

Electromobility in Sweden – Towards a New Dominant Business Model Design?

A perspective looking through the eyes of utilities active on the
Swedish market.

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Abstract

Developing business models in the area of electromobility is one of the primary challenges in order to successfully electrify road transport. As any technology the electric vehicle (EV) or the charging infrastructure that fuels it will not have any value unless one finds ways to commercialise those technologies. This thesis investigates the early stages of business model development within electromobility from the perspective of utilities that are active on the Swedish market. Doing so emerging business model patterns are being presented and eventually evaluated with regards to their advantages and disadvantages from the perspective of utilities. Drawing on these findings factors relevant for utility competitiveness within these emerging business models are being identified.

Keywords: Business model, electromobility, electric vehicle, charging infrastructure, utilities

Executive Summary

Electromobility is an emerging trend that holds potential answers to some of the core problems we face in our society among which are local air and noise pollution, greenhouse gas emissions associated with transport as well as dependency on fossil fuels. During the course of recent years which were heavily influenced by the financial crisis, governments around the world have implemented policy measures that have the goal to help disseminate the electric vehicle (EV) and to overcome some of its short-comings. Also within the European Union and in Sweden there are ambitious goals for the transport sector as well as the electric vehicle.

As a consequence of these developments almost all car manufacturers today have or at least plan to introduce electrified car models, be it hybrid electric vehicles (HEV), range extended electric vehicles (REV) or pure battery driven electric vehicles (BEV). As a result not only is the car manufacturing industry changing, but also other industries like the utility industry and the battery industry are under transformation. At the same time new industries around the charging infrastructure and telematics are forming. This leads to the reorganisation of value chains across and within these industries and as such holds large potential for new business opportunities – for both incumbents and new actors alike.

While electromobility opens up new business opportunities it is still unclear what the actual business models of car manufacturers, utilities and other actors in this new area will look like. There is still a great amount of uncertainty about the technology, its commercial application as well as its potential. Current research around EVs focuses mostly on other aspects like policy, environmental desirability, and economic forecasts but there is little academic literature that connects business model development and electromobility at this stage. This holds true especially in the context of Sweden. Thus, there is a significant gap of practical in-depth explorative case studies that could shed light on the business models in the area of electromobility.

This research focuses on the experiences of the Swedish utility industry in terms of business model development. The aim of the study is to identify major differences and similarities between business models and from this deduct business model patterns. These emerging business model patterns are then evaluated from the perspective of utilities in terms of their advantages and disadvantages as well as their potential for competitiveness as such. The business model framework that was selected for this was the “Business Model Canvas” by Alexander Osterwalder, a tool which helps analysing the nine core elements of a business model, namely the value proposition, customer segments, channels, customer relationships, revenue streams, key resources, key partnerships and cost structure. At the core of this thesis are a wide range of semi-structured expert interviews, some of which included representatives from the three major utilities active on the Swedish market, namely Vattenfall, Fortum and E.ON, but also regional utilities like Göteborg Energi, Öresundskraft and Lunds Energi. Experts close to the utility value chain were also interviewed to get a better understanding of the emerging electromobility value chain.

The analysis has resulted in several key insights. Firstly it became clear that it is still a very early market stage and that not many utilities are actively putting commercial offers on the market. Some utilities, especially smaller ones, will not engage seriously in the business for several years. The business models that do exist focus on the charging infrastructure side of the value chain and some utilities try to develop winning value propositions in that area. One key differentiator so far has been the difference between retailing and installing charging infrastructure as a one time sale or the bundling of the charging infrastructure with services

ranging from installation, maintenance, operation as well as verification, measuring and payment solutions as a recurring payment.

In the future however there will be much more potential for major differences due to evolving areas like smart charging and fast charging. Another upcoming scenario will be the difference between utilities that engage in mobility solutions while others will step away from those opportunities. Engaging in the area of mobility solutions can be an interesting differentiator as the retailing of electric scooters and electric bikes and potentially also electric vehicles could help to convince customers to also buy charging solutions and other services in conjunction. Also the integration of charging and mobility business models into an integrated business model around smart housing will be an interesting possibility for many utilities.

At this early stage of business development the key recommendation for utilities is to early on secure partnerships. This is interesting for many reasons. Firstly, it provides potentially temporarily exclusive access to certain sales channels like car dealerships that could help to commercialise e.g. charging infrastructure solutions on a national scale. For similar reasons early commercial relationships with potentially large customers like fast food chains, large retailers, malls, parking space providers etc. can be an interesting way to establish scalable prerequisites for a time when the mass market starts.

Furthermore, apart from thinking about business model design on paper one of the most important recommendations that can be made in business model development is to test as many business model element combinations as early as possible with real customers. Only by investigating customer needs and how customers react to the value proposition can lead to a successful business model. If one does that now at this early stage one can make more informed choices when the electric vehicle market enters the mass market. Latecomers may have less risk now but they also potentially miss out on strategic partnerships that can be a major specialised asset in future business models.

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Abbreviations

A	Ampere
B2B	Business to business
B2C	Business to customer
B2P	Business to public organisations
BEV	Battery only electric vehicles
CEO	Chief Executive Officer
D.C.	Direct current
e.g.	Example given
ERDF	European Regional Development Fund
EI	Swedish Energy Markets Inspectorate
EU	European Union
EV	Electric vehicle
FP7	Framework Programme 7 of the European Union
g	Gram
HEV	Hybrid electric vehicle
ICE	Internal combustion engine
IEC	International Electrotechnical Commission
HEV	Hybrid electric vehicles
IT	Information Technology
Km	Kilometre
Kwh	Kilowatt hour
NCAP	European car safety performance assessment programme
p.	Page
PHEV	Plug in hybrid electric vehicle
REV	Range extended electric vehicle
RFID	Radio-frequency identification
SEA	Swedish Energy Agency
SEK	Swedish krona
SWOT	Strengths, weaknesses, opportunities, threats
V	Volt
WWF	World Wide Fund for Nature

1 Introduction

1.1 Problem background, definition and purpose

Currently there is a process of transformation from a fossil fuel based transport system towards a transport system that is based on electricity and as a result electromobility is a term that appears very frequently in the news today (Barkenbus, 2009, p. 399). To some observers this may even feel like a media hype that perhaps is a little out of perspective (Weinmann, 2011). On the other hand it looks like this time the electric vehicle is really here to stay. Different news sources have reported that since its introduction in December 2010 the Nissan Leaf, which is the first mass produced pure battery electric vehicle (BEV), has surpassed the worldwide 10,000 sales figure at the end of July 2011 with 5,000 cars being sold in the US (Loveday, 2011). Carlos Ghosn, CEO of Renault-Nissan, recently reported that his company is going to invest 4 billion Euros in the development and production of electric vehicles (Squatriglia, 2011). Their goal is to have the capacity to build 500,000 electric vehicles by 2013. A comparatively optimistic prediction by Carlos Ghosn is that electric vehicles will represent 10 percent of the global automobile market by 2020 (Squatriglia, 2011). This is a large change considering that in 2010 automakers sold 72 million cars worldwide. Almost all car manufacturers are following suit and are introducing or are planning to introduce electrified models ranging from different hybrids to pure battery electric vehicles (BEVs). These developments however do not just stop there but will impact connected technologies in the value chain, e.g. battery development, charging infrastructure, renewable energy technology, smart grid technology and many others. Value chains are very much in flux in all of those areas and will open up new business opportunities for incumbents or new third actors.

For the purpose of this thesis, electromobility is defined foremost as the mobility service that is provided by electric cars or vehicles (EVs) in combination with the necessary batteries and charging infrastructure. As such electromobility represents a trend that will affect many areas of our society and in general is an answer to several core problems we face today. On a more local level it has the potential to eliminate all tail pipe air pollution which essentially reduces health risks and costs, especially in an urban context (Doucette & McCulloch, 2011, p. 803). That holds true whether the electricity for the car comes from fossil power sources or renewable power sources. It will also contribute to less noise pollution in urban areas (Energimyndigheten, 2009b, p. 43). On a more national and global level, electromobility offers the potential to reduce greenhouse gas emissions especially carbon dioxide emissions (Doucette & McCulloch, 2011, p. 803; Energimyndigheten, 2009b, p. 43). The reason for this is that the transport sector currently stands for approximately one quarter of global greenhouse gas emissions (Barkenbus, 2009, p. 401; Ribeiro et al., 2007, p. 325; WWF, 2008, p. 7). This share is going to increase as the economic growth in countries like China and India allows a growing middle class for the first time to purchase cars (Ribeiro, et al., 2007, p. 325). It is being predicted that by 2050, some 2.9 billion cars will be on the roads (Doucette & McCulloch, 2011, p. 803). Indicating a possible solution to that, it is estimated that in many countries worldwide even today the power mix in the grid gives electric vehicles at least a minor advantage over their fossil fuel based rivals in terms of green house gas emissions (Ribeiro, et al., 2007, p. 350; WWF, 2008, pp. 11, 89).

The best results in terms of significant greenhouse gas reductions can however be achieved in countries with a low carbon power mix like e.g. Sweden (Doucette & McCulloch, 2011, pp. 803, 810). So far however, fossil fuels account for 95 percent of the transport energy demand worldwide (Ribeiro, et al., 2007, p. 325; WWF, 2008, p. 7). Related to that within the transport sector road vehicles account for roughly three quarters of energy demand (WWF, 2008, p. 7). Electric cars hence also have the potential to reduce the dependency on foreign fossil fuels which is essential for many countries in terms of energy security (Doucette & McCulloch, 2011, p. 803; Frieser, 2011). They also contribute to achieve the goals for the reduction of greenhouse gas emission, which many countries committed to in international agreements. Apart from that, the batteries in electric cars potentially offer the advantage of being a much needed energy storage for intermittent renewable sources when demand for power is off peak and would otherwise be exported cheaply or wasted. After being used in the electric car, the batteries potentially will have a second life serving as stationary batteries for energy storage. Also, using electric power in an electric motor with usually around 90 percent efficiency has the potential of increasing the overall energy efficiency of a country's transport system substantially (Barkenbus, 2009, p. 402; Energimyndigheten, 2009b, p. 43; Ribeiro, et al., 2007, p. 347; WWF, 2008, p. 8).

Utilities role

For utilities¹ the transport sector is one of the sectors with the largest and most straight forward growth potential (Frieser, 2011). Nowadays, apart from transport on rail there is hardly any electricity consumed in the sector since it is dominated by fossil fuels as direct energy carriers (Frieser, 2011). Additionally the transport sector as such is one of the sectors that is significantly growing worldwide as more and more people have the means to become increasingly mobile (Frieser, 2011). This is the primary reason why many utilities worldwide engage in electromobility as they do not want to miss out on those business opportunities (Frieser, 2011).

At the same time utilities are in a situation of pressure. The liberalisation of the energy market already lead to large structural changes in the industry and increased the necessity of sensitivity towards the customers (Weinmann, 2011). In the aftermath of the catastrophe in Fukushima in March 2011, utilities are suddenly confronted with heated discussions about the usage of nuclear power which e.g. in the case of Germany resulted in a much faster phase out of nuclear power plants than anticipated. However, utilities rely on those long term investments and as a result such sudden policy changes potentially destroy parts of their current business model (Weinmann, 2011).

Additionally, new business arenas like intermittent energy sources, microgeneration of energy and electromobility are areas where the classic utility business model arguably does not provide the answers to succeed. Many experts describe utilities as relatively conservative and that they are not used to developing entirely new business areas or to innovate their business model (Frieser, 2011; Mollstedt, 2011; Weinmann, 2011). At decision levels within utilities, it still seems to be difficult to find acceptance for new business areas or business models.

Business models

¹ For the purposes of this thesis utilities are defined as being involved in the generation, transmission, distribution and retailing of electricity.

As promising as the prospects of the EV technology sound on paper it is far from certain that this time the EV will be a successful innovation. In history, the electric vehicle and the surrounding infrastructure has lost several times to the now dominant combustion engine technology and the vast network of gas stations that supply the fuel. To overcome the barriers that are currently inherent in the EV technology, using different policy approaches, governments around the world have invested heavily in the technologies that are needed for electromobility.

While policy is one important part of making electromobility successful, scholars believe that in order to ensure that the EV is successful close attention to the business model design is needed (Kley, Lerch, & Dallinger, 2011). Generally speaking, without being able to establish a successful business model the technology or innovation as such does not have any value (Teece, 2010). Hence at the moment many companies e.g. utilities, automotive companies and new mobility companies explore how they can adapt their existing business model or create a whole new one. However, the uncertainty among those companies as to what these business models will look like is still significant.

Purpose

This thesis will give insights from the Swedish perspective on what business models for electric vehicles, including key elements, differences and similarities currently look like through the eyes of utilities. Also, using a specific set of criteria, some potential business models will be evaluated. By analysing practical experiences, the author intends to reduce some of the widespread uncertainty among utilities regarding business model design and electromobility. This analysis intends to also have implications for policy decisions because it provides valuable input from a micro actor level which can be included in policy making on a systems level.

1.2 Research question and objectives

With a focus on business models, the overall research question of this study is:

“How can utilities in Sweden ‘competitively’ and ‘sustainably’ engage in electromobility?”

There are three key objectives that underpin the research question. These include:

- 1) Why are utilities engaging in electromobility?
- 2) What are the key differences and similarities in the business models?
- 3) What are the advantages and disadvantages as well as opportunities and threats around these business models?

1.3 Methodology

This thesis represents a qualitative case study of business model development in the area of electromobility with a strong focus on the current and future role of utilities. Such qualitative case studies do not represent one particular kind of method but rather several methods can be used. However, all the methods used in a case study have the goal to get an as much in

depth understanding of the case at hand as possible (Silverman, 2005, p. 126). This has the drawback that the results of such studies are difficult to generalise. Another problem with case studies is to set the boundaries of the case investigated. The author has focussed primarily on the business model development in the area of electromobility within Sweden. Within that boundary foremost activities within the utility sector have been looked upon. To account for the possibility of changing value chains the author has further included activities of nearby industries including charging hardware manufactures, car manufacturers and mobility companies. The utilities chosen are relatively similar in the sense that they are all based in Sweden. While the author primarily chose the largest utilities for expert interviews, representatives from smaller or more regional utilities were also interviewed. The underlying perspective was hence on utilities as a group and not on an individual company as such. Also the case study focuses only on business model design and not on e.g. the actual business model implementation.

