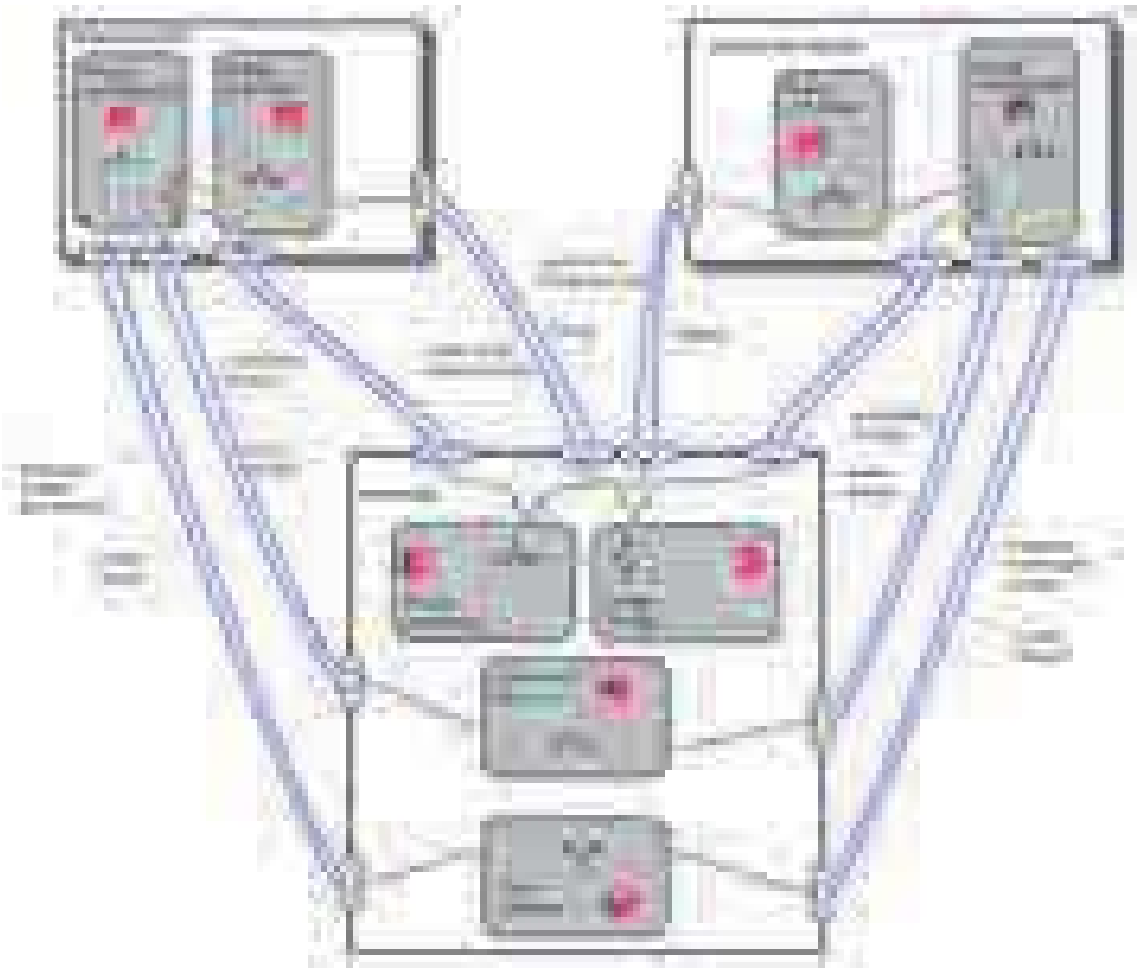

Figure 9: Detailed outline of business model – Strombank

t. Tiko.

The start-up tiko is founded by Swisscom Energy Solutions AG, which was founded in 2012 and is based in Olten, Switzerland. Swisscom Energy Solutions AG is a daughter company of Swisscom AG and Repower AG. RePower was founded in 1904 and is an international utility company with headquarters in Poschiavo (Switzerland). The company employs 670 people, generates approximately €2.2 Bn. in sales and provides 85,000 customers with energy. RePower is a public company listed at SIX Swiss Exchange. RePower conducts business mainly in Switzerland, Italy, Germany , Czech Republic and Romania. RePower is fully integrated along the whole energy value chain: Power Generation, Trading, Distribution, and Marketing. RePower's electricity is generated with thermal, nuclear and renewable energy plants. In addition to this, RePower provides services in plant construction and "New Tech Business", such as electronic mobility, smart home solutions and electronic bicycles. The utility company

focuses on both single households and commercial and industrial customers (B2C and B2B). Customer engagement is ranked very low, since regular customers only sign a power contract. RePower sources its revenues with energy sales and service charges for specific services. With the “New Tech Business” RePower intends to generate new revenue sources.

Tiko (is a joint venture of Swisscom AG and Repower AG) offers innovative solutions for demand response and load management, connecting small consumers (e.g. electrical heating systems), as well as large-scale commercial and industry consumers in a storage network. Tiko owns a self-developed hardware: M-box for communication (sensor) and K-box for steering (controller/simple switch of on & off). Its value creation lies in the storage and aggregation of energy, which it then sells back to the grid or simple short interval consumption of extra output to stabilize the grid.

Thereby, tiko aims at balancing grid fluctuations and at reducing energy costs for private households. Tiko targets private households and intends to generate revenues by selling the communication box or by memberships. Additionally, collecting a service charge for grid balancing services is possible. Customers engage moderately, as they actively control the heat pumps activities. Tiko’s main partner a utility companies (e.g. EKS, AIL) and heating system producer (e.g. CTC) (tiko).

u. Trianel

Trianel is a German energy plant operator and a commercial energy solution consultant. Based in Aachen (Germany), the company was founded 1999 as a cooperation of local public utility companies, with the goal to improve their competitiveness and independency. Trianel generated in 2014 € 1.8 Bn. in energy sales and employs over 230 employees.

Today Trianel operates gas- and coal-fired power plants and wind farms Besides energy production, Trianel consults public utility companies in the following sectors: energy trading, marketing solutions, energy generation, IT and Smart Metering. Since Trianel consults utilities, Customers engage during projects highly. Trianel’s major partners are local public utilities, whereas competitors are cooperations of local public utilities on an equal level, such as the Thüga Group and Verbund AG (Trianel).

v. TransActive Grid

TransActive Grid is a joint venture of the energy software provider LO3 Energy and the applications developer Consensus. The start-up intends to offer a peer-to-peer micro grid to regular house owners. The company was founded in 2014 and started its first micro grid project in Brooklyn, USA. TransActive Grid provides consumers and prosumers with software, which enables virtual micro grids, and hardware, such as smart meters. As a result prosumers are enabled to sell their energy surplus to their neighbours, consumers can source renewable energy, communities keep energy resources local and grid costs can be reduced (Trans Active Grid).

w. Vandebron

Vandebron is a Dutch utility company for renewable energy founded in 2013 in Amsterdam, NL. The Dutch Greentech Fund (Rabo Bank) and Triodos Green Fund have funded the start-up. Vandebron offers private households (B2C) to source energy in form of natural gas and electricity from renewable energy generators. Vandebron does not own any energy plants. It gathers renewable energy generators. A key differentiating factor is their simple user interface and simple, flexible online buying process. It provides energy generators the opportunity to brand their power plant.

To energy consumers Vandebron proposes renewable energy and transparency. Generators have the advantage of branding their services, of data access and of achieving higher sales. Customers Customer engagement is ranked low, since consumers sign a contract and choose the generator. It captures value by collecting service charges for online tradings (Vandebron).

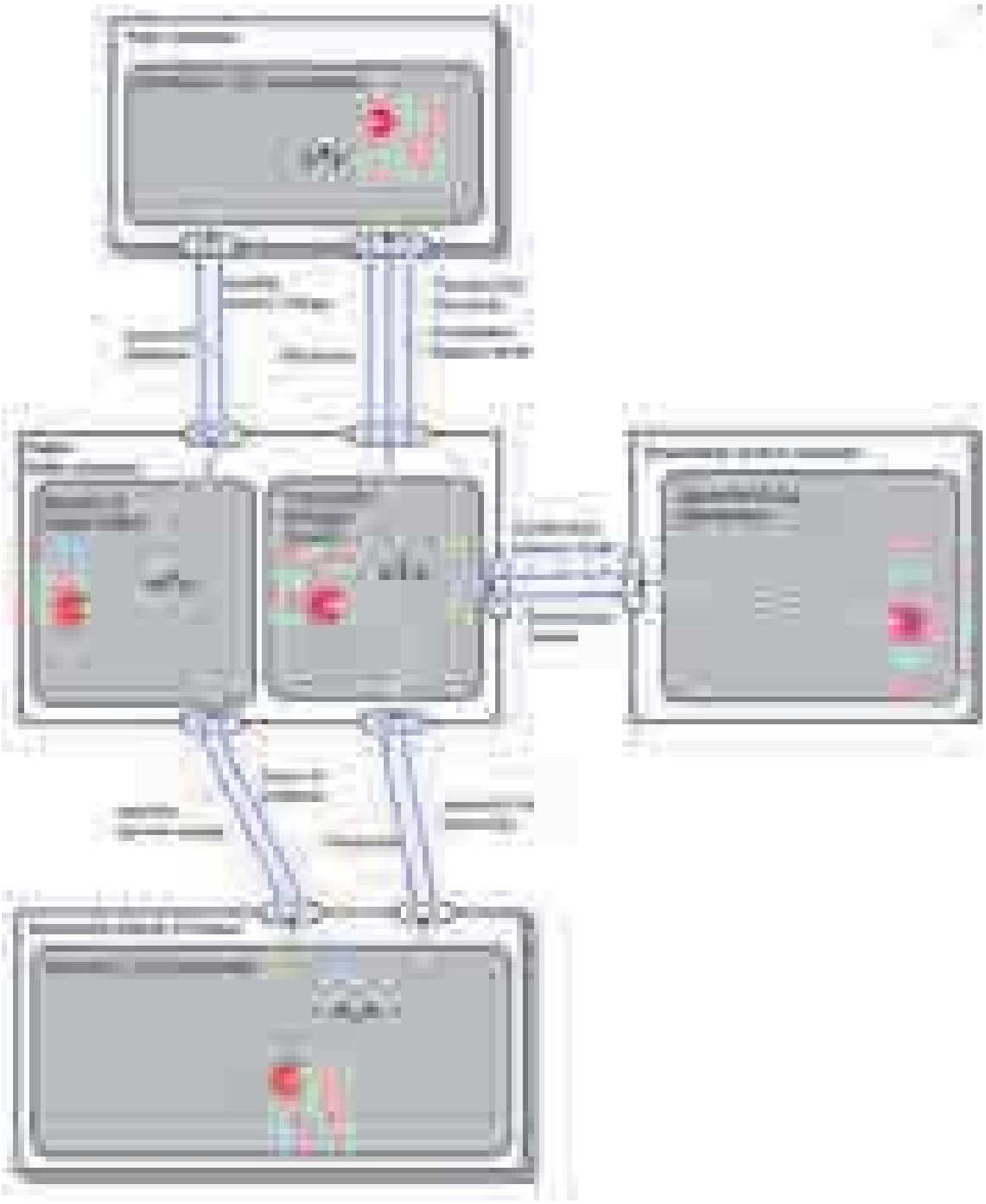

Figure 10: Detailed outline of business model – Vandebron

x. Regional tariffs

An interesting business model evolves around new, regional tariffs. For instance, the label „Unser Landstrom“ (our country-side power) a partner network of German utilities in Rheine, Ochtrup, Greven, Steinfurt, provide regionally produced power to customers within the region. See for more information: http://www.unser-landstrom.de. The regional tariff business model is not only limited to remote, areas on the country-side, but also contain urban offers, such as the Letten Strom through which the Swiss utility EWZ offers power that is produced from an historic, urban hydro-power station http://www.lettenstrom.ch.

y. Heat Reserves

The HeatReserves project is a research project that shows how in large buildings or within aggregations of small buildings heating reserves can be exploited in providing ancillary services. This project shows how reserves can be realized beyond traditional approaches of demand response on the one hand and storage on the other hand http://www.nano-tera.ch/projects/360.php. In such HeatReserves provides opportunities to further expand on business models that exploit flexibility gains on the household-level, such as Tiko.