The primary methods for data collection of this study have been a literature review and expert interviews using the semi structured interview method (Kvale & Brinkmann, 2009). Due to the dynamic nature of the research topic the literature review included several sources. The conventional part was based on a review of the existing catalogues and databases of academic journals. This included topics related to electric vehicle and the charging infrastructure as such, but foremost on electric vehicles and business model development. A large part of the literature research was a review on business models as an academic concept. This is a relatively new unit of analysis in academic journals and as such the research field has still not agreed upon what a business model actually is and what elements it consists of. After considering different concepts the author has decided on Alexander Osterwalder's "Business Model Canvas" as the central framework for investigating business models. The concept is one of the most comprehensive frameworks for business models and is used by many practitioners today.

Due to the relatively new nature of the topic, it has also been important to rely on up-to-date information from major think tanks, consultancies, blogs, internet feeds and even social networks. Also, literature suggestions provided by the interviewed experts have been followed.

Apart from the literature research interviews were conducted in order to get an in depth understanding about business model development in the area of electromobility from the perspective of utilities. In order to get a broad understanding of the business model elements but also the external factors that could influence them, experts within the utility industry were interviewed as well as experts from other relevant industries including hardware manufactures, car manufacturers and mobility companies. Apart from that also policy makers and representatives of interest organisations have been interviewed.

The method chosen for conducting the interviews was that of semi structured interviews. Here, while interviewing the researcher relies on an interview guide that entails a list of core question or topics to be covered (Bryman, 2008, p. 438). During the course of the interview the researcher can change the order of the questions or select only certain questions. However, overall similar questions will be used in all the interviews. For the author this has been dominantly the case and the questions were being organised around the nine business model elements that are part of Alexander Osterwalder's "Business Model Canvas" (please also refer to the business model framework section of this thesis). The semi structured interview approach also allows the asking of follow up questions if needed. Apart from industry experts also e.g. policy makers were asked about institutional factors that are

influencing business model development. In such cases the author had to somewhat part with the interview guide based on Osterwalder's framework.

The experts that were chosen for the interviews were e.g. selected on the basis that they were referred to as being business developers in the area of electromobility from the utility side (please also refer to "Table 2 List of interviews"). Once one such actor had been identified a snow balling process could start where the author asked for other possible contacts to talk to e.g. at other utilities or with regards to policy issues. One important resource here was Björn Mollstedt from E.ON who provided multiple contacts both from the business development side as well as policy side. At the end of each interview the author also often asked who the most active actors are in terms of business model development.

It should be noted that expert interviews are always limited by the fact that the interview results are somewhat co-produced by both the interviewer and the interviewee (Kvale & Brinkmann, 2009, p. 193).

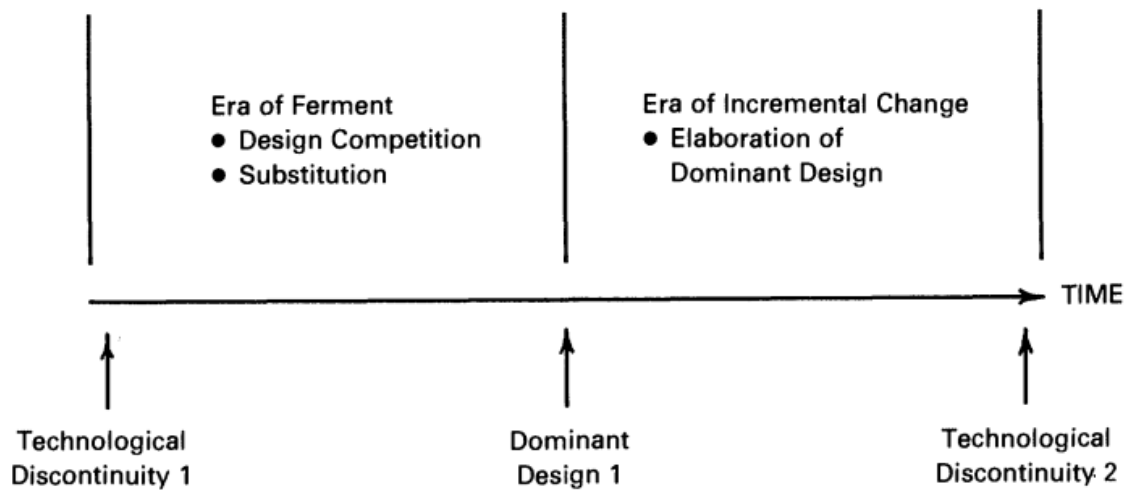
1.4 Theoretical background and analytical framework

The underlying broader narrative of this thesis is essentially one of technological change or technological innovation exemplified by a shift from a fossil fuel based transport system towards a transport system powered by electricity – in other words the electrification of mobility. The business model (re)design, as the focal point of this thesis, is a major part of this shift and interacts with the new technology on many levels. Before proceeding to the business model literature, it is hence necessary to establish the theoretical grounding about the nature of technology shifts and to identify how technology develops in a process of radical change.

1.4.1 Thinking in dominant design

Technological change and technological evolution are terms that can be traced to the idea of technology cycles which in turn is borrowed from evolutionary economics (Anderson & Tushman, 1990, p. 606) (please refer to Figure 1 The technology cycle). These cycles start with a "technological discontinuity" which is a phenomenon where a new or disruptive technology substantially challenges or even unearths an established old technology. In other words it is challenging the continuity of the old technology. This in turn causes a period of "ferment" which describes an era of experimentation around different design options or experimental reactions around the new technology (Anderson & Tushman, 1990, pp. 610-611; Tushman & Anderson, 1986, p. 440). These different options during the "ferment" can be called "technology trajectories" and describe competing pathways and tracks of using, setting up or otherwise making the new technology succeed. These periods of innovation eventually end with the emergence of a "new dominant design" or industry standard (Anderson & Tushman, 1990, p. 613; Tushman & Anderson, 1986, p. 441). The dominant design is the only one that survives the competition for resources and represents a synthesis of the experimentation during the ferment era (Tushman & Anderson, 1986, p. 462).

Figure 1 The technology cycle



Taken from (Anderson & Tushman, 1990, p. 606)

It is the nature of technological discontinuities that they often destroy existing incremental innovation and can render existing capabilities useless (Munir & Phillips, 2002, p. 284). The resulting new dominant design necessitates adaptation for competitors or in Darwinian terms can lead to their extinction. This is possible if the firm continues to commit all its resources to the existing technology and does not have the “absorptive capacity” to develop the new capabilities or new knowledge base necessary (Munir & Phillips, 2002, p. 284). Developing these new capabilities or competencies also requires substantial investments which some firms may not be willing to make in the face of uncertainty (Munir & Phillips, 2002, p. 288). Eventually such a firm may find itself locked out of the market (Munir & Phillips, 2002, p. 284). As a general dichotomy Tushman and Anderson speak of competence-destroying technological changes in the case of discontinuities and in the case of more incremental technological change of competence-enhancing (Anderson & Tushman, 1990, p. 609; Tushman & Anderson, 1986, p. 442). In the case of a competence-destroying change firms struggle to develop applications based on the new technology. The reason for that is that these new applications can necessitate different knowledge, abilities, skills, architectures, configurations, features and standards (Tushman & Anderson, 1986, p. 442). This opens up a variety of technology trajectories or pathways along which the technology evolution in the industry can take place. Which resources, capabilities, products and services are relevant in the future depends on the trajectories along which the technology develops (Munir & Phillips, 2002, p. 288). Usually one firm alone is not able to control the direction of the process of technology evolution (Munir & Phillips, 2002, p. 288). However they may choose to influence the directions together with other players. Also, in such an evolution various innovations based on the new technology, but also on the old technology or hybrids of both can compete with another depending on their individual strengths and weaknesses (Anderson & Tushman, 1990, p. 611).

In fact Windrum and Birchenhall identified a “sailing ship effect” related to this competition in the sense that once a new technology enters the market, firms using the old technology will be stimulated to improve the quality of their products (Windrum & Birchenhall, 2005).

In that sense the fermenting around the new technology also causes a renewed ferment around the old technology.

Technology cycles do of course not always succeed in a sense that the new technology is becoming the only dominant design. New technologies can fail to replace the old technology due to a variety of reasons. Also such technology cycles do not necessarily take place within short time periods. Technology cycles represent a dynamic model and any equilibrium reached is essentially only temporary (Galende, 2006, p. 305). What also has to be noted is that technological superiority does not necessarily translate into the successful establishment of a new dominant design. Rather the definition of a new dominant design is also shaped by technological, market, legal and social factors that are difficult to predict (Anderson & Tushman, 1990, p. 617; Tushman & Anderson, 1986, pp. 444, 463).

1.4.2 Business models as part of a new dominant design

After reviewing the theory around technological trajectories and dominant design it becomes increasingly clear that the theory does not only apply to technology as such but can and has been extended to co-evolving trajectories in the institutional, market and other regimes (Tushman & Anderson, 1986, p. 462). The author of this thesis argues that the literature of technology trajectories can equally be applied to business model design. This is in line with Tushman and Anderson who argue that there are also non-technological discontinuities that can be part of the emergent dominant design (Tushman & Anderson, 1986, p. 463).

Similarly to competing sets of technology trajectories, business model trajectories will also compete to establish that new dominant design. In fact they are essentially parts of the same process. Technological innovation often makes the development of new business models necessary because the technology needs to be brought to the market and perhaps serves quite different customer needs. Other researchers argue that business models can be much more vital to establish a new dominant design than the technology as such. Chesbrough argues that the technology itself does not have an objective value until it is commercialised via a business model (Henry Chesbrough, 2010, p. 354). Similarly Teece argues that technological innovation does not guarantee business or commercial success (Teece, 2010, pp. 183-184). He believes that “[...] good business model design and implementation, coupled with careful strategic analysis, are necessary for technological innovation to succeed commercially: Otherwise, even creative companies will flounder.” (Teece, 2010, p. 184). Teece argues that the innovators ability to capture value from an innovation is deeply compromised unless the innovator has the capacity to create new business models which necessitates a thorough understanding of the different business model design options (Teece, 2010, pp. 172-173; 186). Similar to other trajectory elements business models also have to adapt to changing markets, technology developments and changing legal structures (Teece, 2010, p. 177).

1.4.3 The business model as the unit of analysis

After having placed the business model concept into the larger perspective of trajectories and the dominant design as well as a systemic perspective, it is necessary to define what a business model is and identify relevant components that can be used for the analysis.

Although the concept of business models is being referred to very frequently in our daily lives it is not until the mid-1990s and the advent of the internet that the notion is getting

academic attention and is increasingly studied as a unit of analysis (Zott, Amit, & Massa, 2010, p. 8). Teece criticises the earlier lack of academic analysis and argues that the notion of business models lacks theoretical grounding in business studies and foremost classic economics or in other words lacks an “intellectual home” (Teece, 2010, p. 176). He states that “[...] the absence of consideration of business models in economic theory probably stems from the ubiquity of theoretical constructs that have markets solving the problems that in the real world business models are created to solve.” (Teece, 2010, p. 175). Teece proceeds by explaining that in classic economic theory the problem of actually capturing value from innovations and inventions is “assumed away” by essentially taking for granted that if value is created the customer will pay for it (Teece, 2010, p. 175). In his eyes the problem of business model design is simply overlooked by the conventional thinking that firms can simply sell their products into established markets, protected by e.g. patents (Teece, 2010, p. 175). He argues that the problem with classic economic theory is that in the real world one cannot always find a fully developed market, sufficient protection of property rights, the costless transfer of information or perfect arbitrage (Teece, 2010, p. 175). Teece concludes that customers do not just want products but that they want solutions to their perceived needs (Teece, 2010, p. 175). Also in the cases where markets do not yet exist he believes that entrepreneurs have to build the organisation to perform the activities and execute transactions that the market is not yet ready for (Teece, 2010, p. 175). Teece makes it clear that due to consumer choice, transaction costs, and differences among customers and producers business model design plays a key role in competition (Teece, 2010, p. 176).

Unfortunately a large part of business model studies still does not define the business model concept as such and the scholars that do define it, vary in their definitions considerably depending on their academic background and their purpose of study (Zott, et al., 2010, p. 3; 8). That has the side effect that scholars can mean very different things when referring to the same wording and concept (Zott, et al., 2010, p. 31). In a recent review of the business model literature Zott et al state that this leads to considerable confusion, promotes dispersion and obstructs cumulative research progress on business models (Zott, et al., 2010, p. 9). Teece defines business models as a model that “[...] articulates the logic, the data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value.” (Teece, 2010, p. 179). In his view a business model embodies the organisational and financial architecture of a business (Teece, 2010, p. 173). He stresses that a business model is first a conceptual notion rather than a financial one (Teece, 2010, p. 173). Alexander Osterwalder uses a similar definition by stating that “[...] a business model describes the rationale of how an organization creates, delivers, and captures value.” (Osterwalder, Pigneur, & Clark, 2010, p. 14).