2.2.2 Overview of cases

Taken together, the analyzed cases can be mapped as follows into the business scope areas of the decentralized energy market place. A key observation is that the different players increasingly specialize in energy solutions and services (“Local Market Enablers”) either as a single business scope or in combination with any of the other four business scopes (“Local Demand”, “Local Supply”, “Local Storage”, “Local Trading/Sharing”).

Figure 11: Selected cases' business scope

In addition, a core observation is that the selected cases varied largely according to their technology focus, according to their level of customer engagement, as well as according to their customer focus, as the following figures illustrate. In terms of technology, we differentiate between hardware and software focus with different levels of customer engagement. In terms of customers, we differentiate between customer type and level of customer activity.

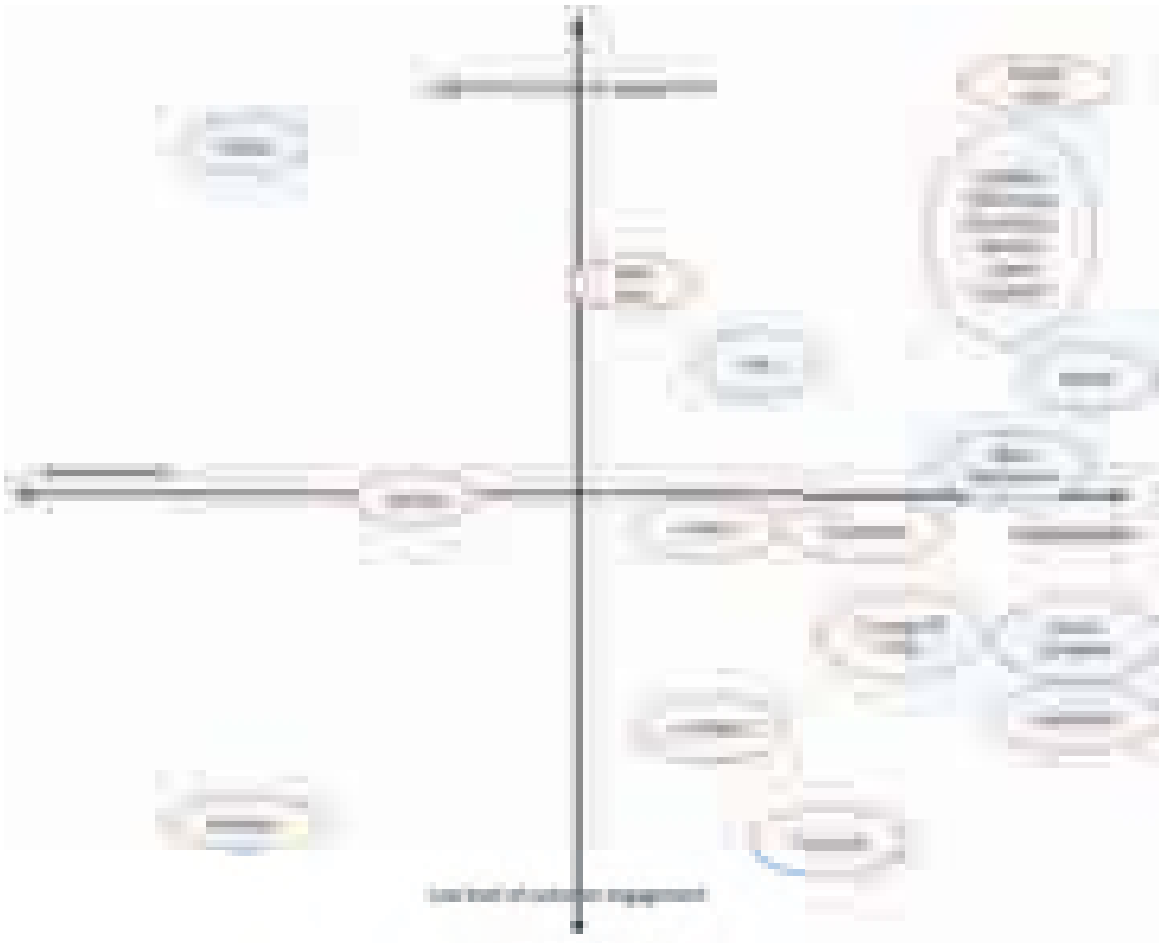

Figure 12: Technology focus of case companies

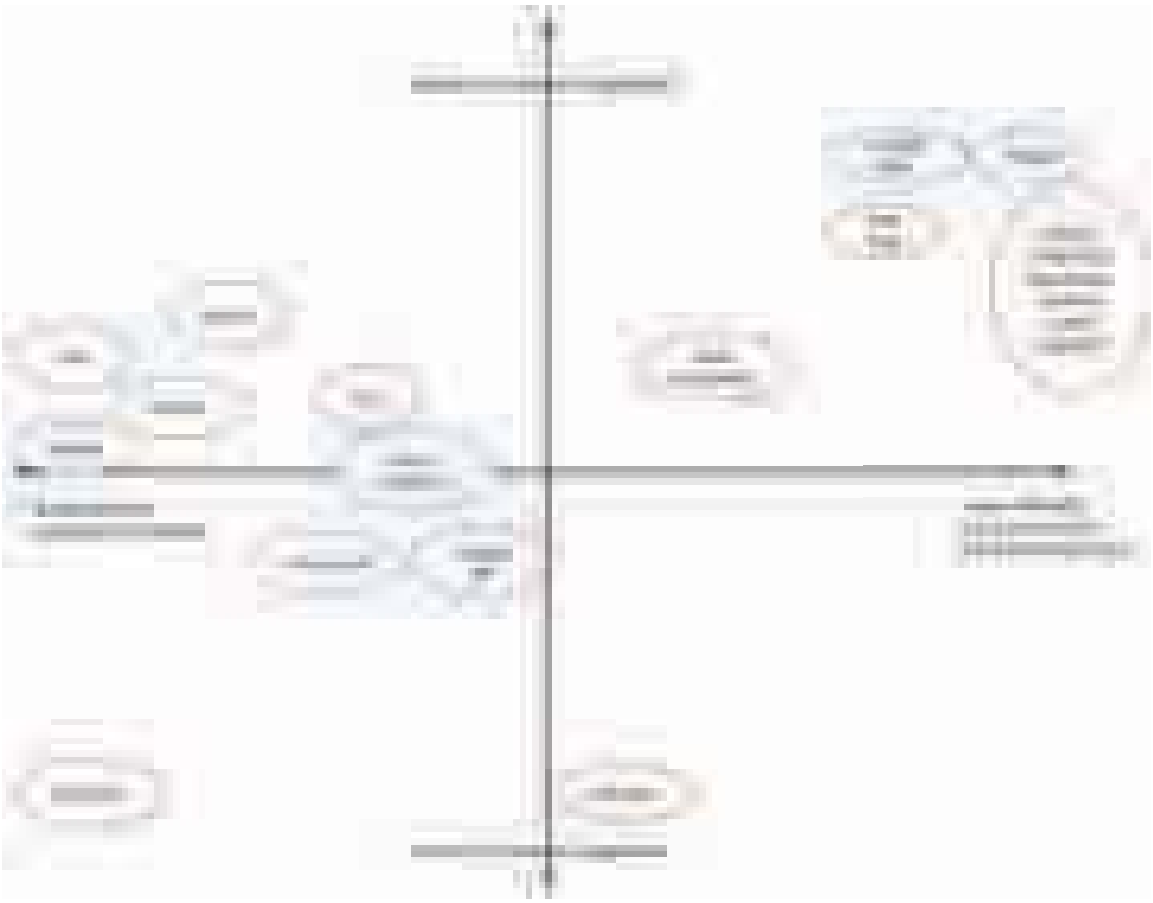

Figure 13: Customer focus of case companies

2.2.3 Overview of services

The case companies reviewed above specialized in a number of value-creating activities, for instance: ensuring grid stability and grid maintenance, offering energy savings and efficiency improvements to customers, enabling local, renewable and customized energy supply, enabling intelligent energy storage, enabling demand response, enabling demand management, providing customized energy solutions, enabling customer-friendly energy trading, offering third-party solutions (e.g. IT).

On the basis of these case analyses and based on the notions of bricolage, a collection of value-creating activities for business models in decentralized energy markets could be identified. The concept of bricolage has been frequently used throughout the social sciences (see for instance Lévi-Strauss). In a first step, we collect suitable services in the case study collection and analyse the interdependencies within the selected business models. In a second step we disassemble the services of the single business models (see the following table, which contains important services that are embedded in the respective cases). In final step we recombine the single services within new EMPOWER

related business models. We present these re-combinations within the chapter on three ideal-type EMPOWER based business models. This procedure allows us to jointly account for the learnings of earlier business modelling and for the specific requirements of the EMPOWER project.

Table 3: Overview of services

Figure 14: Summary overview of cases

In the Appendix we provide more detailed information on the selected case companies. The tables there provide an overview of the selected case's detailed information.

2.3 In-depth case study on piclo

From this case overview and in line with the EMPOWER project focus, we particularly focus on business models for online distribution platforms. With our focus on business

models for online distribution platforms, we mean that new opportunities for value creation emerge for distributing goods and services online. Just like the business models of network market platforms like ebay, Uber, and Airbnb have radically transformed the retail, transportation, and accommodation industries, online distribution platforms have the potential to radically transform the energy industry.

In this section, we will more specifically focus on piclo (a UK-based company), which has successfully introduced an online distribution platform in the UK energy industry. Given the EMPOWER project focus, piclo therefore constitutes a particularly close ally (or competitor) for EMPOWER. The following case study analysis is based on secondary data that was available through the company's website, as well as based on an in-depth interview with one of the company's co-founders.

2.3.1 Company overview

Piclo is UKs first online peer-to-peer energy marketplace and was voted as the startup of 2015. The digital service company "Open Utility" developed Piclo and intends to sell the platform to utility companies. As the Energiewende is making progress, the trend towards decentralized energy generation is increasing. Open Utility is convinced, that "businesses and private households are more likely to use renewable energy if people feel emotionally connected to the source" . As a result, Piclo enables consumers and renewable energy generators to form a local energy market by matching demand and supply based on user preferences. For sustainable consumers, Piclo is a tool to make conscious and active decisions about where they source electricity from. Renewable energy generators obtain the control to set prices and get access to customer data. Good Energy, a renewable energy supplier, forms the framework by signing a contract with consumers and generators, balancing the marketpace and offering customer services.

In October 2015, Piclo started its first trial period, which was provided with grant funding by the UK government (DECC). For six months, 37 business consumers and renewable energy generators from the UK consumed energy with the help of Piclo. On average, all matched electricity travelled 177 miles to its consumers and users spent 20 minutes on Piclo each month. Since Piclo is a unique online market place, the users can be stated as early adopters with high engagement. In the future, Open Utility intends to offer their platform to average customers and charge utility company to access their platform.

2.3.2 Business scenario

Most of today's households and business consume electricity in a very old-fashioned way: Consumers sign a power supply contract with a conventional utility company, receive energy from centralised fossil-fuel power stations and pay the electricity based on an annual bill. However, consumers do not get access to usage data, such as energy origin, consumption rate at specific times or price history. Additionally, consumers are not able to choose specific power plants. As a result, this way of energy consumption is highly intransparent and closed for consumers.

On the production side, a similar process can be stated: New technologies, such as photovoltaic plants and wind turbines, enable land- and homeowner to generate renewable energy. However, generators cannot fully determine their energy sales. Most of the time, renewable energy generators sign a power purchase agreement with a utility company, feed their generated energy into the grid and receive their sales revenues at the end of the month. Similar to the consumption side, generators cannot determine their distribution and receive no information about their final customers.

With Piclo as an online energy marketplace operator, the process of consuming and generating renewable energy and the network of market players will be changed. The network consists of four major players: The market place operator matches energy demand and supply. The group of final customers primarily demands energy, whereas the group of renewable energy generators generates energy. A green energy utility company handles formalities, such as contracts and bills, functions as a contact to the final customer and renewable energy generator and supplies the energy.

Initially, the final customer signs a power supply agreement with the utility company. In line with this contract, the consumer has the choice to select a regular energy source or to form an individual portfolio of renewable energy generators based on distance via Piclo. On the other side, the renewable energy generator signs a power purchase agreement with the utility company. If the peer-to-peer market does not provide sufficient energy capacities the utility company ensures energy supply. As a technical condition, the final customer and renewable energy generator need to install advanced meters in order to ensure fast data communications.

Market place operator. The market place operator obtains two main value activities: At first matching renewable energy demand by households and businesses and supply by local renewable energy producers. The market place operator provides the final customer and renewable energy generator access to its platform via app or browser. In

return, the final customer sets its electricity preferences, such as type of renewable energy, price and the specific renewable energy generator. Whereas the renewable energy generator sets its price and consumer preferences. The market place operator "takes in all the pricing and preference information and matches electricity demand and supply every half hour of the day" (Open Utility, 2016). The market place operator records the matches and reports them to the utility company for billing and energy supply purposes. In the current state, the market place operator does not charge any market player for this demand & supply matching service. For the future, the market place operator intends to charge the utility company for accessing their platform with its services.

The second value activity concentrates on processing usage data. The market place operator analysis and visualises information such as matched electricity percentage, average matching distance, energy source or distribution use of system charges. Via app or browser the final customer can receive the individual consumption analysis. The same applies to the renewable energy generator, which can access individual generation data. Also, renewable energy generators can access such data: The market place operator presents information about their customers and price structure, necessary data for marketing and financial reporting and a benchmark. The market place operator does not particularly charge any market player for this specific service.

Green energy utility company. The utility company obtains two value activities: Being the key contact institution for the final customer and renewable energy generators and balancing the marketpace. Compared to the market place operator, the utility company interacts directly with its customers, the final customer and renewable energy generator. The utility company functions as the central interaction partner for the final customer and renewable energy generator. As a result, the utility company handles customer affairs, such as customer service and marketing. As above mentioned, final customers and renewable energy generators sign a power supply or purchase agreement with the utility company. After the final customer and the renewable energy generator have set their preferences, Piclo reports those preferences to the utility company. During the course of energy generation and consumption, the utility company balances the marketpace in cooperation with the distribution network operator. At the end of a month, the utility company issues the energy bill and handles the financial transactions between the final customer and the renewable energy generator.

2.3.3 Business model analysis

In the following, the business model of the online energy market place operator will be described based on the Business Model Canvas by Osterwalder and Pigneur (Osterwalder & Pigneur, 2010).

Customer and User Segments. The market place operator sells a software service to a single customer, the utility company. However, the service is not only used by the utility company, but also by the final customer and renewable energy generator. As a result, the market place operator deals with two kinds of stakeholders: Customers and users.

The UC can be defined as the customer, because it commissions the market place operator to get access to the platform and makes a payment for this service. The market place operator currently targets the utility company, which are located in the UK and distribute green energy.

The final customers, as platform users, are especially businesses and private households in the UK, which intend to consume energy in a transparent and eco-friendly manner. Since the business model of peer-to-peer energy marketplaces is very young, current users can be classified as early adopters. As a result, the market place operator currently targets users, which show high engagement into the industry. In the future, the market place operator intends to target regular customers with low engagement, in order to convert the platform into a mass product. The other user, the renewable energy generator, are private de-central PV, hydro and wind energy plants located in the UK with different capacities ranging form 30 kW up to 900 kW.

Value Propositions. The energy marketplace operator proposes five main values to its customers, users and partners: Enabling the final customer and the renewable energy generator to form a local energy community, transparency for the final customer and renewable energy generator, enabling market access and choice, reducing grid costs for the distribution network operator and final customer and establishing customer retention for the utility company.

The market place operator provides a platform, which enables final customers to source energy from renewable energy generators. By demonstrating the geographical distance between final customer and renewable energy generator, the final customer chooses the closest generator, because of emotional connection. As a result, consumer and generator are located in the same region and the final customer identifies himself more with his energy source. This process establishes a local energy community. In the traditional way of consuming energy, the final customer received time-delayed and little

information about his consumption. With an online energy marketplace, the level of information for the final customer changes: Detailed and recent information and analysis can be accessed. The consumer is able to improve his supervision and experiences higher transparency. The same applies to the renewable energy generator: The generator used to have no information about his consumer. The online platform of a market place operator enables the renewable energy generator to monitor his sales and consumers. Originally, neither final customer had direct access to the renewable energy generator, nor the other way around. The final customer was able to choose only a utility company and a specific mix of energy sources. The renewable energy generator experienced a similar procedure: Generators chose a utility company as a buyer and had limited sales control. Whereas a peer-to-peer online energy marketplace provides access and control to the final customer and renewable energy generator, final customers and renewable energy generators access the market of decentralised renewable energy. The final customer holds control to choose its energy source and the renewable energy generator is able to set selling preferences. As a result, both platform users experience a democratisation development. Also, the utility company profits from the online platform: As mentioned above the final customer and the renewable energy generator establish over time a local energy community, which results in a strong relationship between the two parties. The utility company enables and formalizes the relationship by providing the framework in form of contracts. Consequently, the final customer and the renewable energy generator are linked to the utility company if they want to maintain the relationship. As a result, the utility company can tie its customers to itself and secure its revenues. Furthermore, the distribution network operator can reduce grid costs with the online energy marketplace. The final customer is incentivized to choose close renewable energy generator. Local grid infrastructure becomes more important and virtual microgrids establish. As a result, the usage of long-distance power lines decreases and both distribution network operator and final customers can reduce grid costs.

Cost structure. The costs of an online energy marketplace can be separated into two stages: First, setting up the platform and second operating the platform. Setting up a platform causes primarily IT costs. Programmers need to construct the marketplace. After the platform is established, the operator needs to maintain and improve the marketplace, which also cause IT costs.

Key resources. Similar to other online platforms, the energy marketplace operator concentrates on soft- and hardware resources. The market place operator invests in

intelligent matching systems and customer friendly interfaces. The market place operator will not maintain hardware such as renewable energy plants or grid infrastructure.

Beyond its immediate value as the key competitor of EMPOWER, we will draw on this case analysis of piclo in chapter 3, in order to develop embryonic business models for Empower.

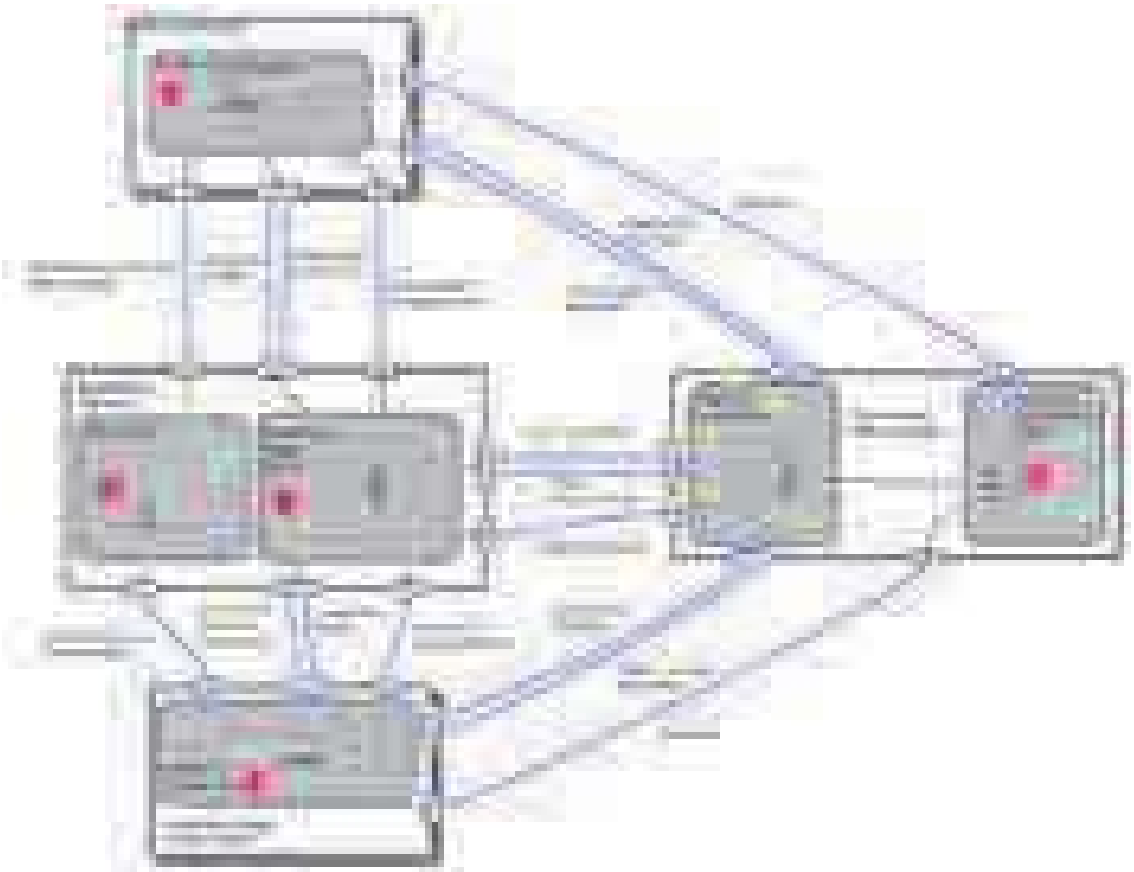

Figure 15: Detailed outline of business model - Piclo

2.4 In-depth case study on Sonnen

The German battery producer Sonnen was founded in 2010 and is one of the leading intelligent home storage producers. The company's headquarter is located in Wildpoldsried, Bavaria (Germany). It has sold over 10.000 batteries in markets worldwide (e.g. Central Europe, USA, Philipines, Australia) and received in June 2016 funding by the American enterprise General Electric. The sonnenBatterie eco is an energy storage solution for private households that uses intelligent software to manage energy throughout the day - enabling the use of solar power at night. The battery is equipped with a renewable energy generator, e.g. a PV plant that can store self-generated power.

The sonnenBatterie includes weather forecasts and electricity consumption behaviour data into an energy management system.

2.4.1 Business scenario

In general, private households with a PV plant feed their self-generated energy into the grid and sell it to utility companies. Sonnen developed the intelligent sonnenBatterie, which stores the self-generated energy and the sonnenCommunity, where prosumers and consumers are enabled to share energy.

With Sonnen as an autarky solution provider, the process of consuming and generating renewable energy and the network of market players are changed. The network consists of four major players: The *autarky solution provider* sells batteries, manages energy usage and operates the energy community. The *distribution system operator* handles energy distribution. The *Prosumer* generates and consumes energy and the *consumer* consumes energy from the community. Initially the prosumer buys the storage system and a PV plant via a licensed dealer. The prosumer additionally enrols in the energy community, in order to sell and buy energy. Alternatively, the prosumer can choose a utility company in order to sell excessive energy or buy missing energy. On the other side, the consumer enrols for the energy community in order to buy energy.