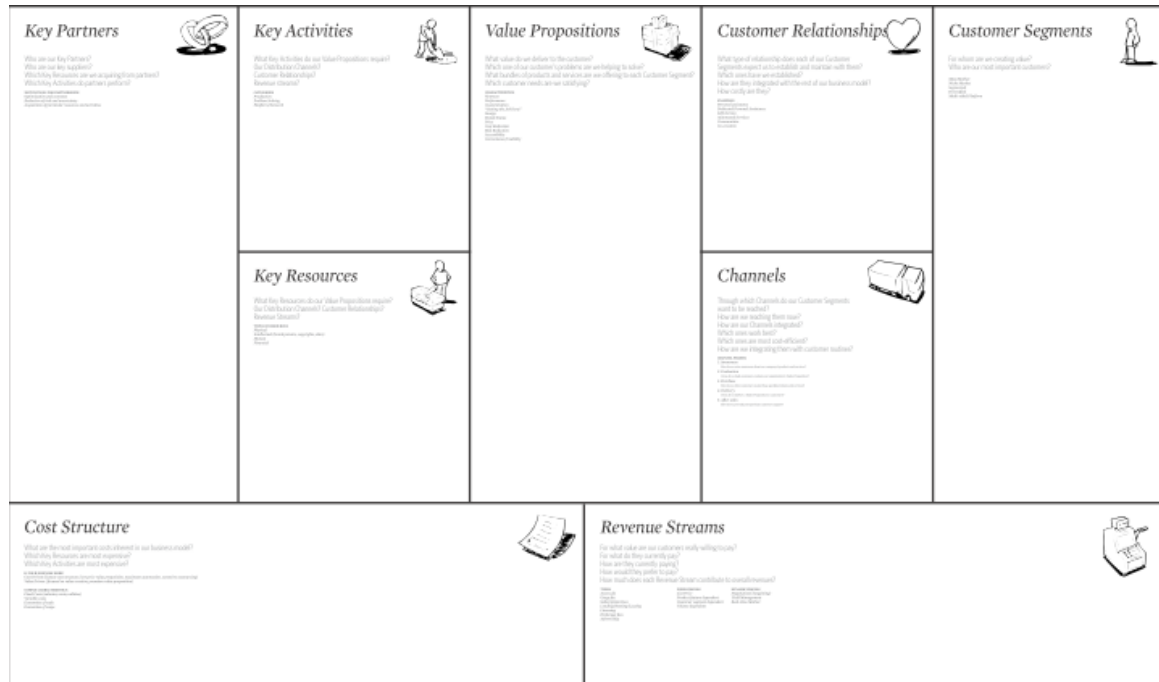
These definitions however do not yet fully capture the systemic, conceptual characteristics of a business model. In the eyes of Zott et al. a business model is a system with interconnected elements that bridges strategy formulation and implementation (Zott, et al., 2010, p. 21). This system has been described differently among scholars. Chesbrough and Rosenbloom state that the function of a business model is to articulate a value proposition, identify market segments, define the structure of the value chain within the firm, estimate the cost structure and the profit that can be made, describe the position in the value network and formulate a competitive strategy (H. Chesbrough & Rosenbloom, 2002, pp. 533-534). Zott and Amit define business model in their work as “[...] the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities.” (Zott & Amit, 2010, p. 219). According to Teece the business model explains which technologies and other features are going to be used in the product or service, how the revenue or cost structure is going to be designed or redesigned, the way in which the

technologies are going to be put together, which market segments will be focused up on, and the mechanism that are put in place to capture the value (Teece, 2006, p. 1142). Regarding the concept behind the business model Teece also suggests that it has underlying assumptions about customers, revenues and costs, the nature of user needs and competitors responses (Teece, 2010, pp. 173-174). A different set of elements is put forward by Johnson who identifies four elements, namely the customer value proposition (identifies jobs to be done and the offering), key resources (includes people, technology, products, equipment, information, channels, partnerships, alliances, funding and the brand), key processes (includes processes, business rules and success metrics as well as behavioural norms) and the profit formula (includes the revenue model, the cost structure, the target unit margin and resource velocity) (Johnson, 2010, pp. 21-46). Another concept that is increasingly used in practice is the business model design concept put forward by Alexander Osterwalder and fellow authors. In his dissertation Osterwalder referred to this as a business model ontology which is a conceptualisation and formalisation of the essential components of a business model into various elements, relationships, vocabulary, and semantics (Osterwalder, 2004, p. 15; Zott, et al., 2010, p. 13). Later he identified nine essential building blocks of a business model, namely customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key partnerships and cost structure (Osterwalder, et al., 2010, pp. 16-17). Apart from the definitions and business model elements presented here there are as mentioned multiple other definitions as there is no consensus in the academic literature (Zott, et al., 2010).

1.4.4 Business model framework

Due to the fact that it is one of the most comprehensive business model definitions in the literature and that it is widely used in the professional world by entrepreneurs, consultancies and large established companies alike, the author has decided to work with Alexander Osterwalder's suggested business model framework or as it is also labelled "the business model ontology" or the "business model canvas" (Henry Chesbrough, 2010, p. 359; Osterwalder, et al., 2010). Before explaining in detail the various elements of the framework it is once again important to stress that when analysing business model elements it is essential that one keeps in mind that they are all interacting parts of a system and hence they also have to be designed with reference to each other (Teece, 2010, pp. 188-189). This has been a central thought when Osterwalder wrote his dissertation and he stresses that it is not just about mapping the elements but also about the interrelationship between the elements (Osterwalder, 2004). The business model canvas consists of nine interrelated business model elements that can be grouped into four larger blocks. These blocks (with business model elements in brackets) are the offer (value proposition), the customer interface (customer segments, channels, customer relationship), infrastructure management (key resources, key activities and key partners) as well as finances (revenue streams and cost structure).

Figure 2 Osterwalder's business model canvas



(Osterwalder, et al., 2010, pp. 18-19)

1.4.4.1 Offer

Value proposition to the customer

The value proposition is perhaps the most essential part of the business model. In simple words it describes what problem it is solving for the customer (or a customer segment) or what customer need it fulfils. Hence it is critical to firstly understand the true customer problems or needs and then find a convenient and affordable solution. In Osterwalders terms value is only produced when “[...] assumed customer value matches perceived customer value after the consumption of a value proposition [...]” (Osterwalder, 2004, p. 51). The proposition itself could then be a product, service, information or a bundle of the former that are of value to the customer (Osterwalder, 2004, p. 49; Osterwalder, et al., 2010, p. 22; Zott, et al., 2010, p. 12). The value proposition often is such a value bundle of products and services that can be decomposed into its elementary offerings (Osterwalder, 2004, p. 50). Looking closely at those elementary offerings within the bundle can help to compare the business model to that of competitors (Osterwalder, 2004, p. 50). Values can be quantitative (e.g. speed or price) or qualitative (e.g. design, quality, customer experience) (Osterwalder, et al., 2010, p. 23). Contributing factors to value creation which customers are willing to pay for can be newness (satisfy an entirely new set of needs), performance (higher product or service performance), customisation (tailoring products and services to a specific customer’s need), design (stand out with superior design), brand or status (act of using and displaying a brand), price (free, offering similar value at a lower price, market price or high end), “getting a job done” (offering an entire set of activities), cost reduction (help customers

reduce costs), risk reduction, accessibility, convenience/usability (making things easier to use or reducing effort) (Osterwalder, et al., 2010, pp. 23-25). Those attributes can be compared among competitors on a value curve or strategy canvas (Osterwalder, 2004, p. 52). The value proposition should also be seen as a life cycle meaning that one could separately look at the creation, the purchase of the proposition, the use phase, a renewal and its final transfer (Osterwalder, 2004, p. 54).

1.4.4.2 The customer interface

The customer interface in Osterwalder's words describes all customer related aspects (Osterwalder, 2004, p. 60). This includes the choice of the customer segment(s), channels and customer relationship. The customer interface explains how and to whom the company delivers its value proposition.

Customer segments

Customer segmenting is necessary to cater the value proposition to a group of customers with similar needs, behaviour or attributes. A company needs to decide which segments to serve and which not (Osterwalder, et al., 2010, p. 20). Segments are different if they require different offers, different channels, different types of relationships, have different profitabilities or a willingness to pay for different elements of the offer (Osterwalder, et al., 2010, p. 20). Types of segments could be: mass market, niche market, segmented (segments with similar but slightly different needs), diversified (two unrelated customer segments) and multisided platforms (two or more independent segments) (Osterwalder, et al., 2010, p. 21). Another general useful distinction is business to customer (B2C) or business to business (B2B) segments (Osterwalder, 2004, p. 60).

Channels

Channels describe how one reaches the customer or a specific customer segment to deliver the value proposition (Osterwalder, et al., 2010, p. 26). This interface which can be understood as touch points with the customer usually consists of sales, distribution and communication. Here it is also necessary to understand how the customers want to be reached. Through those channels a company needs to create a customer buying cycle which consists of raising awareness for its value proposition, helping the customer evaluate what the company has to offer, allowing customers to purchase the value bundle, delivering the value proposition to the customer as well as providing post-purchase support (Osterwalder, 2004, p. 66; Osterwalder, et al., 2010, p. 26). Channels can also be labelled as direct (in house sales force, website) or indirect (retail stores) as well as self owned (higher margins but perhaps costly to create) or partner channels (lower margins but perhaps higher outreach) (Osterwalder, et al., 2010, p. 27). A good balance between these options is key to maximise revenues (Osterwalder, et al., 2010, p. 27).

Customer relationship

Customer relationships describe the type of relationships the company establishes with a customer segment (Osterwalder, et al., 2010, p. 28). The relationship can range from personal to automated. The following relationships can be used and may co-exist within a company: personal assistance (real human interaction with a customer representative), dedicated personal assistance, self service, automated services, communities (companies that utilize user

communities), co-creation (create value together with the customer) (Osterwalder, et al., 2010, p. 29). All of this may be necessary for customer acquisition, customer retention as well as boosting sales (Osterwalder, 2004, pp. 72-73).

1.4.4.3 Infrastructure management

Simply put infrastructure management is about how a company creates value (Osterwalder, 2004, p. 79). It describes the abilities that are necessary to provide the value proposition as well as to maintain the company's customer interface. This necessitates an appropriate value configuration that includes the activities needed to create and deliver the value, the relationship between those activities, the in-house resources and capabilities as well as those ones acquire through the partnership network (Osterwalder, 2004, p. 79). Hence the infrastructure management specifies the business model's resources and capabilities, their respective owners and providers, as well as who executes which activity (Osterwalder, 2004, p. 79). This can lead to a complex value network which shows the dynamic exchanges between enterprises, customers, suppliers, strategic partners and the community (Osterwalder, 2004, p. 79).

Key resources

For each business model companies need certain key resources but also capabilities that leverage on them in order to provide the value proposition. The resources can be owned by the company as well as leased or acquired from key partners (Osterwalder, et al., 2010, p. 34). The resources can be physical (e.g. manufacturing facilities, buildings, machines, distribution networks, point-of-sales systems), financial, intellectual (e.g. brands, reputation, patents, copyrights, partnerships, customer data, trade secrets) or human resources (Osterwalder, et al., 2010, p. 34). Building on these resources are a company's capabilities which use the resources to create, produce and offer its value proposition to the market (Osterwalder, 2004, p. 79). Capabilities describe the ability to perform repeatable patterns of actions (Osterwalder, 2004, p. 80). Resources and capabilities can be outsourced or unbundled if they e.g. do not belong to the core competencies of a firm (Osterwalder, 2004, p. 79). Such core competencies can be essential for building competitive advantage.

Key activities

Key activities describe what essential key actions are necessary in order to create as well as market value and generate profit while doing so (Osterwalder, 2004, pp. 84-85; Osterwalder, et al., 2010, p. 36). The activities relate to the resources and can be performed by the focal company or its partners (Osterwalder, 2004, p. 85). Hence value is also the outcome of a set of inside and outside activities and processes (Osterwalder, 2004, p. 83). Osterwalder extends the idea of activities to the idea of value configuration in which he relies on concepts such as Porters value chain, the value network and the value shop (Osterwalder, 2004, p. 83). Building on these concepts he further differentiate between primary activities which are part of creating, marketing and delivering the value proposition and support activities which are the base for the mentioned primary activities and include the firm's infrastructure, human resource management, technology development, and procurement (Osterwalder, 2004, p. 85). Typical primary functions are inbound logistics (receiving, storing and disseminating input to the value proposition), operations (transforming inputs into its final form e.g. manufacturing), outbound logistics (collecting, storing and distributing the value proposition to the customer), marketing and sales (making it possible to purchase the product and triggering the customer to do so) and service (service to enhance and maintain the value of

the product) (Osterwalder, 2004, pp. 85-86). The value shop model as a more service centred concept sees the primary activities in problem finding and acquisition (recording, reviewing and formulating the problem), problem solving (generating and evaluating different solutions), choice (choosing between alternative solutions), execution (communicating, organising and implementing the chosen solution) and control and evaluation (measuring and evaluating if the original problem has been solved) (Osterwalder, 2004, p. 86). Finally Osterwalder relies on the value network concepts which he sees as a network or platform that connects interdependent customers. This means that one new member increases the value of the network for all (Osterwalder, 2004, p. 87). In such an understanding primary activities are network promotion and contract management (inviting customers to the network, service provisioning (establish, maintaining and terminating links between customers) and network infrastructure operation (maintaining and running a physical and information infrastructure (Osterwalder, 2004, p. 86).

Key partnerships

Key partnerships describe the network of suppliers and partners that are necessary for the business model to work (Osterwalder, et al., 2010, p. 38). Osterwalder defines a partnership as a “[...] voluntary initiated cooperative agreement formed between two or more independent companies in order to carry out a project or specific activity jointly by coordinating the necessary resources, capabilities and activities.” (Osterwalder, 2004, p. 89). Contributions can include capital, technology or firm specific assets. Companies can establish alliances in order to lower transaction costs, reduce risk, optimise and achieve economies of scale, achieve organisational learning, or acquire key resources (can be understood broadly and also include brand, customer database as well as technology and patents) (Osterwalder, 2004, pp. 90-91). Strategic alliances are enhancing the competitive position of the companies involved (Osterwalder, 2004, p. 89). Osterwalder distinguishes four different forms of partnerships which are strategic alliances between non competitors, co-opetition (strategic alliance between competitors to e.g. create new market or establish standards), joint ventures (e.g. to develop a new business or to enter a new geographic area) or the classic buyer-supplier relationship (Osterwalder, et al., 2010, p. 38). The motivation to engage into such partnerships can be an interest in economies of scale (e.g. reducing cost, outsourcing, sharing infrastructure), reduction of risk & uncertainty and acquisition of particular resources & activities (Osterwalder, et al., 2010, p. 38).

1.4.4.4 Finances

The financial aspect is influenced by all other business model elements and is the outcome of the configuration of the other elements. It includes the revenue model of the company and its cost structure which together entail the profit or loss making logic of the company.

Revenue streams or revenue model

Establishing a successful revenue stream is what keeps the business model alive as it converts the value proposition into money. A company can have multiple revenue streams with different pricing mechanisms (Osterwalder, 2004, p. 96). In general revenue streams can be characterised as one-time payments or recurring/ongoing payments (Osterwalder, et al., 2010, p. 30). There are several ways to generate revenue. They include e.g. asset sale (classic sale of a physical product), a usage fee, subscription fee, lending/renting/leasing, licensing (use protected intellectual property), brokerage fee or commission (intermediation service)

and advertising (Osterwalder, et al., 2010, pp. 31-32). The different pricing mechanisms can in theory be fixed pricing (does not differentiate according to customer, volume or time), differential pricing (prices based on customer or product characteristics, volume dependant, or linked to customer preferences, but not based on real time market mechanisms) or dynamic pricing (prices based on real time market conditions) (Osterwalder, 2004, pp. 98-101). Fixed pricing can contain pay-per-use (function of the time or quantity the value proposition is being consumed), subscription (flat fee to access the use or profit from the value proposition) and menu pricing (fixed price as found in catalogues or lists). Differential pricing allows bundling of different products and services, prices that can in theory be tailored to each and every customer (due to customer profiles and databases), prices that are based on purchased volumes, or let the customer even assess the value proposition her- or himself. Dynamic pricing includes bargaining (prices based on bargaining between buyer and seller), auctioning (seller lists the good she or he wants to sell and buyers increase price over time) and yield management (maximising profits from the sale of perishable assets by controlling price and inventory) (Osterwalder, et al., 2010, pp. 30, 32-33). Which pricing mechanisms is used also depends on the relative strength of the seller or buyer (Osterwalder, 2004, p. 101).

Cost structure

The cost structure shows all the monetary costs incurred to run the business model meaning what it costs to create, market and deliver the value proposition (Osterwalder, 2004, p. 101; Osterwalder, et al., 2010, p. 40). The cost structure puts a price on all the resources, assets, activities, partnerships and all other exchanges that cost the company money (Osterwalder, 2004, p. 101). Relying on a partner network for non core competencies can result in large cost savings (Osterwalder, 2004, p. 101). Depending on the type of business model, either cost-driven or value driven, the cost structure is more or less important to the company (Osterwalder, et al., 2010, p. 41). Cost structures can be looked upon by dividing them into fixed costs (costs remain the same no matter how much of a product or service is bought), variable costs (vary depending on the volume of goods or services purchased) and with a focus on economies of scale (business becomes more profitable the more it expands) or economies of scope (e.g. being able to use the same activities and resources for multiple products or services) (Osterwalder, et al., 2010, p. 41).

1.4.5 Framework for the evaluation of business models

Evaluation of business models is not an easy undertaking especially in the context of an emerging industry where so far hardly any functioning business models exist. In many ways one tries to evaluate something that is not there yet. After considering multiple other theories and concepts, the author decided to approach the task firstly from a simple but perhaps at this market stage more effective approach by relying on a strength, weaknesses, opportunities, threats (SWOT) analysis (Mintzberg, Ahlstrand, & Lampel, 1998, pp. 29-30). This approach has its limitations in itself and will also have its limitations as the author uses it on an industry level as the thesis is concerned with utilities as a group. However, having the SWOT analysis approach as a background tool will provide the structure necessary to assess the advantages and disadvantages of different business model options.

In the strategy section of his book on business model generation Alexander Osterwalder also uses the SWOT analysis to evaluate business models (Osterwalder, et al., 2010, pp. 212-224). He does so not only by using SWOT on the whole business model but applies it to each of the above already described nine business model elements. In essence this will lead to nine

different SWOT analyses. Used this way the SWOT analysis becomes more insightful and valuable. The author will have this tool as a lens while thinking about the advantages and disadvantages of each of the business model elements for utilities.

As an additional element for the evaluation Teece's framework called "Profiting from Innovation" will be taken into account (please also refer to Figure 3 Teece's market entry strategies) (Teece, 1986, 2006). The framework starts with the premise that business models can be the source of competitive advantage. However, developing a long lasting successful business model is only possible if it is difficult to imitate and is in itself differentiated from other competitive business models. It must thus be hard to replicate for incumbents and new market entrants alike (Teece, 2010, p. 173). The ease with which competitors could imitate the business model Teece also calls weak or tight appropriability (Teece, 1986, p. 287). The problem is that business models are relatively transparent and hence after years if not months competitors will start to try to imitate them (Teece, 2010, p. 179). This is why he calls for "isolating mechanisms" that can be used to prevent competitors from copying the business model (Teece, 2010, p. 180). This is especially important in areas where a company does not have patents or other entry barriers at its hand (tight appropriability).

According to Teece there are three mechanisms that can help in such a competition. Firstly a business model may necessitate systems, processes and assets that are hard to replicate and in that context capabilities matter (Teece, 2010, p. 182). The second factor is a sort of "uncertain imitability" which describes a situation where competitors may grasp some of the key elements of a business model but do not understand in sufficient detail how the model is being implemented or what key elements constitute customer acceptance (Teece, 2010, p. 182). The third factor that Teece identified is somewhat more indirect. He states that some incumbents or other relevant actors may not be willing to "cannibalise" their existing sales and profits or else upsetting their business relationships by engaging into competition with the company in question and its particular business model design (Teece, 2010, p. 182). Of course other new entrants may not be limited by such aspects.

The underlying basis, especially for the first isolating mechanism, is what Teece calls complementary assets and technologies. This is a view that is also very essential to the resource-based theory of the firm (Teece, 2006, p. 1135). Complementary assets are assets and capabilities that will be needed for successful commercialisation and are also influenced by the maturity of the industry in question (Teece, 1986, p. 288). As an example Teece mentions that this could be assets and capabilities in the area of marketing, distribution, sales, competitive manufacturing, after sales support or any other potentially relevant area for the innovation (Teece, 1986, p. 288). Within those complementary assets there can be different levels of specialisation or degrees, namely generic assets, specialised assets and co-specialised assets.

- Generic assets are general purpose assets that are available in the industry or available in competitive supply via contracts and do not need to be specialised to the innovation in question or else specialising them according to the needs of the innovation involves only few risks (Teece, 1986, p. 289). Despite this lower risk one still needs them in order to commercialise the innovation.
- Specialized assets on the other hand involve significant irreversibilities in terms of risk and investment and cannot be easily accessed via contracts (Teece, 1986, pp. 291-292).

As such Teece speaks of unilateral dependence between the innovation and complementary asset in the case of a specialised asset.

- Co-specialised are e.g. distribution channels, specialised manufacturing capacity or similar without which it is almost impossible to commercialise the innovation. Teece states that in such cases there is a bilateral dependence between the innovation and the complementary asset (Teece, 1986, p. 289; 2006, p. 1134).

Once these complementary assets have been identified there are different strategies possible on the continuum between integrating all of these complementary assets or fully contracting them (Teece, 1986, pp. 292-293). Usually hybrid modes can be found in practise and it depends on the perceived core strengths of the company in questions which ones will be selected for integration. In general it is important to stress that control of an asset does not yet imply control of a market, unless the asset is truly essential to the competitiveness of that market (Teece, 2006, p. 1134). That is also an aspect that can change fast during the course of industry development. Teece concludes that a sustainable business model is very much about the choice where to position oneself as a company in the value chain and what the key bottleneck assets are which the company needs to control or own in order to capture value (Teece, 2010, p. 191). There will be many activities that the industry must perform, but which of those the company chooses to undertake is essentially a business model choice (Teece, 2010, p. 191).

Apart from Teece's model another possibly fruitful complementary perspective to look at competitive advantage among business models is to look upon what Amit and Zott call different business model design themes (Amit & Zott, 2001, p. 503; Zott & Amit, 2010, p. 221). Such themes describe the way different business model elements are put together or are orchestrated in order to create value (Zott & Amit, 2010, p. 221). According to these authors these design themes can be an important differentiator compared to the business models of competitors. Their framework consists of four factors, namely novelty, lock-in, complementarity and efficiency (the NICE framework) (Amit & Zott, 2001, p. 503; Zott & Amit, 2010, pp. 221-222).

- Novelty as a design theme centres very much on new ways of performing the different business model elements compared to the business models of competitors (Zott & Amit, 2010, p. 221). It can centre on the adoption of a new innovative value proposition with different elementary offerings, new key activities and how they are configured or also other elements like new customer channels (Amit & Zott, 2001, p. 508).
- Lock-in as a design theme centres very much on the ability and power to keep customers attracted to the business model (Zott & Amit, 2010, p. 221). Developing such a business model will create switching costs for customers that make it hard to switch to competitors (Amit & Zott, 2001, p. 506). Moreover, the theme centres on powerful network externalities and network economics which entails that the attractiveness of the network grows the more customers use it and in the end customers keep coming back and are in that sense locked in. Also a company's brand and trust in a buyer-seller relationship can create lock in situations (Amit & Zott, 2001, p. 506).
- Complementarities as a design theme is to some extent already covered by other parts of the theory discussed above. The theme entails that complementarities are present if it provides more value to bundle different elementary offerings into a value bundle compared to running the different elementary offerings separately (Amit & Zott, 2001, p.

504; Zott & Amit, 2010, p. 221). In essence the system is worth more than its individual parts.

- Efficiency as a design theme centres on the aim to achieve greater efficiency through reducing transaction costs especially within the value configuration by whom key resources and key activities are provided (Zott & Amit, 2010, pp. 221-222). This can also entail new ways of linking those elements or changing the performance levels within these activities. In essence transaction efficiency increases if costs per transaction decrease (Amit & Zott, 2001, p. 503). One way to do that is for example to reduce information asymmetries between buyer and seller (Amit & Zott, 2001, p. 503).

1.5 Scope

This study is geographically limited to Sweden. The country has an interesting utility sector with three large international utilities as well as many regional and local utilities. Utilities for the case studies were chosen based on the premise to get a representative group of utilities with different sizes. For the purposes of this thesis utilities are defined as being involved in the generation, transmission, distribution and retailing of electricity.

In terms of the business model concept the author is primarily focussing on the business model design and not on the innovation processes in the business model development that lead to it. Also, the implementation phase of the business model development is not included (Teece, 2010, p. 174). However it has to be underlined that the business model may change over time due to the competitive environment and as such any business model design is only provisional (Teece, 2010, p. 187).

1.6 Limitations

One limitation of the thesis is the dynamic and evolving nature of the topic which leads to ongoing input of new information even during the course of research.

At the same time the focus on business models in the area of electromobility is an extremely sensitive topic since many actors are not willing to talk about such issues especially if it is in a new business area where competition is still not defined properly. Hence many experts that were interviewed were reluctant to disclose information. This can be exemplified by the following expert statement: “The things that would most interest you I just cannot tell you.” (Frieser, 2011). This is the reason why the author only received very limited input on the key aspects of certain business model elements.

Additionally, the thesis was limited by the very early market stage as such which the author perhaps had underestimated. This led to the fact that some of the interview partners and their respective companies have not even started to think about business model implementation in the area of electromobility and hence interviews remained on a very vague level.

Another aspect is that the unit of analysis in this case “the business model” is still a very fuzzy term even though there has been some development in recent years. While the author is convinced of the usefulness of this perspective, it has to be taken into account that the academic literature still differs on what a business model and its elements actually are. This

means that there is not yet a framework that would provide a consensus among scholars. . Another limitation is that trying to evaluate business models that do partially not even exist and are only mere future options contains a lot of uncertainties in itself.

In addition, differentiating the business model concept and the academic areas it is related to, can become very complex. This can be exemplified by the fact that the business model concept is related to many other issues like strategy, the supply chain, the value chain, the value network, business ecosystems, the market model and multiple other concepts.

Finally, there is the possibility that the researcher due to language barriers and personal background could have misinterpreted some of the answers put forward in the expert interviews.

1.7 Audience

The intended audience for the thesis are business developers and policy makers in the area of electromobility alike. Both groups are potentially interested in the opportunities that come with electromobility from the perspective of society and from the perspective as a business opportunity. With regards to policy this thesis can provide valuable insights into a micro level. For business developers it can show a first glimpse on the business model design options in the area of electromobility in Sweden.

1.8 Outline

The following sections will firstly give a general background to the research topic which includes the electromobility technology as such, as well as institutional background information on the level of the European Union and Sweden. This is followed by an analysis section where current similarities and differences in business model designs among utilities active on the Swedish market are investigated. Subsequently, different emerging business model designs are being discussed. The thesis concludes with recommendations for utilities as well as policy makers.

2 Background

2.1 Technological aspects

2.1.1 Electric vehicles

Modern electric cars have been manufactured since the 1980s but have originally started off earlier than their rivals using internal combustion engines (ICE) with the first experimental electric cars around the 1830s (Hoyer, 2008, p. 63). In those early days the electric car rivalled automobiles using steam-powered engines as well as gasoline powered ICE cars and eventually lost the race to the later around 1920 (Hoyer, 2008, p. 64). Nowadays in the face of multilayered dilemmas in our energy as well as climate system this race is picking up speed again. Currently about every major car manufacturer has at least plans to introduce an electric vehicle in the form of BEV, HEV or PHEV in the very near future (Energimyndigheten, 2009b, p. 14; Thiel, Perujo, & Mercier, 2010, p. 7142).

Electric cars are automobiles that are propelled by electronic engines running on electric energy. The electronic engine uses the chemical energy stored in the battery. They come in a variety of technologies and one today e.g. has to differentiate between hybrid electric vehicles (HEV) (e.g. Toyota Prius; Honda Insight) and battery only electric vehicles (BEV) (e.g. Nissan Leaf) (Hoyer, 2008, p. 68). These different technologies have advantages and disadvantages and address some of the concerns that surround the area of electric cars.

Within the HEV technology platform the main difference lies in the series and parallel configuration (Hoyer, 2008, p. 68). Within the series configuration the transmission of power from both the combustion engine and the electric drive system is both primarily electric. Hence the combustion engine is used to generate electricity and is combined with the electric power from the batteries. While braking, the motor can act as a generator and feed electricity back into the batteries. In the parallel configuration the transmission of power is primarily mechanical. Within the parallel setup the two motors can function independently or combined. The parallel and series technology can also be integrated.

Current plug in hybrids (PHEV) are mostly such combinations with the ability to charge the battery from the grid (Hoyer, 2008, p. 68). Through such systems the combustion engine can be downsized up to 60 percent (Hoyer, 2008, p. 68). PHEVs are perceived as a transitional technology setup that allows to combine the strengths of the combustion engine and the electrical motor which reduces important uncertainties and anxieties around EVs range (Barkenbus, 2009, p. 399; Energimyndigheten, 2009b, p. 14). Still after establishing an overview of existing technologies it is necessary to point out some of the uncertainties or constraining factors that exist (Hoyer, 2008, pp. 70-71).