Autarky solution provider. The autarky solution provider obtains three main value activities: At first, developing and selling the storage system. Intelligent software and a powerful battery are developed in order to provide the storage system. The autarky solution provider sells the storage systems to regional licensed dealers, which resell it to the customer and installing the storage system in private households. The autarky solution provider handles nationwide marketing. The second value activity is software-based and handles the energy management. Weather forecast and usage data are used to improve storage capacity and provide efficiency services for the prosumer. The autarky solution provider is not paid for this service. Furthermore, the autarky solution provider operates the energy community. Prosumers can access the community by paying a monthly membership. The prosumer is then able to share or source fixed-price energy via the community, if the prosumer does not have sufficient energy or generated excessive energy. The regular consumer does not pay a monthly membership for the community access, only a payment for the consumed energy. The autarky solution provider manages the community by distributing the energy. In order to secure constant energy supply, the autarky solution provider buys additional energy from renewable

energy generators, such as biogas plants. Currently, the autarky solution provider does not generate any profits with the community activities.

Prosumer. The Prosumer obtains three main value activities: Generating, storing and consuming energy. At first, with the help of a PV plant, the prosumer generates renewable energy. This energy is directed to the home storage system. If the private household consumes energy, the storage system decides whether to use stored energy or obtain external power. External power can be sourced from the energy community or utility companies. If the prosumer generates excessive energy, the storage system sells it to the community or to a utility company.

Distribution system operator. In order to physically receive energy, the distribution system operator needs to handle the distribution of the renewable energy. The autarky solution provider informs the distribution system operator about energy transactions and pays a service fee, which is included into the price of community energy. If prosumers sell and buy energy to and from other utility companies, the utility company handles the distribution service fee.

2.4.2. Business Model

In the following chapter, the business model of the autarky solution provider will be described based on the Business Model Canvas (Osterwalder & Pigneur, 2010).

Customer Segments. The autarky solution provider deals with two kinds of customers: The prosumer and the consumer. Prosumers are private households, which generate renewable energy. Typically, households generate energy with a PV plant installed on the rooftop. Prosumer set value on being independent and sourcing green energy. A home storage system can be also categorized as a “gadget”. Prosumers are likely to show high technical affinity. Additionally, the market of home storage system is relatively young. As a result, present prosumers are likely to show high engagement into the topic. In the future, the customer engagement will likely decrease to a moderate level, because the product will become more established and during the course of use interaction with the storage system is low. The second customer segment “consumer” sources energy from the energy community. Consumers do not generate renewable energy, because either they are not able to install the appliances (e.g. apartment owner) or do not want to generate energy. The customer relationship with consumers is rather loose, because consumers do not make any expansive investments into appliances. As a result,

customer engagement is more likely to be moderate. The autarky solution provider targets in this customer segment also environmentally conscious energy consumers.

Value Proposition. The autarky solution provider proposes five main values to its customers: energy independency, green energy supply, transparency, a stylish gadget and the sharing community.

The storage system enables house owner with renewable energy plants to consume their self-generated energy time-independently. As a result, the prosumer does not depend on utilities or fossil fuels. Additionally the autarky solution provider proposes long-term energy cost reduction, because for example a PV plant does not cause variable costs. Secondly, the autarky solution provider proposes 100% renewable energy. Both prosumer and consumer can be certain that they source only renewable energy. This also leads to the third value proposition: Energy transparency. Prosumers have full transparency where they source their energy, because it is coming from their rooftop. Via a mobile app prosumers can monitor their energy budget. As a result, the prosumer is able to improve his energy consumption habits and reduce energy costs.

The autarky solution provider also proposes social values. Sonnen understates to design and market its product as an innovative and stylish gadget. The home storage system is an aesthetically designed appliance with the ability to become a symbol of social status. While the energy community promotes the “sharing community idea”: By being part of the community prosumers are enabled to share energy with their peer. On the other side, consumers are enabled to source energy from their peer. As a result, prosumers feel helpful and consumers feel environmentally conscious. This leads to high emotional attachment to the community.

Cost structure. The development and production of the home storage system represents the largest matter of expenses. The autarky solution provider needs to develop the intelligent storage software and the build-up of the hardware part. Software development includes human resource costs, whereas the hardware part includes factory and human resource costs. Additionally, the energy community causes software development and maintenance costs. Besides the costs of operations, the autarky solution provider handles advertising and marketing activities.

Key resources. The autarky solution provider owns four major resources: Hardware and software know-how, distribution system and the image of a stylish product.

Since 2010, the autarky solution provider develops home storage system. During this time, the company developed expertise on how to build home storages. The same applies to software parts. Algorithms have been developed to intelligently store energy and operate an energy community. Additionally, the autarky solution provider has developed over the last year a network of licensed dealer. A large distribution system supports the product availability increases sales. At last, the marketing of the autarky solution provider has established a brand and a stylish image. Compared to competitors with similar products, the autarky solution provider understands to position its product.

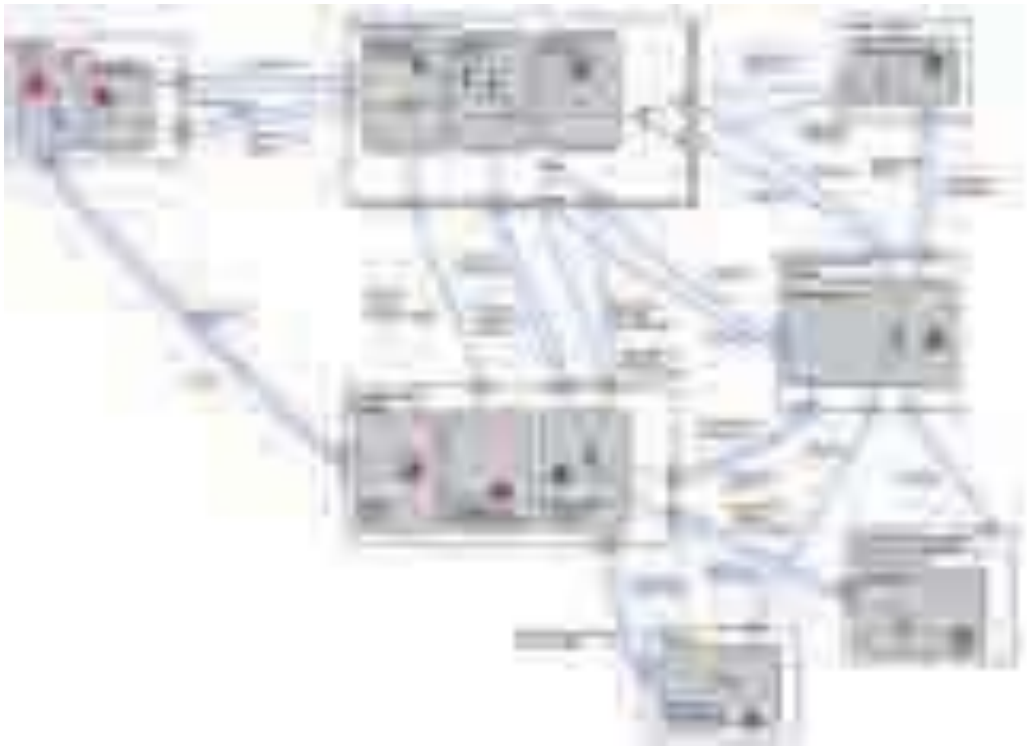

Figure 16: Detailed outline of business model – Sonnen

2.5 Relevant business models in parallel industries

Given the scarcity of cases for online distribution platforms in the energy industry, we complemented our insights with analyses of ebay, Uber, and Airbnb, which have radically transformed the retail, transportation, and accommodation industries through the introduction of online distribution platforms. In the remainder of this section, we briefly introduce these three cases. We then build on this case analysis for developing a typology of value propositions for online distribution platforms in the section thereafter.

2.5.1 Case descriptions

a. Pagecloud and The Grid: the role of ICT in democratizing professional services

Pagecloud claims itself to be the „worlds most advanced website creator“ (https://pagecloud.com). Craig Fitzpatrick, CEO & Founder of pagecloud, has developed an approach which is based on ICT and offers a radically simplified approach of designing and setting up webpages, so that no programming skills are required. Also the traditional backends like for instance in Wordpress are not required anymore and the hompages can be designed right within the broweser. The technology behind Pagecloud enables also laymen in website programming to setting up and developing an homepage. Thus pagecloud lowers the entry barriers to webdesign, enabling more people to directly set-up their homepage. Pagecloud still requires the designer to actually do the choices for design. An alternative model, which also brings down the entry barriers to webdesign is offered by The Grid. Within the Grid artificial intelligence conducts the programming. In such the technology takes a more active role already for the design choices. More information about The Grid can be found here: https://thegrid.io While the role of human agency and the role of technology is different in both models, the general approach of using ICT to lower entry barriers and empower a broader community of individuals to perform a professional task (here website design) is similar.

b. Upwork: the role of ICT in match-making and project management

Upwork is the globally largest freelancer market place. It is headquartered in Mountain View in California. In 2015, Upwork results from the merger between oDesk (founded in 2003) and Elance (founded in 1999). It is an online freelancing platform that matches businesses and independent professionals to connect and engage in transactions at a distance. It allows independent professionals to offer jobs on app and software development, engineering and data science, creative services such as graphic design and writing, business and administrative. It enables businesses to outsource services in a variety of different domains. Upwork hosts 9 million registered freelancers and 4 million registered clients. Three million jobs are posted annually, totaling a worth of USD1 billion.

The platform retains a 10% charge of the payment to the freelancer. Starting on May 3rd 2016, the service fee for freelancers will change from a flat rate of 10% to a “sliding service fee” of 5% to 20%. Payments are done through credit cards, PayPal or bank transfer. Payments are made with Upwork’s escrow system. The escrow system comprises a contractual arrangement in which Upwork receives and disburses the

money after a 6-day period and depending on the conditions agreed upon by the transacting parties.

To secure that independent professionals are billing fairly on an hourly basis, the platform offers a time sheet application that tracks time and takes screenshots while the freelancer is billing. Upwork further offers voluntary skill tests and ratings of the transacting parties. It also has a mobile app.

c. Online stores: the role of ICT in processing digital business

Online stores enable consumers to directly buy goods or services from a seller over the internet via a digital distribution platform. Sellers present their products for sale with text, photos and multimedia files. Online stores offer a number of key benefits, among others convenience and transparency. Transparency is further enhanced as search engines enable online comparison of products/ services and prices. Items are reviewed by buyers. Payments are generally made through credit card or PayPal accounts.

On the one hand, Amazon may be considered as the largest internet-based retailer in the United States. It surpassed Walmart by market capitalization in 2015. It is based in Seattle, Washington. It started with a bookstore and later diversified in a range of other products, including downloading and streaming of software, music, and video. It has separate websites for different countries. Retail package delivery is typically done by the public postal system or by retail couriers such as FedEx, UPS, DHL or TNT.

On the other hand, online stores comprise sales of applications, like App Store, or Google Play. The App Store is a digital distribution platform for mobile apps developed and maintained by Apple Inc. The App Store has more than 1.5 million apps https://en.wikipedia.org/wiki/App_Store_(iOS)_-_cite_note-1.4mil-1and more than 100 billion copies of apps have been downloaded.

d. Uber: the role of ICT in disrupting existing industries

The on-demand transportation service “Uber” founded in San Francisco, USA in 2009 has caused a revolution in the taxi industry. Uber has raised over $ 9 bn in funding and operates its services in about 70 countries.

Uber offers different mobility products: From cost-efficient taxis up to luxurious SUVs, but also other kinds of transportation, such as bicycles or helicopters. Uber sources revenues by collecting payment for the drive. Compared to regular taxis with a few level of fares, Uber sets prices with a surge price technology, where demand and supply decide the price.

Uber proposes a variety of advantages to its consumers: No long waiting times, certain free rides, cheaper alternative than regular cabs, travelling in style, fixed prices for common places and especially transparency. It proposes the following: Additional source of income, flexible working schedule, easy payment procedure and payment for being online without a customer. Customers can be segmented into people, who do not have a car, who need a lift to events, who want to travel in style or who want to travel cost-efficiently.