Firstly many potential customers are worried that the battery will run out of power before they reach their final destination, also called “range anxiety” (WWF, 2008, p. 98). This stands opposed to the fact that the daily average for commuting for most people in the EU is about 40 km (WWF, 2008, p. 100). The range of an EV is limited depending on the battery technology used, the battery size and naturally the charging possibilities. Therefore currently some planning is involved if one relies on a BEV (Energimyndigheten, 2009b, p. 33). With regards to that it is not surprising that some efforts are put into the setting up of public

available charging structure to prepare for eventualities of running out of power and perhaps to change the perceptions around EVs. It would primarily be useful at places where EVs may be stationary for longer periods of the day (Energimyndigheten, 2009b, p. 34).

Still this also leads to the fact that many may see the recharging time an EV needs as cumbersome (WWF, 2008, p. 98). On the research and development side there is also considerable uncertainty with regards to the future role played by fast charging technologies and its different designs as well as battery switching technologies (Energimyndigheten, 2009b, p. 33). This in turn will increase investment risks and may need entrepreneurs to take action.

A general disadvantage of electric vehicles compared with incumbent technologies is their relatively high costs mostly due to the labour intensive and expensive battery production (WWF, 2008, p. 98). However it is being estimated that the prices of the batteries are going to drop relative to the market share reached (Energimyndigheten, 2009b, p. 22; Werber, Fischer, & Schwartz, 2009, p. 2465). Despite of that it is likely that EVs will be more expensive than conventional cars in the near future (Thiel, et al., 2010, p. 7151). It is still worthy to note that BEVs over their life time have much lower maintenance and usage cost. One way around the cost problem could be to disconnect batteries from EV car purchase.

2.1.2 Charging infrastructure

How long it takes to charge an EV depends on the fuse and if one uses 1 phase or 3 phase current. How far one can drive then depends on how much energy can be stored in the car battery. A general rule of thumb is that an electric vehicle uses an average of 2 kWh per 10 km or 1 Swedish mile (Svensk Energi, 2010, p. 12). Apart from the charging infrastructure most electric cars have an inbuilt charger which one can connect to an ordinary household outlet (Svensk Energi, 2010, p. 12).

Slow charging

This is the charging group that is common in most Swedish households and outlets. It uses a one phase outlet with 230 Volts and either a 10 A or 16 A fuse. Hence when using a 10 A fuse one can get 2,3 kW and when using 16 A one gets 3,7 kW (Svensk Energi, 2010, p. 12). One hour of slow charging corresponds with 11.5 km to 18.4 km worth of driving (Svensk Energi, 2010, p. 12). Most studies have shown that this type of charging will be sufficient for people with access to an outlet at home and/or at work. Charging at home over night is sufficient for the needs of most users (Svensk Energi, 2010, p. 12).

Semi-fast charging

To increase the charging further from household level one would need a three phase socket or a fuse with higher Ampere (Svensk Energi, 2010, p. 12). One problem is that not all electric vehicles are capable of three phase charging at this point. Three phase charging with 16 A and 230 V would already lead to 11 kW which would represent a five times increase in speed (Svensk Energi, 2010, p. 12). Another combination would also be to increase the fuse to 32 A and continue to rely on one phase charging which would at least to 7 kW.

Fast charging

While this is a very important technology for long distance trips with BEVs the development of a universal method for fast charging is still held back by the lack of a common standard amongst automakers (Csere, 2011). One way to define fast charging is by stating that the charging should not take longer than 10 minutes (Svensk Energi, 2010, p. 13).

Fast charging is more challenging since it has higher demands on the grid and the charging system. Also there are no agreed upon standards yet for fast charging. Today often a standard called “Chademo” is used which can be translated to “charge and move” (Csere, 2011). This is a D.C. fast-charge systems which was developed in Japan by Nissan, Mitsubishi and Subaru together with Tokyo Electric Power (Csere, 2011). However this fast charging standard uses a connector that is different from most other that is necessary in other electric cars today. As a result e.g. the Nissan Leaf for example needs to have to different sockets (Csere, 2011).

An international standard to differentiate between different ways of charging has been proposed by the IEC (Bossche, 2009; IEC, 2011). In their international standard IEC 61851-1 they propose to differentiate between four different charging mode definitions. Charging mode 1 describes the slow charging from a standard household socket outlet, charging mode 2 stands for slow charging from a household-type socket-outlet but with an in-cable protection device, charging mode 3 can be slow or fast charging but using a dedicated EV socket outlet that also includes the installation of control or protection functions (includes e.g. earthing) and lastly charging mode 4 which represents fast charging using an external charger. With charging mode 1 to 3 EVs can be charged within three to ten hours. When it comes to charging mode 4 the IEC defines fast charging as being able to fully charge an EV in under 10 minutes (IEC, 2011).

2.2 Institutional aspects

This section will give an overview of the context for business model development in the area of electromobility by looking at relevant institutional aspects in the European Union as well as Sweden. It includes political goals, institutional and legal issues that are related to the electric vehicle and charging infrastructure.

2.2.1 European Union

On the EU level there are policy goals and regulation that affect business model development in the area electromobility (Holmgren, 2010; Söldner, 2011). Firstly, the EU as part of the renewable energy directive has the goal of achieving 10 percent renewable energy in the transport sector by 2020 and within that biofuels have to fulfil sustainability criteria. Through the fuel quality directive a reduction of CO₂ intensity of fuels by 6 percent by 2020 has to be achieved. With the clean vehicle directive starting December 2012, public procurement of vehicles needs to take into account the energy consumption as well as CO₂ emissions of the vehicles. Furthermore there are exhaust norms in place that are valid for Sweden as well. These are that by 2015 130g CO₂/km (phased in starting 2012) and by 2020 95g CO₂/km have to be fulfilled. Secondly, the European Union has partly been financing demonstration projects on regional, national and European level (Lindblad & Zinkernagel, 2011). The relevant funding bodies in the EU are Interreg, the European Regional Development Fund (ERDF) and the Framework Programme 7 (FP7) (Lindblad & Zinkernagel, 2011; Mollstedt, 2011).

2.2.2 Sweden

Sweden has implemented a long term policy goal of achieving a fossil fuel free transport system by 2030 (Holmgren, 2010, p. 4). A related Swedish national goal is to achieve a sustainable and resource effective energy supply without net increase of greenhouse gases by 2050 (Holmgren, 2010, p. 4). Yet another goal is to supply 50 percent of its total energy use by renewables in 2020 (Energimyndigheten, 2009a, p. 8). That is also in line with Sweden's Kyoto protocol goals of achieving a green house gas emission reduction of 40 percent by 2020 based on 1990 levels. Furthermore it is planned that in accordance with targets by the European Union a minimum of 10 percent of renewable energy should be used in the transport sector² (Energimyndigheten, 2009b, p. 48; Holmgren, 2010, p. 4).

In 2010 the transport sector in Sweden accounted for one third of green house gas emissions in Sweden and accounted for one quarter of final energy use (Sköldbberg, Löfblad, Holmström, & Rydén, 2010, p. 18). Road transport stands for a large part of the impact of the overall transport sector and contrary to other sectors the transport sector emissions are still increasing (Sköldbberg, et al., 2010, p. 18). It is being estimated that if the whole private car fleet could be substituted by battery driven electric cars (BEV) about 80 percent of the energy and about 10 million tons CO₂ per year could be saved (Bandhold, Wallner, Lindgren, & Bergman, 2009, p. 6). Compared to other vehicle fleets in Europe, Sweden has a relatively old fleet with a lower share of diesel cars and higher fuel consumption (Sköldbberg, et al., 2010). In September 2010 there were 4,427,032 private cars registered in Sweden out of which at that time 350,979 were environmental friendly cars (Transport Styrelsen, 2011a). That number gives environmental friendly cars a share of roughly 8 percent. In terms of newly registered cars the overall trend is that environmental cars have a share of about 30 percent (Transport Styrelsen, 2011a). At the end of 2009 the number of registered electric cars (BEV) was 157 and the number for HEVs was 16,095 giving them a combined share of the private car fleet of 0.4 percent at the end of 2009 (SCB, 2010). However one needs to take into account here that so far there were not many BEVs available on the Swedish market which is likely to change in 2011 and the coming years. Particularly the growth rate of HEVs seems promising during the last years. At the end of 2010 190 pure battery driven electric vehicle were registered in Sweden. These developments however may be offset by increasing use of road transport in general (Sköldbberg, et al., 2010, p. 19).

Actors from the Swedish industry (Power Circle, ElForsk, TSS) expressed a vision of having 600,000 electric vehicles on the street by 2020 which nevertheless has not been enacted into any government regulation (Mollstedt, 2011; Power Circle, ElForsk, & Test Site Sweden, 2009). The Swedish Energy Agency however has a lower estimate for 2020 which is in between 20,000 to 85,000 EVs (Lewald, 2011). None withstanding these numbers different actors see Sweden in a good position to support a shift towards electromobility for a couple of reasons that are not comparable to most countries (Test Site Sweden, 2011). Due to its cold winters Swedish consumers and companies are accustomed to using electric engine heaters which are needed during winter to preheat the car engines (Energimyndigheten, 2009b, p. 24). It is estimated that there are approximately 600,000 such outlets mostly north of Stockholm if one combines the devices at home, at the workplace and in car parks (Energimyndigheten, 2009b, p. 25). These could easily be converted and also work as charging spots for electric vehicles (Energimyndigheten, 2009b; Test Site Sweden, 2011). It is also being said that the transmission infrastructure is more advanced than in some other European countries which allows smart interaction and access to the power of 20 kW three-

² Electricity obtained from renewable power sources is allowed to achieve those goals.

phase transmissions (Test Site Sweden, 2011). Also the existing 230 V system with both 10 and 16 A fuses have great potential for charging electric vehicles at home, at car parks and housing cooperatives (Energimyndigheten, 2009b, p. 25). Therefore it seems that Sweden has good prerequisites to further develop charging infrastructure compared with other countries worldwide (Energimyndigheten, 2009b, p. 25). Despite this there will still be potential customers that lack access to such potentially easy charging possibilities which is why some studies see the need for more charging infrastructure in public available spaces (Energimyndigheten, 2009b, p. 26). Also standards with regards to 400 V three phase current fast charging stations need to be implemented and harmonised with other worldwide standards (Energimyndigheten, 2009b, pp. 26-27).

Furthermore Sweden has a very high content of low carbon power sources in its national grid, giving electric vehicles the clear advantage of being a true environmentally friendly alternative (Energimyndigheten, 2009b, p. 24). Provided that certain peak demand management efforts and the necessary incentives for off peak capacity are being implemented the Swedish power grid already today can accommodate large numbers of electric cars without losing stability (Energimyndigheten, 2009b, p. 28). Electric vehicles can also play a vital role as charge equalizers due to their storage capacity in the scenario that more intermittent renewable power sources are being added to the grid (Energimyndigheten, 2009b, p. 29).

Apart from the described context and institutional environment there are a set of concrete regulatory issues and policy proposals that will be briefly described in the following.

Environmental car incentive

The “Supermiljöbilspremién” is a monetary incentive that was proposed for very environmentally friendly car. The original proposal put forward spoke of a 40,000 SEK monetary incentive for private persons that would be buying electric vehicles or methane driven cars that have emission values below 50g CO₂/km (Transport Styrelsen, 2011b). The incentive was said to have a volume of 200 million SEK and hence would be sufficient for the equivalent of about 5,000 EVs. The time period under which the incentive would be valid was proposed to be between the 1st of July 2011 and mid 2014. The proposal has been criticised by several actors due to its limitation to private persons as well as overall incentive volume (Strandberg, 2011). Also the proposal is said to only accept cars that fulfil the highest Euro NCAP safety requirements which not yet many EVs have been tested for (Käck, 2011). Recently some of the previous criticism has been addressed and the Ministry of Environment will investigate if it is possible to include companies into the proposal which apparently could be illegal according to European legislation (Baltscheffsky, 2011). The new proposal first of all foresees to include taxi companies, car pools and car leasing companies. The original budget of 200 million SEK is supposed to be raised to 300 million SEK.

Company fringe cars and employee benefit tax

In Sweden company fringe cars are a very important market as more than 50 percent of newly registered cars are bought or financed by companies (Lewald, 2011). That is something that is very different from most other European countries and will likely impact the development of electric vehicles in Sweden (Lewald, 2011). Volvo is currently the market leader in these fringe car sales and also 80 percent of Saab’s orders on the Swedish market are for the company fringe car market (Östermark, 2011; Petre, 2011). Employees that use

those company fringe cars have to pay taxes in Sweden for the benefit they are receiving of having access to them. This tax is part of the personal income tax of the individual employee. In order to give incentives for environmentally friendly cars (“miljöbilar”) the Swedish government has enacted tax legislation that reduces that benefit tax in the case that it is an environmentally friendly car. In the end of May 2011 the Swedish department of finance has put forward a proposal for environmentally friendly cars for the income years 2012 and 2013. This proposal will likely appear in the finance budget in September 2011, then be finalised in November 2011 and eventually come into force from the 1st of January 2012 (Lewald, 2011; Skatteverket, 2011). This proposal foresees that next to methane driven vehicles also electric vehicles that can be charged from the grid, in other words plug in hybrids (PHEV) and battery driven electric vehicles (BEV), will get a 40 percent reduction on the calculated benefit (Skatteverket, 2011). The maximum amount of that reduction however is 16,000 SEK per year. As a result this will make it relatively seen more beneficial for an employee to drive a PHEV or BEV. After being used for 3-5 years as company fringe cars EVs could then gradually become part of the second hand market (Östermark, 2011). At least that is the way how new car models to a large extent are brought into the market in Sweden at the moment.

National procurement initiative

Still, in order to get this reduction as an employee and in order to gradually start the second hand market later on, the company that starts the process has to buy such cars in the first place. Currently there is only one existing major monetary incentive that would allow companies and public organisation to lower the cost for electric vehicle purchases. This is a national procurement initiative called “Stockholm upphandling” or sometimes also called “elbilsupphandling” which is a joint initiative of Vattenfall and Stockholm city that is supported by the Swedish Energy Agency (Elbilsupphandling.se, 2011b; Energimyndigheten, 2010a, 2010c; Vattenfall, 2010; Vattenfall & Stockholm City, 2010). The initiative has the overall goal of eventually facilitating the purchase of 6,000 electric vehicles for companies and public agencies all over Sweden. The Swedish Energy Agency (SEA) is providing the economic incentives for purchasing the first 1000 electric cars in the project. Essentially the SEA pays for 25 percent of the additional cost of buying an electric car compared to conventional cars. Recently it has been published which electric vehicles have passed the evaluation criteria of the public procurement process (Elbilsupphandling.se, 2011a). Among them are six private cars, namely the Chevrolet Volt, the Citroën C Zero, the Mitsubishi iMiEV, the Renault Fluence, the Saab 9-3 ePower and the Vantage SUV as well as four transport cars³. Notably one of the most successful electric vehicles, the Nissan Leaf, has not been part of the initiative. From the 1st of October 2011 onwards the 303 organisations that were part of the procurement process will be able to purchase those cars. Out of these 303 organisations 83.5 percent are public agencies which shows the considerable interest among these actors (Sunnerstedt, 2011).

Parking EVs in public spaces

Since February 2011 it is legally allowed in municipalities and local communities to reserve parking lots in public spaces for electric vehicles (Lewald, 2011; Swedish Transport Agency, 2011). Previously this has been illegal and has only been possible for e.g. handicapped people. If you charge parking fees however you are not allowed to exempt electric vehicles

³ Prices can be found on the “elbilsupphandling” website (Elbilsupphandling.se, 2011a).

from them (Sunnerstedt, 2011). It is still not allowed to reserve parking spaces for car pools, but if those were electric vehicles that should indirectly be possible (Sunnerstedt, 2011).

Grid and electricity issues

When it comes to the electricity grid there are a couple of regulatory problems that make it potentially more difficult and costly for non-grid companies to install charging infrastructure. According to the electricity law (“*ellagen*”) one has to get a grid concession (“*nätkoncession*”) from the responsible local grid company for installing charging infrastructure and the grid connection itself is also supposed to be done by the local grid company (Alpman, 2010). This however depends very much on the location of the charging infrastructure since e.g. charging infrastructure within parking houses today is exempted but charging infrastructure on an outside parking space e.g. a mall has to pay for such a grid concession (Energimarknadsinspektionen, 2010b). Depending on the situation it can then even happen that each and every charging station has to get such a grid concession which would increase costs substantially (Energimarknadsinspektionen, 2010a, p. 13). The Energy Markets Inspectorate (“*Energimarknadsinspektionen*”) (EI) has put forward a proposal to the Swedish government that is supposed to make it easier to install charging infrastructure and proposes to make an exemption from the grid concession requirement in the case of charging infrastructure for EVs in an internal low voltage grid (Alpman, 2010). In essence that proposes that low voltage grids below 1000 Volts for charging EVs can be build and used without having a grid concession (Energimarknadsinspektionen, 2010a, p. 13).

When it comes to the electricity used for the individual charging station the proposal of the EI also foresees that there could be an exception made for the requirement that the customer has to be given a choice which electricity is going to be used. This is supposed to make it easier for the charging station provider to recoup investments (Alpman, 2010). What is meant here is that the owner of all the charging stations as a whole decides which electricity will be used and not the individual customer that may e.g. be renting a parking lot (Energimarknadsinspektionen, 2010a, p. 15).

However, at this point these legal changes are still at a proposal stage, but in another recent proposal by the Swedish government from June 2011 the demands made by the EI are already included (Energimarknadsinspektionen, 2011). As such the implementation of EI’s proposal seems at least likely and many companies already act according to it.

Fuel tax

Of indirect advantage for electric cars are the Swedish energy tax and the carbon tax. Today the combined energy tax and carbon tax for diesel is 4.54 SEK/litre and for gasoline 5.52 SEK/litre (Energimyndigheten, 2010b, p. 53). The Swedish vehicle tax has been reoriented along the lines of CO₂ being emitted in 2006. In 2011 this tax has changed from 15 to 20 SEK per g CO₂/km. The cap for the tax is at 120 g CO₂/km (Energimyndigheten, 2010b, p. 53). Essentially pure electric cars (BEV) would only need to pay electricity tax which currently is at 0.282 SEK per kWh.

3 Existing business model development

Drawing on the theory section of this thesis the nine business model elements by Osterwalder are used to give a snapshot of the activities by utilities in the area of business model development in Sweden (Osterwalder, 2004; Osterwalder, et al., 2010). The individual elements are used as aggregates on a higher level to show possible differences, similarities and eventually design options for business model development in the area of electromobility. This approach has been necessary due to the very early stage in business model development in Sweden which did not allow to solely focus on specific companies. As such the business model analysis is primarily explorative and also draws on expectations that some of the interviewed utility experts have for the future. The principal interest during this analysis is hence on utilities. It is of course impossible to include all utility companies that are involved in electromobility in Sweden. Firstly, the largest utilities in terms of turnover are included. Secondly, to represent smaller sizes one more regional and one more local utility are included. The choice was also shaped by the extent of access the author received through interviews. The findings will be summarised in “Table 1 Derived business model elements” in the appendix of this thesis.

3.1 Business Model Elements as currently used or considered by Utilities

3.1.1 Offer

The Swedish electromobility market is still at a very early stage and much is still happening on a pilot project level. One expert characterises this the following way: “We talk about a market that may be huge at some stage, but that does not yet exist today.” (Frieser, 2011). Hence apart from looking at the offers that already exist today, the author has also included some initiatives and ideas that market actors are merely thinking about.

3.1.1.1 Value proposition to the customer

Göteborg Energi

Göteborg Energi is a regional utility owned by Gothenburg municipality. Early on the utility has decided to have a market driven approach to electromobility and is mostly focused on offering solutions that are being demanded on the market already today. The value proposition Göteborg Energi has is a full charging infrastructure service mostly directed at companies and public authorities. Through this service Göteborg Energi is bundling the installation, maintenance of the charging infrastructure as well as the charging with locally produced wind energy (Östermark, 2011). The customers pay a fixed monthly fee for the availability of the charging infrastructure as well as a variable monthly fee depending on how much electricity has been used. Göteborg Energi also gives a guarantee to update the charging infrastructure should there be a change in international standards and through that it effectively reduces uncertainty for customers. Because Göteborg Energi technically still owns the infrastructure they can also decide who is going to be the retailer and servicing company behind the offer. Hence this bundling allows Göteborg Energi to use its own retailing and servicing organisation. Östermark claims that they now have a good

understanding of what potential customers are willing to pay for such a service at this market development stage. According to Östermark the market currently is demanding simple one directional slow charging offers and is not yet willing to bear the costs for fast charging and smart charging solutions (Östermark, 2011). Göteborg Energi has been offering this service now for more than a year and Östermark is convinced that this is a scalable model. Östermark however stresses that they are still waiting for more electric cars on the roads. Regarding bidirectional charging and smart grid activities Göteborg Energi states that they will not engage in anything that the market is not yet asking for. Right now Göteborg Energi is working to come up with an offer for private customers but has not put forward anything official yet. Other than that they have also put up a few public charging spots but this has been done mostly for public relations reasons (Östermark, 2011).

Apart from the offer they are currently using Göteborg Energi has also thought about directly including EVs in their service. However they have not received any signals from their owner that they should extend to such an offer (Östermark, 2011). Notwithstanding is the fact that Göteborg Energi and the mobility company Move About have been approaching the same companies and are offering each others' value propositions to each others customers (Jakobsson, 2011; Östermark, 2011). This could be seen as an extended value proposition that includes mobility services even if it is through a partner.

According to Östermark another possibility in the future may be to bundle the electric vehicle offer with micro renewable energy production in a smart offering (Östermark, 2011). Apart from that the company also sees stationary batteries as a business opportunity but they still are uncertain with regards to the exact use of those batteries in their power grid.

Fortum

Fortum is one of the three largest utility companies in Sweden and is primarily owned by the Finnish state. They are foremost active in the Nordic countries, notably in Finland, Sweden and Norway (Käck, 2011). Not too different from Göteborg Energi the company is offering a charging infrastructure service (Käck, 2011; Östermark, 2011). Interestingly, both companies are also connected through a pilot project supported by the Swedish Energy Agency ("Energimyndigheten") where they also exchange knowledge (Östermark, 2011). Fortum introduced their charging solution called "charge and drive" in March 2011 which is about one year after Göteborg Energi introduced their solution (Käck, 2011; Östermark, 2011). The service includes installation, operation, maintenance and customer service of the charging infrastructure (Käck, 2011). The IT system behind the service allows tracking of available charging stations, verification and payment solutions all connected to a smart mobile phone (Fortum, 2011d). However the electricity itself is not directly included in the service (Käck, 2011). Also similarly to Göteborg Energi, Fortum offers to upgrade the infrastructure if needed. Normally this bundled service means that companies have a renting arrangement with Fortum, but Käck explains that the companies can also request to buy the installation service and charging infrastructure from them in a one time purchase (Käck, 2011). Hence in essence it depends very much on what the client wants, but the official position on the website is the renting option (Fortum, 2011a). One of the major customers is Europark which has 200,000 parking spaces in Sweden and is overall one of the largest parking space providers in the Nordic countries (Fortum, 2011b).

Apart from this official offering Fortum has also been engaged in public demonstration projects which involved among others the installation of charging infrastructure at a regional

parking lot company (“Stockholm Parkering”) as well as a project at a multi dwelling house (Käck, 2011). The multi dwelling house project, apart from the charging infrastructure, also included an EV and solar panels on the roof and thus having the whole energy system in focus. A similar multi dwelling house project is now being tested in Finland as well. Apart from that Fortum is partner in a smart grid project in Norra Djurgårdsstaden in Stockholm where they test the possibilities around the smart grid in which the EV will play its role (Fortum, 2011e; Käck, 2011) Apart from those activities Fortum is also looking into the options around fast charging and Käck mentions that this is an interesting option in the future (Fortum, 2011c; Käck, 2011). Käck also mentions that the inclusion of the EV in some sort of service package is being thought about by other utilities, but Fortum themselves are not interested in such a move at this stage (Käck, 2011).

Vattenfall

At the moment Vattenfall understands itself as a provider of charging infrastructure solutions (Weinmann, 2011). Instead of renting this infrastructure the current approach in Sweden is to sell the infrastructure. In that sense they are retailing the infrastructure. Vattenfall’s charging infrastructure concept includes pre-studies, planning, installation and maintenance (Vattenfall, 2011c). Apart from that they also offer a security guarantee. The offer is a very much individualized and costumed solution and focuses on providing slow charging solutions to company clients. What is also different from other utilities is that Vattenfall offers the solution in all of Sweden. Vattenfall also offers to upgrade the technology if there is a change in international standard. Moreover Vattenfall provides an upgrade service to convert motor engine heaters so that they also can work as charging stations.

Weinmann argues that in the long term Vattenfall should be focusing on smart charging (Weinmann, 2011). However those solutions do not exist currently as a business offer, but Vattenfall is working on developing the software and hardware together with their technology partners. According to Weinmann the solutions already work but are still a little bit too expensive. In a test family pilot project called “One Tonne Life” Vattenfall already uses a smart charging concept called “Home Wall Box” which allows the tracking of driving patterns, electricity consumption as well as charging and battery status (Vattenfall, 2011b). It seems that it will be commercially introduced some time in 2012, possibly in conjunction with the introduction of the Volvo V60 Plug in Hybrid (Elbilupphandling.se, 2011c; Vattenfall, 2011a). In the past Vattenfall has also looked into public charging infrastructure but in the end decided that there is no viable business model in the area of public charging (Weinmann, 2011).

What puts Vattenfall strictly apart from its competitors like E.ON or Fortum and which surprised many other utilities is the joint venture with Volvo (Käck, 2011; Östermark, 2011). The joint venture derived from a previous research and development cooperation between Vattenfall and Volvo where in the very beginning also Saab was included (Frieser, 2011; Konnberg, 2011; Petre, 2011). Saab had to step out because their past owner General Motors wanted to exclusively focus on the development of the Chevrolet Volt (Petre, 2011).

Within the current joint venture both Vattenfall and Volvo hold fifty percent of the ownership and together they are financing the production of Volvo’s Plug in Hybrid which is based on Volvo’s V60 model. Frieser states that they will be able to produce 25,000 of these cars in the first generation and that it will be brought to the market in 2012 (Frieser, 2011). Also for Vattenfall it does not play a role how much revenue exactly Volvo makes on each of

those cars. This is because Vattenfall gets a fixed amount of money similar to a license fee for each car sold (Frieser, 2011).

Weinmann also states that Vattenfall has investigated the selling of mobility as a function on top of their charging services. Hence this would include electric cars or other electric vehicles into the value proposition.

When it comes to the model that utilities own the car battery and lease it to the end customer Frieser does not believe that this will happen since he does not think that car manufacturers will give away that key part of their car (Frieser, 2011). He points out that the utility does not need to own the battery to get involved in a future demand side management scenario (Frieser, 2011).

E.ON

E.ON does not have a mature or standardised business model at this stage (Mollstedt, 2011). However they are experimenting with different offers within the framework of the pilot project called E-mobility Malmö where they address multi dwelling houses as a key segment (Åberg, 2011; Mollstedt, 2011). Within that segment E.ON has been selling and installing charging infrastructure for landlords or property owners (Mollstedt, 2011). One customer was for example the property company HSB Malmö (Åberg, 2011). They also offer maintenance services if needed. Recently E.ON has also started to work with test families which will test electric cars, electric scooters and electric bikes over a period of two to three months (Åberg, 2011). Those offers for test families are at this stage offered for free because E.ON is more interested in the evaluation part and also gaining knowledge what suppliers and what sort of cooperation is needed (Mollstedt, 2011). The only thing the families have to pay for is the electricity for the charging as such. Insurance and parking space is also included for the test families. What can be drawn from this is that E.ON sees some potential in offering mobility not only through electric cars as such but also through electric scooters as well as electric bikes (Mollstedt, 2011). Overall E.ON is also thinking about fleet solutions which does not mean that they will actually include that in their business model (Mollstedt, 2011).

Apart from the E-mobility Malmö project they also have a project around smart housing in Solbacken also in Malmö called "Thinking Energy" where electric vehicles and a smart charging station are included and a smart renewable energy system is being tested (Mollstedt, 2011; Sehlin, 2011). E.ON also hopes that the trend of electromobility offers the opportunity of cross selling on top of their existing business areas around gas, heat or other services (Mollstedt, 2011). Generally they hope that they find added services on top of simply selling electricity.