Uber has developed its services in more than 400 cities worldwide. The entrance into new cities follows a certain procedure: First Uber provides sufficient money to incentivize drivers and consumers. Secondly, Uber advertises their offering in local media and makes use of its known brand.

The business model of Uber is so successful, because Uber recognized the problem that regular cabs are too expensive and take too long to get one. Consequently, Uber disrupted an existing model with a new technological infrastructure. During the expansion, Uber succeeded because it understands how to make use of penetration marketing and how to expand step-by-step. In addition to this, Uber owns only the virtual platform, no hardware, which makes Uber very flexible

e. Airbnb: the role of ICT in enabling sharing

Airbnb is an online marketplace connecting travellers with local hosts and is a role model for “sharing economy” business models. The platform enables homeowners to advertise their available space and earn an extra income by renting out. At the same time, it “enables travellers to book unique homestays from local hosts for little money and giving them a chance to interact with locals”. Airbnb was founded on 1 August 2008 in San Francisco, USA by Nathan Blecharczyk, Joe Gebbia and Brian Shesky and grew rapidly since then. Today Airbnb has received funding over $3,89 Billion, reached a company valuation of $25,5 Billion and connects accommodations in over 34,000 cities .

Airbnb deals with two customer segments: The hosts and the travellers. Hosts are people who own houses or apartments and intend to generate revenues by renting out their underused living space. Hosts can offer their living space on the platform, add information about the accommodation and set their own rent. Based on reviews of the travellers or personal information, the hosts can accept or reject a booking. Travellers are able to browse and filter offered accommodations from local hosts. Afterwards the traveller books the favoured accommodation and pays through the Airbnb portal. New customers are mainly acquired via social media, word of mouth or digital marketing.

The accommodation platform proposes a variety of values to its users: At first, it enables homeowners to generate revenues from underused living space. Homeowners are able to flexibly rent out during absence or underused space. The degree of living space utilisation increases and new revenue streams for homeowners establish respectively living costs decrease. Secondly, travellers have a cheaper alternative to regular commercial accommodations. Especially travellers with basic needs and, who do not want to pay for extra hotel services, choose accommodations via Airbnb. In order to overcome the trust barrier with strangers, the platform offers as a social control tool a rating and review system for hosts and guests. In order to financially secure the host, Airbnb provides insurance.

Airbnb generates revenues by handling booking and monetary transactions on the platform. Both host and traveller pay a booking service charge: The host has to pay a 10% commission upon every booking. At the same time, the traveller pays a 3% commission upon every booking.

The key problem for Airbnb is the trust issue between host and traveller. In the majority of the bookings, the two parties do not personally know each other and face high uncertainty. Additionally, if users have made bad experience, it is difficult for Airbnb to maintain user retention.

2.3.2 A typology of value propositions for online distribution business models

Value propositions that take stock of online distribution have been successful in a number of other industries. For companies to survive in highly competitive and innovative environments, a key requirement is to develop differentiating value propositions that grant a company competitive advantage over its competitors. In this section, we develop a typology of value propositions for online distribution business models based on the analysis of the previously described successful cases. In particular, we differentiate the following types: **Type 1** – Democratization of market access; **Type 2** – On-demand access to services; **Type 3** – Utilizing untapped assets. These types are described in greater detail in the following Table.

Table 4: Typology of value propositions for online distribution business models

Type 1 – Democratization of market access.

We define Type 1 value proposition as an online marketplace granting access to a private & non-private seller base that otherwise would not exist. ICT play a key role for matching buyers and sellers in an online auction platform and with ancillary services. A key example is the online auction marketplace eBay, which through its online marketplace granted access to private people as sellers.

Type 2 – On-demand access to services.

Type 2 value proposition is referred to as an on-demand matching of buyers and sellers for a transaction. Also in this type ICT play the major role in the form of real time and on-demand matching between buyers and sellers and with ancillary services. Therefore, the on-demand transportation service Uber was chosen as an example.

Type 3 – Utilizing untapped assets.

Type 3 value proposition is referred to as online marketplace granting access to underutilized assets (assets that otherwise would not be up for sale). Again here, ICT play a key role for matching buyers and sellers in an online platform for sellers to be able to distribute their products and services. The host company adds ancillary services. The online service Airbnb may be considered as a primary example.

It is important to note that for analytical purposes, it makes sense to differentiate the value proposition types outlined above. In practice, however, they may be combined to form a comprehensive value proposition. Taken together, the value propositions offer key advantages in terms of choice and transparency, bundling of services, repeated transactions (e.g. flat fee pricing models), new customer segments and new service types.

3 Three ideal-type business models for EMPOWER

In the following, we link the previous work to the distinct opportunities for EMPOWER based business models. The EMPOWER project features two classes of business models (see Table 13 for an overview): Within the first class EMPOWER provides ground for business models that enable the SESP. These business models facilitate the implementation and operation of SESP. Such business models organize the supply of products and services that constitute the SESP. Within this class, business models differentiate in regard to their integration. Low integrated business models are stand-alone business models, for instance business models that focus on supplying single elements of what is needed to implement and run the SESP. For instance, component manufacturers or supplier of ICT- or consulting-services. Medium integrated business models, are business models that operate within an eco-system. Examples are the different business models of the EMPOWER partners (e.g. Schneider, e-Smart etc.). While the business models are operating independently for example in regard to financial affairs or economic interests, they coordinate their value creation activities within an eco-system to jointly provide and further develop the products and services that are required to implement and run the SESP. High integrated business models are business models, that manage to provide seaming-less integration of the distinct services and offers on a standardized platform. As the platform business model seems to be the most challenging but also most promising business model within the class of SESP enabling business models, we will further develop it in the following section (provide section number).

Within the second class Empower provides ground for SESP based business models. These business models utilize the SESP for value creation and value capture. In such these business models enable local presumption, local balancing or the provision of complementary services. As the SESP basically facilitates a new local energy market design, SESP based business models contain all business models that can be operated within the EMPOWER market design (for an overview of the mechanics of the market design see deliverables of WP 6). Within the EMPOWER market boundaries business models differ in regard to their market and customer requests, their value creation and value capture activities, their distinct approach of monetization - for a basic classification of business models see D2.1). We have further investigated the potential of the embryonic EMPOWER business models that have been discussed in D2.1. and found that especially the “our power” business model targeting energy cooperatives, and the “DSO local” business model targeting DSO bears potential.

Table 5: Two classes of EMPOWER based business models

In the following we describe the ideal-type business models for EMPOWER in more detail. In particular, we first spell out the market and customer requests the business model needs to accommodate. The methodology has been specifically developed for

EMPOWER, and is subject to a working paper on „business model quality“.[2] Second, we make use of a recent proposed methodology to develop business models based on concepts, which points to the distinct practices of using analogies and re-combinations (Martins, Rindova, & Greenbaum, 2015). In such, we point to analogical business models and important differences of the proposed EMPOWER ideal-type business models. Third, we sketch the value creation and value capture activities as well as important aspects of each models monetization approach. For each of the three business models, we conclude outlining the prospects in regard to social acceptance. Social acceptance is a major predictor of business model success for smart grids (Wolsink, 2011; Wüstenhagen, Wolsink, & Bürer, 2007) and will also be one of the core subjects in the following work in WP2, especially for the upcoming D2.3.

3.1 EMPOWER platform business model

3.1.1 Market and customer requests

The quality of the EMPOWER platform business models is a function of how well the business model accommodates important requests form the market and from customers. (1) The platform needs to integrate reliable products and services, that enable the envisioned market design of EMPOWER. The development and integration of these services is a day-to-day challenge within the EMPOWER project. This requirement refers to the fit of components and services. Which technological components support EMPOWER? What ICT design and infrastructure is required? Which marketing instruments can be used to engage prosumers. Requests concern the choice of reliable products and services, the design of the required products and services, the integration (the mutual fit of these services), and an integrated offering and provision for the SESP. (2) The platform needs to be variable. Local energy markets are sensitive to local legislation, ownership claims, local structures of social acceptance etc. (see D2.1). In such the platform needs to be able to facilitate EMPOWER markets under different external control factors. In such the platform needs to offer a modular structure, that can support EMPOWER in Hvaler, Wolpertshausen, Malta and beyond. (3) The products and

[2] The working paper is part of the actions in WP2 and is in preparation for publication. It outlines an „ecological rationality“ view on business models and outlines how business model design and business model quality is a function of cognitive and structural processes, that constitute the ecology of a business model.

services that are provided on the EMPOWER platform require expert knowledge. For instance, local management of power supply, demand and grid requires expertise in the energy utility business. Aspects of flexibility trading require knowledge on energy trading, the sourcing, set-up and maintenance of technological components require technological competences, the developing of suitable ICT infrastructure requires software and programming competences and engagement of prosumers requires competences in customer and regulatory policy. (4) EMPOWER targets prosumers that are often laymen and not experts. Laymen require a different language then the professionals, require a different – assumingly more intuitive – functionality and also differ in regard to preferences of what is important and how an EMPOWER related business model needs to look like.

The EMPOWER platform business model needs to mediate between these requests. For instance, the sharing between laymen and professionals is an interesting challenge, which will likely determine success or failure of the EMPOWER platform business model.

3.1.2 Analogical business model modules

The EMPOWER platform business model shares similarities with analogical business models. Like retailers do, an important service of the platform is the preselection of products and services. The distinct services of the display, provision and payment of IT-based services is similar to the standard App store of apple[3]. The distinct services of the display, provision and payment of general services is similar to the standard freelancer platforms.[4] The distinct services of the display, provision, payment and customer interface of products is similar to these of standard online retailers, such as Amazon[5]. The distinct provision of specific cloud-based services for a selected target group is similar to the approach of how Swisscom offers products and services for small and medium sized companies[6]. However, what is new is the combinations of these elements towards a new platform which has a unique focus on distinct products and services for local energy markets, and the respective target groups that are interested in these local energy markets.

[3] https://itunes.apple.com/gb/app/apple-store/id375380948?mt=8

[4] https://www.upwork.com

[5] https://www.amazon.com

[6] https://www.swisscom.ch/en/business/sme/digital-work.html

3.1.3 Value creation and capture

One of the most important features of the EMPOWER platform business model is the role of the SESP as a project. While the SESP focuses on delivering the smart energy services, the platform provides the arena on which prosumers and product and service providers interact. In such the platform enables the SESP, hosting all supporting and enabling processes for the SESP, the supply of the services for the SESP and the services from the SESP.

The *platform-prosumer services* contain communication, access to a relevant product and service portfolio, order processing and payments, quality management (based on grading and ratings) and information provision. The *platform-prosumer fees* contain fees the prosumers pays the platform (which are a membership fee and a pay-per-use fee) and fees the platform pays the prosumer (prosumer share of platform gains as such from flexibility trade). The *platform-supplier services* contain communication, access to a relevant product and service portfolio, order processing and payments, quality management (based on grading and ratings) and information provision. The *platform-supplier fees* contain fees the supplier pays the platform (which are a listing fee and a handling fee) and fees the platform pays the prosumer (payments for actual supply).