Björn Mollstedt can foresee a move from the classic utility value proposition towards functional sales that sell temperatures and km with different monthly flatrates or similar (Mollstedt, 2011). Mollstedt can also foresee a value proposition that includes the energy management around the car, house and the grid in a sort of smart value proposition. Hence this would be a focus on energy management and energy solutions in and around the building including the electric vehicle. It has to be seen what role slow charging, stationary batteries and fast charging can play in this. Mollstedt also states that a potential "freemium" service is the usage of maps to show information on charging infrastructure or similar (Mollstedt, 2011).

Öresundskraft

Öresundskraft at the moment does not have a standardised business model in terms of charging infrastructure or electromobility as such. They do install and retail charging infrastructure if required, but that is only on demand (Lundgren, 2011). Per Lundgren can currently not see how they can make a business case in the area (Lundgren, 2011). They also tried to order electric vehicles through the national electric vehicle procurement program called “Stockholm upphandling” but at this stage this seems to have failed (Lundgren, 2011). They are however much more active in terms of driving electric vehicle development through knowledge exchange and knowledge development as well as different marketing measures. They also work together with the regional politicians and institutions in order to establish favourable conditions for electric vehicles (Lundgren, 2011). Many experts also cited Öresundskraft engagement in terms of knowledge transfer by organising seminars about electric vehicle development as well as organising electric vehicle races (Käck, 2011).

Lunds Energi

Lunds Energi is currently only monitoring developments in the electromobility market and consider themselves as a “follower” that does not need to be at the cutting edge (Strandberg, 2011). At times, they retail and install charging infrastructure and also offer maintenance contracts but that is still in very low volumes. They also have set up a few public charging stations mostly for public relations or marketing reasons or as a service to the community (Strandberg, 2011). An example is the installation of three slow charging stations at the shopping mall “Nova Lund” which Lunds Energi is essentially sponsoring (Strandberg, 2011). Strandberg however can foresee that they could invest in fast charging in a view years time (Strandberg, 2011). He also thinks that they should be focussing on services around the charging infrastructure and that the business around simply selling more electricity is not interesting enough (Strandberg, 2011).

Even tough that is not a new business model for electromobility as such several experts pointed out that for utilities with energy production capacity just waiting and selling more electricity due to the future electrification of the transport sector is an option (Mollstedt, 2011; Östermark, 2011). It is also a common interest of utilities to support the electrification of the transport sector as this supports their core business (Käck, 2011; Weinmann, 2011).

3.1.2 Customer interface

3.1.2.1 Customer segments

Current customer segments can roughly be divided into business to business (B2B), business to customer (B2C) and business to public authorities / public organisations (B2P) segments.

Business to business (B2B)

Almost all offers provided by utilities in Sweden today centre on different business customers or other professional organisation like public authorities (Käck, 2011; Weinmann, 2011). Also many utilities are currently focussing on regionally close customers which in part is due to the utilities regional ownership structure as well as good regional connections (Östermark, 2011). Östermark can imagine that Vattenfall, E.ON or Fortum could offer their value propositions nationally at some stage (Östermark, 2011).

One segment within the B2B group is companies that would like to offer charging possibilities to their employees, either for the employee's private electric cars or company fringe cars in the form of electric cars. The other B2B segment is those companies that would like to offer charging and/or EVs to their customers. Examples are parking space providers, restaurants, multi dwelling house owners as well as other facility owners (Käck, 2011; Mollstedt, 2011; Östermark, 2011), supermarkets, hotels, shopping malls, large stores like IKEA etc. (Jakobsson, 2011; Östermark, 2011). It has been raised by many experts that currently the primary motivation for these companies to set up charging infrastructure can be found in public relations or marketing (Mollstedt, 2011). Most of those companies request simple slow charging solutions. In a way however once more of these companies offer such charging infrastructure they represent a semi public network of available charging stations. With regards to fast charging there seems to be potential for fast food chains along highways or traditional gas stations (Haglund, 2011; Jakobsson, 2011). Ulf Jakobsson points out that for owners of a gas station that also offers food or groceries 10 minutes fast charging is a "dream" because then the clients will buy something within those 10 minutes (Jakobsson, 2011). Another group of company customers in the case of Göteborg Energi is Move About which is a Nordic mobility company working with electric car pools (Jakobsson, 2011; Östermark, 2011).

Business to public organisation (B2P)

An additional important group that more close to the business customers is public organisations, be it public companies, municipalities, regional or national entities (Jakobsson, 2011). Many public authorities have procurement requirements that favour environmental friendly cars (Lindblad & Zinkernagel, 2011). In the national procurement program "Stockholm upphandling" it is mostly public authorities that buy electric cars and hence will also require some sort of charging infrastructure (Sunnerstedt, 2011).

Business to customer (B2C)

Within the private customer segment different customer groups are being considered. There are customers living in their own houses that will technically have their own charging opportunity. These are also usually target for some of the current family pilot trials among the utilities because charging and parking is not so much of an issue there. Mollstedt reckons that forty percent of private household have their own charging possibility in Sweden (Mollstedt, 2011). However there are also many urban customers that are living in multi dwelling houses with possibly no direct charging possibility of their own at this stage. The reason for that is that either they do not have a direct parking space available near their homes or because the parking space is owned by the property owner. Such customers would need to be targeted through their property owners who could then offer parking spots with charging infrastructure.

3.1.2.2 Channels

A first general distinction among the current business models is that some use partner channels to accomplish their offering and some rely on their own channels.

Weinmann argues that if the utility chooses just to sell more electricity in the area of electromobility no new or expanded sales channels are needed. However if utilities start to include hardware in their value propositions, like in the case of providing charging

infrastructure, the usual sales channel needs to be expanded. In a similar vein Mollstedt argues that the sales channel in the electromobility business is different because new knowledge is required on the part of the sales team (Mollstedt, 2011). Hence a question that in his opinion will come up is whether to integrate electromobility in the current sales function or to create a new one (Mollstedt, 2011).

As potential partner sales channel Mollstedt could foresee car dealerships as potential sales channels if there was some sort of cooperation (Mollstedt, 2011). Also Käck could imagine a partnership with car manufacturers when it comes to sales channels, possibly at the car dealership point (Käck, 2011). The same argument is brought forward by Weinmann and Frieser who as well could see combined offers with car manufacturers at the point of the car sale that could include infrastructure services as well as electricity (Frieser, 2011; Weinmann, 2011).

Göteborg Energi and the mobility company Move About are already using each others sales channels or partner channels to some extent (Östermark, 2011). Move About recently came to an agreement with Öresundskraft which will mean that they offer Move About's mobility solutions to their customers (Lundgren, 2011).

Käck also stresses that at this stage one has to be open minded about the sales channels and that there is first a need to find the clients who are ready for it and willing to be early adopters (Käck, 2011).

The current communication channels for offering the value proposition still seem to be in a developmental stage as not many utilities e.g. actively offer their charging solutions on their website.

3.1.2.3 Customer relationships

At the early stage of most of the value propositions an emergency phone number for customers is provided by many utilities, e.g. by Göteborg Energi (Östermark, 2011). As more and more customers engage in electromobility Mollstedt believes that there is a need to build up new call centres for customer support or at least a need to train existing call centre staff (Mollstedt, 2011). Fortum on the other hand already has a call centre which their charging infrastructure clients can call around the clock during the whole week (Käck, 2011).

In general one can make the distinction between automated or personal customer relationships. What is also possible is communication via Email, SMS or other form of feedback systems (Jakobsson, 2011).

3.1.3 Infrastructure management

3.1.3.1 Key resources

The electric vehicle is a key resource in business model development depending on what business model utilities intend to offer. At this stage the car is not directly included in an offer but during pilot projects utilities are using electric vehicles to experiment with different business models.

The charging stations as such represent a key resource for any kind of value proposition in the charging business model. At the beginning of the business model development utilities

usually built their own slow charging infrastructure to get to know the technology (Mollstedt, 2011; Östermark, 2011). Some utilities have abandoned this now and as soon as they found suitable suppliers for it changed to those products (Käck, 2011; Östermark, 2011). Also Vattenfall will not be building charging infrastructure in the future (Frieser, 2011). While E.ON for the most part has the same approach to this, they have a slightly different opinion about producing equipment since they are also using their own co-developed charging station if appropriate (Mollstedt, 2011). E.ON can offer wall boxes for garages as well as charging stations (Mollstedt, 2011). What has to be kept in mind here is that almost all utilities limit themselves to slow charging stations at this stage. Only few utilities, e.g. Jämtkraft, have set up a fast charging station and most of them in a context of demonstration projects.

Another possibly important resource is an IT system which could allow charging time control, booking systems, monitoring, billing etc. Solutions here can be anything from relatively simple to rather complex smart grid solutions. Östermark for instance does not think the market is ready for this kind of communication technology and software solutions (Östermark, 2011). This is the reason why Göteborg Energi is not investing in this at this moment. Fortum on the other hand is already using such IT capabilities and are offering those add on services (Käck, 2011). Fortum is relying on an outside IT provider to do this (Käck, 2011). Another IT aspect is the development of the capabilities that are needed for smart grid applications. Even if it is not yet part of any form of business model the major utilities are looking closely at this issue. Fortum, Vattenfall and E.ON all have pilot projects that explore smart housing concepts which includes in all cases electric cars and sometimes also other electric vehicles like electric scooters or electric bikes (Mollstedt, 2011; Östermark, 2011).

Capabilities that relate to those key resources are the ability for maintenance, installation etc. which some utilities choose to keep in house whereas others use partners for it (Mollstedt, 2011; Östermark, 2011).

3.1.3.2 Key activities

At this early stage in the market one of the most important activities is finding the customers that are willing to pay for value propositions in the area of electromobility. Hence primary activities like marketing, public relations and sales are considered to be important parts of the business model (Käck, 2011).

Activities that need to be performed during the charging infrastructure solution are of course also activities like installing and maintaining the charging infrastructure. One more critical activity that allows utilities to put their value propositions forward is the actual measuring, metering and tracing of how much electricity is used and by whom (Östermark, 2011). This allows accurate invoicing and individual user profiles. It is important to have all the information necessary to send an invoice to the right player. In order to do this some sort of verification is necessary before the charging takes place. This is currently being done through a physical key that only the person in question has access too, or through relying on RFID cards (Mollstedt, 2011; Östermark, 2011).

3.1.3.3 Key partnerships

A general distinction that has to be made in this section is the difference between suppliers for which ordinary business agreements can be used and cooperation for research and

learning purposes (Östermark, 2011). It has to be kept in mind that many areas today are still at a pre-competitive state which explains why in some areas there is even cooperation between utilities to develop the technology, especially in the smart charging or fast charging area (Weinmann, 2011). Weinmann characterises this as doing “the first steps together until it starts to fly” (Weinmann, 2011). In areas like slow charging already today one could speak of a competitive market, even if the market is still relatively small in terms of volume.

Having usually build and experimented with slow charging stations themselves for a while, utilities now typically feel confident about their knowledge in terms of slow charging stations. For that reason most of them increasingly rely on suppliers that are offering their products on the market and for most utilities this is likely to remain the case (Frieser, 2011; Käck, 2011; Östermark, 2011). These suppliers can include e.g. ABB, Siemens, Garo, TurningPoint (distributor of the French company DBT’s products), Park & Charge and Charge Storm (Jakobsson, 2011; Käck, 2011; Mollstedt, 2011; Östermark, 2011). In terms of slow charging Garo seems to be one of the early movers and has achieved the biggest market share in Sweden with at least 50 percent market share (Jakobsson, 2011; Mollstedt, 2011; Östermark, 2011). E.ON however apart from using the stations on the market is additionally also using their own charging station which they have co-developed with a charging infrastructure manufacturer (Mollstedt, 2011).

During the early stages of business model development E.ON relied primarily on local electricians for carrying out some parts of the installation of charging stations. Mollstedt however foresees the use of a business partner for such services in the future that allows a certain scalability of the business model (Mollstedt, 2011). Fortum already uses outside business partners for installation and maintenance of charging infrastructure and use in house installation capacity only to a limited extent (Käck, 2011). Göteborg Energi and Lunds Energi on the other hand still rely on in house capacity for those aspects (Östermark, 2011; Strandberg, 2011).

Depending on the smartness of the slow charging stations also IT partners become increasingly important which can help customers to e.g. trace the battery or charging status of their car. Fortum is using an IT partner for their “charge and drive” solution (Käck, 2011). Other utilities may choose to develop those capabilities in house.

In terms of potential smart grid applications, but also fast charging and battery storage, companies like ABB and Siemens are potential partners for utilities (Käck, 2011; Östermark, 2011; Weinmann, 2011). Göteborg Energi for instance has a pilot project with ABB in terms of battery storage as well as fast charging (ABB, 2011; Östermark, 2011). Also Vattenfall sees ABB and Siemens as hardware providers and hence partners for their future smart charging services (Frieser, 2011). Vattenfall also has pilot projects with them.

Another possibly very important key partnership is the one between car manufacturers and utilities (Mollstedt, 2011). Both those players could benefit from joint value propositions. Together Mollstedt reckons that they could provide a joint energy management service proposition connected to the car purchase (Mollstedt, 2011). Vattenfall has been going one step further here and actually has co-produced a hybrid electric vehicle together with Volvo. This is something completely different from most utilities (Käck, 2011). Weinmann can however foresee partnerships with different car manufacturer so that during a car purchase you will also be offered charging infrastructure and electricity in a joint offer (Weinmann, 2011). In a similar vain Weinmann can foresee partnerships with car leasing companies

(Weinmann, 2011). As such those partnerships with car manufactures are both than for knowledge as well as sales channel reasons.

Another interesting cooperation that exists in the Swedish market is the cooperation between the mobility company Move About and Gothenburg Energi (Östermark, 2011). They offer each others' value propositions to their respective customers. Similarly Öresundskraft will offer Move About solutions to its clients from autumn 2011 onwards (Lundgren, 2011).

Apart from car manufacturers also battery producers can be a potentially interesting partner with regards to future smart grid applications and research in that area (Mollstedt, 2011). Also partnerships with renewable energy equipment providers for micro generation applications can be interesting for utilities (Mollstedt, 2011).