Figure 17: Overview of the EMPOWER platform business models

3.1.4 Monetization

In regard to monetization two aspects are important. First, revenues and costs consist of multiple elements that will appear in combination. It is unlikely that one element alone (e.g. power prices) can refinance the costs of the whole system. In such, the monetization constitutes of multiple combinations. Second, like already mentioned in D2.1. a specific feature of platform business models is that value and money flows can be decoupled. In

such, the customer does not always pay the service, but someone else might sponsor the service for various reasons. On the revenue side, following elements will generate income:

- **Fee for development and design:** The EMPOWER platform requires a fee for the conceptual development (selection of product and service mix, functionality, hard- and software requirements etc.) and the actual design (programming) of the platform. While this fee can be integrated in other fees, it also can be a pre-operational fee (e.g. like financing of R&D as within the EMPOWER project through funding within the Horizon 2020 programme).
- **Fee for hardware and software sales for suppliers**: The platform provides the opportunities for partners to sell their hardware and software. In particular, the platform facilitates and handles sales for the partners, which is a valuable service. The EMPOWER platform leverages that and requests a fee for hardware and software sales. The fee can be variable to cover the actual handling of sales and thus might be depending von volume and unit sales.
- **Listing fee for suppliers:** The listing fee covers the general access and pays the set-up and maintenance of a particular product or service offering on the platform.
- **Pay-per use for consumers/ prosumers:** As an alternative or complementary offering to hardware and software sales, the platform also offers pay-per-use, and charges suppliers and consumers/prosumers for the facilitation of the pay-per-use option.
- **Membership fee for consumers/ prosumers:** Consumers and prosumers who seek access to the platform pay a membership fee.
- **Fees for complementary services:** For complementary services the platform offers, a service fee will be charged.

On the cost side, the EMPOWER based platform needs provide payments for following elements:

- **Costs for platform development and design:** The EMPWOER platform pays the conceptual development and design of the platform.
- **Costs for platform maintenance:** The platform pays he maintenance and continuous further development of the platform. This consists for instance of costs for the IT-based side of the platform (e.g. hosting, programming etc).
- **Costs for sourcing third-party products and services:** The platform pays the initial, conceptual definition of the product and service mix. The platform further pays the continuous monitoring and improvement of product and service mix).

- **Costs for developing and providing platform owned products and services:** The platform pays the developing and offering of own products and services: These can be services in regard to efficient supplier-consumer/prosumer relationships (e.g. establishing agency sales handling, pay-per use etc.) or complementary services (e.g. derived from data-analytics which leverages market insights based on platform usage dynamics).

3.1.5 Prospects and drivers of acceptance

The EMPOWER platform surfs clearly on the trend of developing more-sided platform business models. It benefits from the further development of ICT which by know is able to provide simplified access to very specific services. The platform business model also contains important aspects of the EMPOWER project: while many single elements of the EMPOWER concept are already available on the market, the EMPOWER project is one of the first eco-systems which integrates the different elements. If the platform business model succeeds in collecting these different elements and integrating them, the platform will be the logical next step for dissemination the innovations and action, EMPOWER has been developed. An advantage of the platform business model is also its scalability, once implemented the platform can easily be adjusted to the needs of specific market segments. Within the work to come in WP2 we will further investigate the drivers of acceptance of such a platform business model.

3.2 OUR Power

3.2.1 Market and customer requests

The quality of the OUR power business model is a function of how well the business model accommodates important requests form the market and from its customers. (1) OUR power targets to serve energy cooperatives. The total number of energy cooperatives has grown steadily in the last years, although more recently their expansion has found some slowdowns. Still in important European markets, energy cooperatives out-numbers incumbent organizations, such as utility companies. Energy cooperatives differ in their structure, human resource and government from traditional profit-oriented companies. They have a strong link to a geographical region, and are partly organized through their members in their spare time. In such contact points with professional energy managers are limited, which makes communication and knowledge transfer

between energy cooperatives and the traditional energy industry a challenge. Our power needs to respond to the particular requests of energy cooperatives. (2) OUR power targets to enable an expansion of value creating activities beyond supply. In such the business model of OUR power seeks to couple local energy production with local demand, trading, storage, direct marketing etc. (3) OUR power seeks the involvement of local energy consumers and prosumers that have not yet been attracted by the energy cooperative. (4) OUR power needs to manage the interface with the incumbent grid infrastructure and with the incumbent energy players. In particular, it needs to enable an integration of the regional OUR power framework into the broader grid and industry structure.

3.2.2 Analogical business model modules

The Our power business model shares analogical ideas with other business models. It shares the idea of democratization energy which has but forward for instance by Open Utility. In such it empowers individuals (like prosumers) or new organizations (like energy cooperatives) to take an extended role in the power market. In fact, based on ICT it simplifies traditional energy products and services and with that brings down entry barriers into the energy industry for new players. Such IT-enabled democratization finds reference in business models from other industries, such as www.pagecloud.com

Our power enables an easy-to-use market place, which finds references not only in traditional market places for energy but also more frugal concepts, like peer-to-peer energy sharing-platforms such as Buzzn or Vandebron. Our power potentially integrates storage and finds reference for this module in the approach currently tested by Strombank. The module for supply side flexibility and trading finds reference in the approach of next Kraftwerke, the handling of demand side flexibility finds reference in the model of Enernoc. In regard to direct marketing our power shares similarities with regional power tariffs (e.g. http://www.unser-landstrom.de, http://lettenstrom.ch/) What is new for Our power is the distinct regional community focus for all business model modules. Within WP2 we are experimenting and testing with the design of the Our power model, the experimental set-up can be assess under http://newtility.eu/wordpress/

Figure 18: Screenshot from the WP2 test model “Newtility” and the featured concept of Energy managers from the hood; Source: http://newtility.eu/wordpress/

3.2.3 Value creation and capture

Important extensions of the value creation and value capture activities in comparison with the EMPOWER platform is the customization of the EMPOWER platform in response to the specific requests of energy cooperatives. In that regard the Energy Cooperative formulates specific requests to the standard EMPOWER platform and pays a customization fee. The standard platform provides the customization services and provides a customized “our power platform”, in turn it receives a franchise fee. The energy cooperative provides market access services to the Our power platform and receives the revenues the platform generates.

Figure 19: Overview of the Our power business model

3.2.4 Monetization

In regard to monetization Our power similar to the EMPOWER platform model and two aspects are important. First, revenues and costs consist of multiple elements that will appear in combination. It is unlikely that one element alone (e.g. power prices) can refinance the costs of the whole system. In such, the monetization constitutes of multiple combinations. Second, like already mentioned in D2.1. a specific feature of platform business models is that value and money flows can be decoupled. In such, the customer does not always pay the service, but someone else might sponsor the service for various reasons. On the revenue side, following elements will generate income:

- **Power price:** While generally the role of the power price in creating revenues will be lower than in traditional energy systems, power sales are an opportunity for revenue generating
- **Premium local**: Our power will charge a premium for the locality of the electricity. While earlier studies indicate the value of such local electricity (see also for instance offerings like “unser Landstrom” or “Letten Strom”, it is under current debate how this premium is contingent to different countries and regions.
- **Premium sustainability**: Our power will charge a premium for the sustainability of electricity.

- **Premium prosumer**: Our power will charge a premium for the service of empower prosumers, hence backing up and providing reserves for prosumer entities.
- **Premium alternative to established players**: Our power will charge a premium for being an alternative to established players. While large incumbent utility companies eventually can leverage economies of scale, our power provides value for offering the freedom of choice.
- **Fee for additional services**: Our power will request a fee for additional services, that will complement traditional power related products and services.
- **SESP gain:** The SESP will generate revenues, for instance through external trade of flexibility, such as on reserve markets.
- **Eco system sponsorships:** The ecosystem will sponsor the SESP in various ways. For instance, hardware and software suppliers provide sponsoring as the SESP allows them to facilitate their core business (e.g. Sonnen traditionally focuses on battery sales, but also sponsors the Sonnen community).

On the cost side, the Our power needs to provide payments for following elements:

- **Costs for SESP:** Our power needs to pay the costs for establishing and maintaining the SESP.
- **Costs for grid**: Our power needs to pay the costs for the local grid. This can be either a fee for an existing grid or eventually even investments in implementing a new local grid.
- **Cost for prosumer integration**: Our power needs to pay for the integration of the prosumers. This concerns the initial set-up as also an ongoing integration, such as through demand-response initiatives.
- **Costs for reserves**: While some might refer to the final goal of local energy markets as becoming independently, assumingly the provision of reserves also requires expenditures for Our power.
- **Costs for complementary services**: Our power also needs to pay for the provision of complementary services.

3.2.5 Prospects and drivers of acceptance

One of the main challenges for Our power is to open up products and services for power markets. These products and markets currently provide very high entry barriers for new entrants, and often require energy utility expertise. If Our power is successful in lowering these entry barriers – e.g. based on intuitive-usable, ICT-enabled services – new players

like energy cooperatives could be empowered to broaden their offerings. Once the overarching challenge of improved and simplified usability is solved, there are two important drivers that benefit the Our power model. First, there is an increasing number of energy cooperatives and prosumers (see instance the figures for Germany in D2.1). These new market players, already made the first step into the energy market and may want to extend their activities.

Basically some energy cooperatives even, face pressure to further extend their business model. The SESP can be the blueprint, the container of services that might attract prosumers and cooperatives. Second, project developer who had initially a very focused business model of developing production-side projects, increasingly face difficulties in generating new projects. A logical next step for them is to shift from developing larger number of projects towards a broader scope of already existing projects. In such project developers can become a driving force of promoting and developing Our power like business models.

3.3 DSO Local

3.3.1 Market and customer requests

The quality of the DSO Local business model is a function of four different developments. First, DSO face increasing challenges. For instance, in regard to financial distress of their core business, they need to investigate the potential of novel business models and new approaches of creating and capturing value. Also many DSOs seek new strategies how to accommodate an increasing amount of prosumers among their customers. Market liberalization leaves DSOs to rethink approaches of customer retention. Second, local energy consumers and prosumers request new services and roles from DSOs. While their preferences shift towards claiming a more active role on power markets, they request DSO as partners for the co-creation of value. Third, market dynamics demand an expansion of value creating activities that go beyond supply. Markets request new services, such as demand-response initiatives, storage, prosumer-empowerment, flexibility trading, the provision of reserves and many more, new services that touch and go beyond the core business of many utilities. Fourth, at the same time the DSO local business model needs to respond to requests from incumbent grid infrastructure and industry players and consider for instance long-term partner contracts and structures or refinancing needs of large assets and the respective economic and political obligations.

3.3.2 Analogical business models and re-combinations

The DSO local business model share some similarities with analogical business models. In providing a localized offer of an DSO, it is similar to for instance projects in which DSOs develop local tariffs. Also some DSO are engaged in setting up local initiative, such as local production and local tariffs (e.g. http://www.lettenstrom.ch) virtual power plants or extending their services towards demand response activities, and complementary storage and trading. The DSO local business models also share similarities with local strategies of incumbent utilities (e.g. energy systems of large buildings such as universities or hospitals, that accommodate energy consumption, production, storage, metering and grid-related services). Each of these “local smart grid activities” share important similarities with the EMPOWER project. New however is the integrated and holistic approach of EMPOEWR in which services of local power markets are not derived from traditional DSO products and services, but more radically invented from scratch so that they can be integrated in the SESP and potentially are independent and complementary to existing product and service bundles.

3.3.3 Value creation and capture

The difference between the DSO local business model and the Our power business model, is twofold: First, the DSO substitutes the role of the Energy Cooperative. In such the DSO initiates the customization requests to the standard platform to set-up an DSO local platform. Second, the DSO also acts as a SESP supplier. In such the DSO local platform enables the DSO to venture into EMPOWER-like market designs.

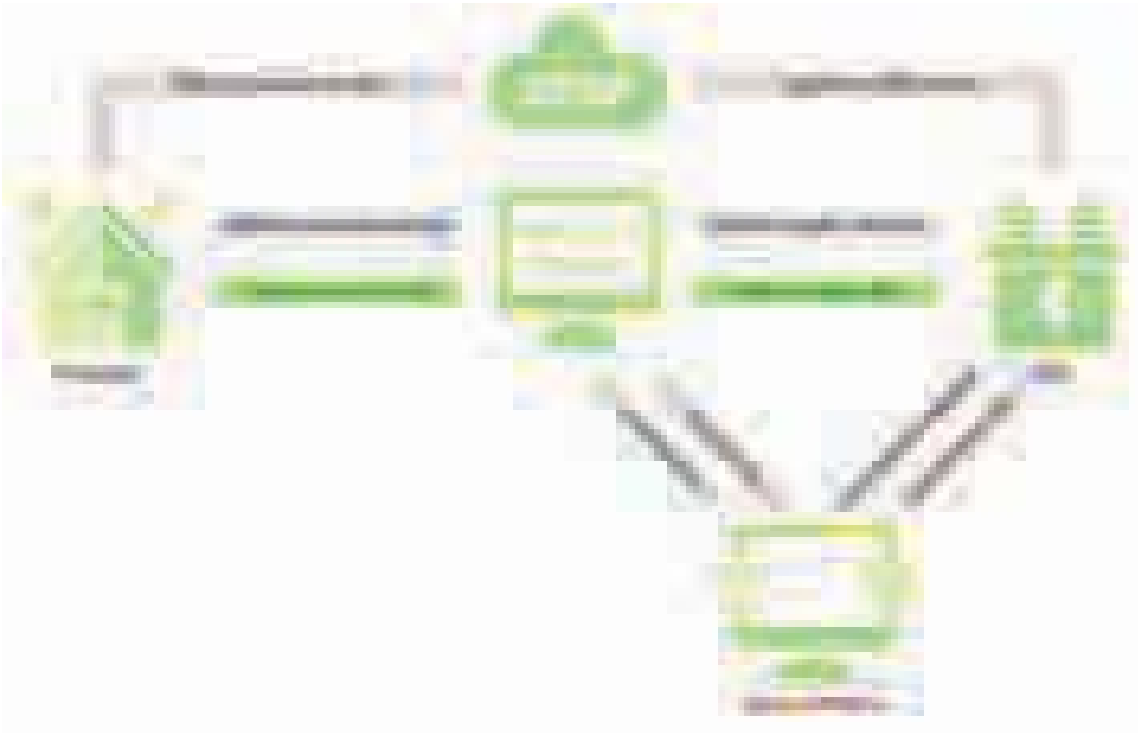

Figure 20: Overview of the DSO local business model

3.3.4 Monetization

- **Premium prosumer**: DSO local will charge a premium for the service of empower prosumers, hence backing up and providing reserves for prosumer entities.
- **Premium alternative to established players**: DSO local will charge a premium for being an alternative to established players. While large incumbent utility companies eventuell can leverage economies of scale, our power provides value for offering the freedom of choice.
- **Fee for additional services**: DSO local will request a fee for additional services, that will complement traditional power related products and services.
- **SESP gain:** The SESP will generate revenues, for instance through external trade of flexibility, such as on reserve markets.
- **Eco system sponsorships:** The SESP can help the DSO to avoid investments in infrastructure which would have been required because of a rising number of prosumers. The DSO´s sponsorship helps it saving these investments.

On the cost side, the EMPOWER based platform needs provide payments for following elements:

- **Costs for SESP:** DSO local needs to pay the costs for establishing and maintaining the SESP.
- **Costs for grid**: DSO local needs to pay the costs for the local grid. This can be either a fee for an existing grid or eventually even investments in implementing a new local grid.
- **Cost for prosumer integration**: DSO local needs to pay for the integration of the prosumers. This concerns the initial set-up as also an ongoing integration, such as through demand-response initiatives.
- **Costs for reserves**: While some might refer to the final goal of local energy markets as becoming independently, assumingly the provision of reserves also requires expenditures for the DSO local business model.
- **Costs for complementary services**: DSO local also needs to pay for the provision of complementary services.

3.3.5 Prospects of acceptance

The prospects of the DSO local model depend heavily on two dynamics. First, it will be interesting to observe how urgent the pressure for rejuvenation the DSO core business model is. Also, how capable are DSOs to rejuvenate their core business model and develop the DSO local business model. Second, it will be interesting to observe how successful other, competing business models (e.g. such as Our power) are in developing and offering SESP based services. If the DSOs are successful, then the DSOs can disrupt themselves with their DSO local approach. However, if they are too slow and other competitors will be more successful in implementing new business models, it could be that major parts of the traditional DSO business model will be substituted by new business models. Overall, the competitive dynamics among different new EMPOWER based business models will have an important impact on their market acceptance.

4 Implications for the EMPOWER project

The work presented here has implications of the EMPOWER project on various levels. In particular we will discuss the impact on the following work in WP 2 and following work on the other WPs (e.g. WP5, WP6, WP7 and WP8).

4.1 Impact on the further work in WP 2

In the next work package, we will touch upon aspects of social acceptance. Our specific focus will be on the barriers and opportunities that incumbent firms face for accepting the EMPOWER business models as outlined here. Prior academic research revealed a number of key barriers for innovations to succeed in established markets. We will draw upon this research to study barriers and opportunities for social acceptance.

A first key emphasis will be on firm-level barriers and opportunities by incumbents to develop new EMPOWER-based business models. To develop these insights, we have already conducted 20 interviews with a major utility company in Switzerland as well as a brief survey of industry experts. The collected empirical data will be analysed next. The purpose of this work is to investigate into potential opportunities and barriers to integrate innovative EMPOWER business models within incumbent firms.

We will uncover the factors that enable and constrain the acceptance of prosumer-oriented business models by incumbent utilities. How incumbent utilities react to disruptive innovations, like the emergence of decentralized prosumer-based energy markets, is a question of key concern for strategic management scholars. Disruptions can offer significant opportunities for value creation and growth for incumbents. Only few incumbents succeed in continuously reclaiming leading positions in their industries largely because they fail to adapt their entrenched ways of doing things. Only few incumbents succeed in spotting the need for change soon enough, so as to be able to anticipate the changes needed to address disruptions. In turn, numerous examples exist where new market players displace incumbents. This sub-task investigates into incumbent utilities' reactions to prosumer-oriented business models. We investigate the degree to which incumbent utilities take stock of such innovations, what enables and what constrains their acceptance of such innovations.

To do so, we perform case study analyses of managers' acceptance of prosumer-oriented initiatives of incumbent utilities in Switzerland. We uncover to what extent incumbent players build on decentralized, prosumer-oriented innovations. We further uncover the obstacles that young initiatives go through for developing the prosumer-oriented business models with the established players in the industry. We seek to generalize these insights, in order to derive managerial implications on how to best navigate the barriers that exist in an energy industry that is in transformation. A particular emphasis will be laid on uncovering how new thinking paradigms diffuse not only inside organizations but also in a market to support the acceptance of prosumer-oriented business models. Furthermore, we seek to develop insights on the particular roles that

incumbent players may play in decentralized, prosumer-oriented market designs.

A second key emphasis is on barriers and opportunities that firms face in their interactions with policy-makers. A first initial analysis of incumbent utilities' non-market strategies has been conducted in this respect. We will disentangle the intersection between firms' acceptance of innovations and policy-making. We seek to better understand the factors at the policy level (eg. EU policies) that enable and constrain the successful development of decentralized, prosumer-oriented business models. In a first step, we will list and classify smart grid-related policies at the level of the EU in order to develop a comprehensive overview of EU-level policies that are related to the diffusion of smart grid technologies. In a second step, we will investigate the effectiveness of these policy frameworks by looking into the extent to which incumbent utilities attended to smart grid-related technologies and the extent to which incumbent utilities invested in smart grid-related technologies in response to changes in EU policies. With this approach, insights on the effectiveness of the regulatory framework regarding prosumer business models will be gained. We seek to develop our understanding of what are the critical regulatory issues that need to be addressed for these technologies to diffuse effectively.

4.2 Impact on the work in other WPs

We see major implications for WP8 on the exploitation of the EMPOWER project. Basically business models are mediators between a technology and value creation and are an important element of successful organizations and firms. The EMPOWER based business models enable companies to exploit and further develop the potential of the EMPOWER project. In such it provides guidance to incumbent firms but also to new start-ups of how to incorporate EMPOWER into their business. Further we see major implications for the work in WP6. The interwoven relations-ships between the market-level (WP6) and the firm-level (WP2) has already been subject of discussion in D2.1. D2.2. further sharpens the business models and thus provides refined insights on the models that are likely to populate the and also further shape the EMPOWER market and its dynamics. While the ideal-type business models are rooted partly in existing business models from similar industries, they also point to relevant market dynamics from the outside that potentially also can have a further input in the coming work in WP6. Especially the newly pronounced role of platform business models and the respective requirements for instance from digitalization and ICT provides important guidance for the further development and programming in WP5. An aspect of profound importance is

"democratization" and the respective ease-of-use, that brings down entry barriers to professional services. Similar to business models of piclo (in the energy domain) or pagecloud and The Grid in the web-publishing domain, the EMPOWER business models seek services that can empower laymen to perform professional services (e.g. the set-up and operation of a local power market). Finally, we see implications for the implementation work in the pilot sides (WP7). The business model can be an important reference point in providing justification of the EMPOWER actions. In such, they can provide additional help and clarification to communicate the EMPOWER actions and thus supporting the engagement of new stakeholders within the demo-sites.

5 Appendix

The work of D2.2. is complemented by two working papers that are under further development for publication in scientific journals. Both of the are available on request.

5.1 Business model quality

The growing research on business models is unspecific in regard to business model quality. Still the quality of a business model is an urgent practical problem as start-ups as well as established firms often find themselves in a position to design or re-design high quality business models to strive in global market places. In this paper I review existing literature on business models in regard to the established claims of quality. It appears the literature on business models is diverse in regard to different inferences of business model quality. For instance, business model quality refers to the representation of existing structures, on adaptive fit or, as for the cognitive processes of business modeling, for accuracy and creativity. However, business model quality has not yet been discussed from an ecological rationality perspective, which jointly accounts for the requirements of the cognitive and structural environment of a business model. As this paper reveals, such a "business model in context" view offers considerable potential to advance our knowledge about business model quality as well as our knowledge on business models themselves. Thus, I conclude presenting a research agenda that encourages work especially on the ecology of business models.

This is a corresponding working paper by Moritz Loock. It is currently in preparation for submission to a journal. The paper is available on request at moritz.loock@unisg.ch

5.2 Corporate business model innovation

The empirical challenge this paper addresses is rejuvenation of a mature businesses, which is a complex process (Baden-Fuller & Stopford, 1992). The case of Alpiq´s acquisition of GridSense is particular useful to study scaling of a novel business model, as the differentiation between traditional and novel model is particular visible across different elements of the business model, such as customers (large energy consumers and large distributors vs. small and decentralized consumers that are partly also producers like households with photovoltaic), value chain linkages (large production assets that follow a centralized approach of energy production vs. small decentralized production and consumption that is balanced through IT in a Smart Gird) or monetization

(large IRRs that refinance large existing assets vs. small IRRs based on a less business that is less capital and risk intensive). The case study enables us to map distinct processes and practices of scaling a novel business model. As this is work in progress and we are about to finalize data collection, we rather present results but the core set-up of the case study.

This is a corresponding working paper by Moritz Loock. It is currently further developed. The current draft is available on request at moritz.loock@unisg.ch

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Appendix I

List of interview partners

Bernt Bremdal	New Venture
Peter Graf	Utility
Per Gjerløw	Utility
James Johnston	Start-Up
Brian Keane	Start-Up
Christian Kunze	Utility
Vincent Rittener	Utility
Simon Ryser	Utility
Dagfinn Wage	Power Producer

Table 6: Overview of experts interviewed

Appendix II

Company	Business Model		Core competence /USP	Customers - Size			Customer - Activity		Marketplace		Market (geographical)			Business type	Progress		
	Value Capture	Value Proposition		Private Household	Small-size C&I Customers	Mid/big-size C&I Customers	Today (high/medium/low)	Expected (high/medium/low)	Offline	Online	EU	USA	Asia	B2B/B2C etc	Sales	Founded	Employees
Flexitricity	Service Charge, Trading Profits	Grid stability, energy savings, efficiency improvements in usage, new revenue sources	early established demand response know how			X	BU: high DU: medium	BU: high DU: medium	professionel connections	HP: Infos	UK			B2B	No data	2004	
Change 38	Membership	Energy saving, local & renewable energy supply	Connecting Consumer and Producer -> establishing prosumer community	X	X		BU: high DU: low	BU: high DU: low	Mail registration	HP: Infos	CH			B2C B2B	No Data	2013	
Piclo	Service Charge	100% green energy transparency branding for generators	Marketing of Renewable Energy Producer, Connecting Demand & Supply	X	X		BU: medium DU: medium	BU: low DU: medium		peer 2 peer	UK			B2C B2B		2015	
Sonnen	Sales, partnership	intelligent energy storage independecy (community) transparency	intelligent batteries, using network of battery users to form network	X			BU: medium DU: medium	BU: low DU: low		online registration peer 2 peer	Central EU	x	Australia	B2C	10.000 batteries	2010	
Trianel	Energy Sales, Service Charge	cooperation & representation for local utility companies	Improving competitiveness & independency of local utility companies		X	X	BU: high DU: medium	BU: high DU: medium	professionel connections	HP: Infos	D			B2B	1.8 billion € (2014)	1999	230
CPower	Service Charge	Demand response management, new reveneue sources, efficiency improvements	analysing large energy consumer on efficiency improvements			X	BU: high DU: medium	BU: high DU: medium	professionel connections	HP: Infos		X		B2B	2,269 managed MW	2014	

Table 7: Detailed information on the selected case companies

Company	Business Model		Core competence /USP	Customers - Size			Customer - Activity		Marketplace		Market (geographical)			Business type	Progress		
	Value Capture	Value Proposition		Private Household	Small-size C&I Customers	Mid/big-size C&I Customers	Today (high/medium/low)	Expected (high/medium/low)	Offline	Online	EU	USA	Asia	B2B/B2C etc	Sales	Founded	Employees
RePower	Energy Sales, Service Charge	Energy supply, customized energy solutions, grid maintenance	Generation & distribution	X	X	X	Private: BU: low DU: low C&I: BU: medium DU: medium	Private: BU: low DU: low C&I: BU: medium DU: medium	offices, telephone	HP: Infos	X			B2B B2C	2.2 bill.	1904	670
Energie Pool	Partnership annual or service charge	representation, consulting, know-how platform	expertise center		X	X	BU: low DU: high	BU: low DU: high	professionel connections	HP: Infos, customer access	CH			B2B		2006	
Strombank	probably: service charge, partnership	customer friendly energy trading, independency, efficiency improvement, decentral/local power generation	understanding energy community interactions	X	X		BU: high DU: medium	BU: medium DU:low		registration	D			B2B B2C C2C	18 community member	2013	
Next Kraftwerke	probably: service charge, trading profits	new revenue sources, efficiency improvements in usage & generation, access to energy exchange	VPP capacity, targeting large energy consumer, trading feature offers new revenue source		X	X	BU: high DU: medium	BU: medium DU: medium	professionel connections		D			B2B	184 million (2014)	2009	105
GridSense	probably: licensing sells, device sells, installation service charge	energy usage reduction and transparency	independend software for energy usage improvements, targeting single households	final product: X		component: X	BU: medium DU: low	BU: low DU: low	via hardware supplier	HP: Infos	X			B2B B2C		2013	
Tiko	Sales of devices or memebership Swiss grid	Energy usage reduction, grid stability, transparency	devices for free, busiess model dependent on swiss grid rules,	X			BU: medium DU: medium	BU: low DU: medium		Homepage	CH			B2C		2012	

Table 8: Detailed information on the selected case companies (continued)

Company	Business Model		Core competence /USP	Customers - Size			Customer - Activity		Marketplace		Market (geographical)			Business type	Progress		
	Value Capture	Value Proposition		Private Household	Small-size C&I Customers	Mid/big-size C&I Customers	Today (high/medium/low)	Expected (high/medium/low)	Offline	Online	EU	USA	Asia	B2B/B2C etc	Sales	Founded	Employees
Lichtblick	Energy sales, service charge for installtion	100% green energy,	network capacity, individual household VPP,	X	X		BU: medium DU: low	BU: low DU: low	telephone	Homepage	D			B2C B2B	700 million €	1998	460
Kiwi Grid	probably: Sales of devices, license, service charge for indivudal solutions	Smart Grid Management platform, IT solutions for smart grid operator	providing smart grid operator with cloud solutions		X	X	BU: high DU: medium	BU: high DU: medium	professionel connections	HP: Infos	D			B2B	> 2 million € (2014)	2011	65
Kiwi Power	Service Charge, trading revenue	grid stability, energy savings for c&i customers	network capacity, know how on how to optimise energy usage (c&i customer)			X	BU: high DU: medium	BU: high DU: medium	professionel connections	HP: Infos	UK			B2B		2009	
Restore	Service Charge, trading revenue	grid stability, energy savings for c&i customers	network capacity, know how on how to optimise energy usage (c&i customer)			X	BU: high DU: medium	BU: high DU: medium	professionel connections	HP: Infos	UK, Belgium			B2B		2010	
Caterva	membership for 20 years deferred payment	independent, green energy supply	know-how in hardware (batteries) and network	X			BU: high DU: low	BU: medium DU: low	contact via phone		D				46 sold batteries	2012	
Vandebron	energy sales	100% green energy transparency branding for generators	green utility company	X	X		User: BU: medium DU: low Generator: BU: high DU: medium	User: BU: low DU: low Generator: BU: high DU: medium	contract	registration	NL			B2B/B2C		2013	

Table 9: Detailed information on the selected case companies (continued)

Company	Business Model		Core competence /USP	Customers - Size			Customer - Activity		Marketplace		Market (geographical)			Business type	Progress		
	Value Capture	Value Proposition		Private Household	Small-size C&I Customers	Mid/big-size C&I Customers	Today (high/medium/low)	Expected (high/medium/low)	Offline	Online	EU	USA	Asia	B2B/B2C etc	Sales	Founded	Employees
Mosaic	percentage of loan	easy access to solar panel loans	connecting investors with home owners	X			Medium	Low		online registration		X		B2C		2011	
buzzn	energy sales (flat fee)	monthly membership	community software know-how	X			High	Medium		online registration	D			B2C			
Enernoc	Service package	energy usage improvements, customer transparency, energy effiency	long term know-how in energy software		X	X	Medium	Medium	professionel connections	HP: Infos	D	USA, Canada, Australia		B2B	$ 470 Mio.	2003	1300
Clean Energy Sourcing	probably service charge	renewable energy, direct marketing	know-how in demand side management, VPP		X	X	Medium	Medium	professionel connections	HP: Infos	primarily D			B2B			
Localpool	service charge	local energy community, renewable energy, grid cost reduction	community software know-how	X			Medium	Medium		HP: Infos	D			B2C			
Transactive Grid	in the future: membership, service charge	local energy, independent energy source, grid cost reduction, renewable energy	community software know-how	X			Medium	Medium		HP: Infos		Brooklyn		B2C		2014	

Table 10: Detailed information on the selected case companies (continued)

The following Tables further specify the selected cases' partner structure and the technology focus.

Company	Partner			Technology - Software								Technology - Hardware				
	Name	Type	Function	Monitoring (e.g. via App)	Energy Usage Optimisation	Peak Load Management	Demand Response / VPP	Online Trading Platfrom	Energy Trading	Cloud Services	Energy Community	Smart Meter	Communication Box	Battery	Generation	Distribution
Flexitricity	NHS Norish Cold storage Veolia Water Thameswey Excel London	Hospitals temp. Warehouses Recycling Energy supplier fair host	major customer major customer major customer project partner (DRA) major customer				x									
Change 38				X							X					
Piclo	Department of Energy & Climate Change Nominet Trust Bethnal Green Ventures Carbon Trust	Government Foundation Accelerator Consultant	Funding Funding Investment Know-How					X								
Sonnen	Sungevity	PV solutions	PV plants partnership	X							X			X		
Trianel		local public utilities	network													X
CPower	Vedero Software Novar Regen Energy iQ Lucid Phoenix Energy Solutions 8760 Inc. Power Secure	C&I Buildings Software C&I Energy Solutions C&I demand management solutions C&I Energy solutions hydropower technology C&I Energy solutions facility performance monitoring C&I Energy Solutions	IT Partnership Know-how Know-how Know-how hardware partnership Know-how IT partnership Know-how	X		X	X									

Table 11: Partner structure and technology focus of case companies

Company	Partner			Technology - Software								Technology - Hardware				
	Name	Type	Function	Monitoring (e.g. via App)	Energy Usage Optimisation	Peak Load Management	Demand Response / VPP	Online Trading Platfrom	Energy Trading	Cloud Services	Energy Community	Smart Meter	Communication Box	Battery	Generation	Distribution
RePower															X	X
Energie Pool																
Strombank	MVV Energie ads-tech Netrion GmbH University of Stuttgart Ministry of environment	Utility company battery producer Energy distributor research institution govnermnet	network partner hardware partnership grid know-how research/know-how funding	X				(X)			X					
Next Kraftwerke	ABB PlanET SAE-IT Systems Statkraft Weltec Biopower	Automation technology producer biogas technology producer energy plant construction utility company bioglas plant producer	hardware partner hardware partner hardware partner marketing partner hardware partner				X		X							
GridSense	Alpiq Kanton Solothurn Helion Solar Fenecon Energy Engineering Mennekes AEK	Utility company government PV & solar installateur Engneering firm plug producer Utility company	funding, network funding hardware partner hardware partner hardware partner network	X	X							X	X			
Tiko	AIL EW Rothrist EKS CTC	utility company utility company utility company Heating system producer	network partner network partner network partner hardware partner	X	X								X			

Table 12: Partner structure and technology focus of case companies (continued)

Company	Partner			Technology - Software								Technology - Hardware				
	Name	Type	Function	Monitoring (e.g. via App)	Energy Usage Optimisation	Peak Load Management	Demand Response / VPP	Online Trading Platfrom	Energy Trading	Cloud Services	Energy Community	Smart Meter	Communication Box	Battery	Generation	Distribution
Lichtblick	Tesla Energy Sonnenbatterie WWF Volkswagen	Battery&car producer Battery producer NGO/NPO Car producer	Hardware partner hardware partner marketing/"eco" partner hardware partner				X		X		X				X	X
Kiwi Grid	Lichtblick Steca Sonnenbatterie Gemalto Elster	Utility company electronic manufacturing services battery producer & energy pool operator chip producer metering company	network partner hardware partner hardware partner supplier know how	X	X					X			X			
Kiwi Power	National Grid UK Power Networks Shell Mayor of London SSE Swanbarton	utility company distribution network operator gas supplier government utility company energy storage consultant	network partner project partner project partner funding network partner know how				X		X							
Restore	National Grid Elia EDF Lumnius Ardo Watelink Darta Vivaqua	system operator company transmission network operator renewable electricity generator frozen food producer water recycling food services water treatment	network partner network partner major customer major customer major customer major customer major customer	X			X		X							
Caterva	N-Energie	Utility company	network partner	X							X		X	X		
Vandebron	Sprout	magazine	platform					X								X

Table 13: Partner structure and technology focus of case companies (continued)

Company	Partner			Technology - Software								Technology - Hardware				
	Name	Type	Function	Monitoring (e.g. via App)	Energy Usage Optimisation	Peak Load Management	Demand Response / VPP	Online Trading Platfrom	Energy Trading	Cloud Services	Energy Community	Smart Meter	Communication Box	Battery	Generation	Distribution
Mosaic		Installers	hardware partner													
buzzn				X							X					
Enernoc					X		X			X						
Clean Energy Sourcing				X	X		X	X								X
Localpool											X					
Transactive Grid	LO3 Energy Consensus	software provider application developer	software partner software partner	X							X	X				

Table 14: Partner structure and technology focus of case companies (continued)