3.1.4 Finances

3.1.4.1 Revenue stream

In the context of charging infrastructure solutions utilities currently use both one time payments as well as recurring/ongoing payments. For their charging infrastructure service Göteborg Energi gets a fixed monthly payment for the availability of the charging infrastructure and for the electricity they rely on a variable monthly fee. Fortum is offering its service in a similar way where they get a fixed monthly fee for their service. But Käck also stresses that revenue mechanisms can vary a bit because the business model is adapted to each customer requests and for what features they are willing to pay (Käck, 2011). In the case of Fortum the variable monthly for the electricity is not part of the package (Käck, 2011). Most other utilities simply offer the infrastructure installation service in a one time sale. But should there be a need for after sales maintenance services Mollstedt sees the possibility of a subscription or per hour charge for the actual maintenance service used (Mollstedt, 2011).

In general Mollstedt sees that the revenue for charging as such can be done according to kWh used (with prices similar to the spot market price), included in the price of the parking spot or sold as km per month which would connect the charging infrastructure model to the mobility solutions business model (Mollstedt, 2011). Mollstedt can also foresee flatrates similar to mobile phone subscriptions today (Mollstedt, 2011). However in his point of view these would need to have certain boundaries. Subscription models can also be an option in the electromobility area e.g. for the access to charging infrastructure like public charging networks. (Mollstedt, 2011).

Dynamic pricing based on hourly or other real time tariffs can be an option once smart charging will be possible and demanded (Mollstedt, 2011).

In the case of Vattenfall one pricing mechanisms that is used is one similar to licensing as they get a fee for each Volvo V60 plug in hybrid that is being sold (Frieser, 2011).

3.1.4.2 Cost structure

In general if a cost will be a fixed cost or a variable cost depends on the business model and if the company retains ownership of some of the resources for one or the other reason (Jakobsson, 2011)

Depending on the inclusion of the electric car in the value proposition the car as such with the necessary battery is a major cost that has to be overcome by any business model. One expert estimated the average cost of an EV currently at an average of 300,000 SEK (Jakobsson, 2011).

Business models that would like to include fast charging are still very challenging since fast charging stations remain an expensive undertaking. Experts estimated the average costs are between about 350,000 SEK and 500,000 SEK depending on the model (Jakobsson, 2011; Mollstedt, 2011).

The slow charging stations require lower investments. E.ON's wallbox charging station for garages costs less than 10,000 SEK to buy and install (Mollstedt, 2011). E.ON's free standing charging station costs about 50,000 SEK including installation (Mollstedt, 2011). Mollstedt also pointed out that at times due to the space between individual parking spots the cable could also be laid close to the surface protected by a steel casing hence reducing installation costs (Mollstedt, 2011). If done this way he estimates the costs for buying and installing one outside charging station at 20,000 SEK (Mollstedt, 2011). The simple and popular slow charging stations from Garo have been rated by the interviewed experts to cost between 5,000 and 7,000 SEK in purchase price (Löfblad, 2011; Strandberg, 2011). Depending on the exact business model design Mollstedt reckons that the cost for the charging infrastructure can be distributed over a certain time period or subsidized by the car sale (Mollstedt, 2011).

What is quite costly is also the actual installation itself which varies depending whether the charging will be done inside or outside of the building (Käck, 2011). These are the costs for the technical equipment and salaries which are needed for digging, putting the cable into the ground, closing the hole again, putting the asphalt back etc. (Käck, 2011; Östermark, 2011). Also if technically necessary attaching the charging stations to the power grid represents a one time fixed connection cost that has to be taken into account. In the past each and every charging station had to pay such a fee, but the legislation in the future will only require one charging connection fee to be paid for a group of charging stations (Wingfors, 2011). The distance from the charging station(s) to the power grid connection point will also represent a variable cost that rises depending on how many meters one has to dig (Käck, 2011; Östermark, 2011).

Due to a combination of these cost factors however the offer for each customer is somewhat different (Östermark, 2011). If the customer only wants to install one or two charging stations, a new power connection to the grid may not even be necessary depending on the electricity system in the building (Östermark, 2011).

Although at this stage it is not huge, there is the cost of the actual charging with electricity which is included in the costs depending on the business model used (Östermark, 2011). Mollstedt argues that the price charged for the electricity can not be much higher than the spot market price (Mollstedt, 2011). Depending on the exact business model there is the potential cost of parking space (reserved personal parking space) that would need to be included (Mollstedt, 2011). This could be a monthly rent being paid to a private company or e.g. the municipality (Jakobsson, 2011). Depending on the smartness of the business model it is likely that there are costs for the development of an IT system (Jakobsson, 2011). Apart from the above mentioned cost factors it was also rightly pointed out that the employees themselves are always a big cost (Jakobsson, 2011).

4 Emerging business model patterns

During the investigation of the Swedish utilities and their activities in the business development at this early market stage it became apparent that there are many smaller utilities that do not see much of a business model around electromobility at all. Also Oliver Weinmann from Vattenfall, as a representative of a larger utility, was surprised how difficult it is to get a positive business case. He still does not think that Vattenfall will find a profitable business model very soon, which in his opinion is caused by the very early market stage (Weinmann, 2011). This exemplifies the enormous task that is still ahead for many utilities and that no easy answers can be provided. However during the interviews there were a few emerging business models that experts considered worth investigating. The first one is the one that is already being used by some utilities which is in the area of charging infrastructure solutions. The second one which is relatively close to being an option is in the area of mobility solutions. The third model that was discussed is the combination of charging and mobility in a smart housing concept which however is still at pilot level stage. The fourth and most complex one is the one of an integrator that potentially has an encompassing business model around all the aforementioned business models. The integrator is a value proposition that is still totally based in the future. Apart from having charging and mobility solutions, the integrator would also be involved in demand side energy management and helping to balance the grid.

In the following section the charging infrastructure solution business model and the mobility solutions business model will be discussed as they are the most immediate options for utilities. The last two models in the area of smart housing and complete integrator are still a somewhat vague option and depend very much on future developments in the area of the smart grid. The two business models will be investigated from the perspective of utilities with regard to their advantages & disadvantages but also with regard to the strengths, weaknesses, opportunities and threats for utilities. While investigating those aspects the author will again primarily rely on the expert interviews, but also include insights from other studies and reports to triangulate some of the arguments made by the interviewed experts. Also the author will use information about potential competitors within Sweden as well as findings that the author came by through statements made by experts and desktop study.

4.1 Charging infrastructure model

The charging infrastructure is the area where most utilities in Sweden have seen themselves during the previous analysis. Many utilities perceive this area as their natural core strength. As Käck points out focussing on the charging side of the value chain is what a grid company is used to – maintaining and operating the grid and so maintaining and operating charging points did not seem too far away from the existing business (Käck, 2011). In one way or the other the charging value proposition potentially consisted of elementary offerings like building the charging stations, upgrading electric engine heaters, retailing the charging stations, installing the infrastructure, operating the infrastructure, maintaining the infrastructure and also to offer verification, measuring and billing services. In essence the value chain includes all steps that are necessary until the electricity is received at the electric vehicle (Ernst & Young, 2011). For utilities that have a grid company the value chain should also be seen as a whole including the generation, transmission and distribution of the

electricity as this also indicates their interest in having a stable and balanced grid when it comes to charging.

4.1.1 Offer

4.1.1.1 Value proposition

When it comes to the value bundle as such the principle question that utilities have asked themselves is if the charging infrastructure is to be included in a service package type value proposition or if it is seen as a one time transaction with only potentially a maintenance contract included.

Bundling the different offering elements into a complete service and then leasing it as a package has the advantage that the utility has complete say in what products will be chosen and who is performing the different activities, be it in-house activities or through a partner (Östermark, 2011). This allows the utility to capture more of the value in the value chain and position itself as a solutions provider. One advantage that was explicitly mentioned is that this also allows the bundling of e.g. renewable energy and while doing so relying on the company's own electricity retailing organisation (Östermark, 2011). Also it allows the utility to choose who will be the maintenance and service provider for the charging stations. Moreover being able to package a larger variety of services will be helpful to customise offers towards customer needs (Ernst & Young, 2011). Both Östermark and Jakobsson pointed out that customers are becoming more open towards buying a function or service especially if it is a new product that they have no experience with (Jakobsson, 2011; Östermark, 2011). Having such a functional approach of course also brings more risk and responsibility with it (Käck, 2011). A threat for bundling the value proposition like that is that some customers are just not interested in models where they will not be the owner of the charging stations.

Other utilities have chosen only to offer selected elements of the available elementary offerings. Among such were retailing and installing the infrastructure for their customers while perhaps offering additional services like maintenance as a service contract if requested. This is also the overall approach that many local utilities in Sweden are using with selected customers that are interested at this early market stage. The reason for just setting up the infrastructure and not bundling a service is also due to the fact that some clients just want to own the charging infrastructure themselves (Käck, 2011; Mollstedt, 2011). Also E.ON made the experience that e.g. landlords have not even always wanted a maintenance service connected to the charging station and first wanted to see for themselves how much maintenance actually is required (Mollstedt, 2011).

This approach potentially involves less risk for the utility at the early market stage but it also means that the market entry barriers are low for other actors (Ernst & Young, 2011, p. 4). Utilities of course have the advantage that they often already have a service and maintenance team and are used to setting up infrastructure like street lights which in many ways are not that different from simple charging stations (Strandberg, 2011). Also utilities often have a strong brand and close ties to their regional community. Still, when it comes to simple one directional charging solutions, several experts stated that there is the threat that car manufacturers together with charging hardware manufacturers will start to offer such relatively simple charging value bundles themselves as their electric car sales increase over time (Frieser, 2011; Weinmann, 2011). One of the reasons for that is that electric vehicles supposedly need less maintenance in the after sales segment which is why car manufacturers will try to engage into new after sales business areas (Käck, 2011; Konnberg, 2011). There is

also the threat for utilities that charging hardware manufacturers will directly approach customers, especially in the company customer segment in order to install and maintain their charging infrastructure (Löfblad, 2011). For some companies with the maintenance staff at hand it can also be an option to buy the hardware and install and maintain it themselves (Östermark, 2011). Hence there are multiple ways that are already mentioned how utilities could lose out on the value chain, at least when looking at simple charging solutions. This could reduce the utility's role to primarily selling electricity.

Already today there are competitors in Sweden that can offer similar charging services similar to the value proposition that some utilities provide. Such companies can comparable to utilities work as an intermediary between hardware manufacturers and the clients. One of them is the company "Park and Charge" which offers the installation of charging infrastructure, retailing of the charging infrastructure, connection to the grid, the charging infrastructure itself, access solutions to the charging station as well as payment systems, metering and consumption statistics and other support and service offers (Park and Charge, 2011). While such companies can be interesting as partners for smaller utilities that do not have the resources to establish such a service themselves, they can be a threat to utilities that have similar services. Such companies also have the advantage that they act in the whole of Sweden and are not limited to a regional area which most utilities in Sweden are.

When it comes to the different charging stations that are chosen on the Swedish market there is a clear demand for simple, one directional and cheap charging infrastructure. Especially regional or local utilities are not willing to invest in charging infrastructure that will lead to losses in their business (Östermark, 2011). Östermark points out that customers are not yet willing to bear the costs for more advanced charging solutions, be it fast charging or smart charging. When it comes to smart charging however, there was considerable disagreement among the experts. Due to competitors in the mentioned "unintelligent" charging station segment, Weinmann clearly sees smart charging as one of the primary opportunities for larger utilities like Vattenfall to differentiate themselves. Looking at the up-coming challenges around intermittent sources and the possible use of batteries as a steering element in the energy system, Weinmann sees opportunities for added value provided by utilities (Weinmann, 2011). He claims that the smart charging solutions are ready but that they are still somewhat too expensive (Weinmann, 2011). Östermark on the other hand argues that the market at this stage is simply not asking nor willing to pay for such solutions (Östermark, 2011). At this stage he thinks those type of smart charging products are still "fantasy products" (Östermark, 2011). Löfblad from Siemens also agrees that currently the Swedish market is only asking for simple and cheap solutions, but that in five years time there may be higher demand for smarter and safer charging infrastructure (Löfblad, 2011). She states that there will be regulation introduced in Sweden that has higher safety requirements once there are more electric vehicles on the street (Löfblad, 2011). This she thinks will eventually favour smarter and more complex charging stations (Löfblad, 2011).

Hence overall there is a considerable debate about the question if the initial charging infrastructure needs to have smart grid capability or not (Ernst & Young, 2011, p. 5). In Sweden it seems that the current market thinks that this is not the case, which also has to do with the relatively high uncertainty around smart charging standards and the fact that many electric vehicles that are sold today do not have bidirectional smart charging capabilities (Ernst & Young, 2011; Mollstedt, 2011). As long as the standards for smart charging are not agreed upon customers have even more reason to not install such complex and more expensive charging infrastructure. The result of this large uncertainty around the smart

charging can be that in the end there will be only regional standards which may slow down the charging industry as a whole (Ernst & Young, 2011, p. 4). Some services connected to the smart grid however necessitate such smart charging infrastructure. For larger utilities at some stage smart grid connectivity is clearly a prerequisite if they want to integrate the electromobility business into a larger model around e.g. smart housing (Mollstedt, 2011). Käck reckons that as a grid owner they will always be part of the smart grid in one way or the other and hence will eventually have an interest in steering energy usage (Käck, 2011). As such those utilities that can think more long term may have an incentive to already install charging infrastructure that at least has the prerequisites for smart grid applications. If utilities decide to do that it has been stressed in the literature that there will be a need for better data management systems in the case of smart grid management of the energy (Ernst & Young, 2011)

But in the smart solutions business area where some of the larger utilities can see themselves adding value in the future, there is already competition on the Swedish market in the form of a start up called “Charge Storm” (Charge Storm, 2011). The company tries to place themselves between the regional grid owner and the facility owner. Charge Storm offers smart control units for charging infrastructure and local grid management capable of vehicle and grid communication. This also includes the verification and different payment solutions as well as metering and consumption data access that is all integrated into web applications.

Within the smart grid debate there were also different opinions about the usage of stationary batteries in a smart charging scenario. For example stationary batteries could optimise the charging of electric vehicle fleets (Mollstedt, 2011). For that reason there is the opinion that utilities could be interested in second hand batteries. According to Östermark it is difficult to say at this stage if there will be a business model around the second hand use of car batteries. He thinks that this is determined very much by the price or value the batteries will have after being used in a car. As a utility he stresses one needs reliability and authorised, safe components and he is not yet sure that second hand car batteries that were originally made for car usage can provide that (Östermark, 2011). A problem Östermark stresses is also the low level of standardisation in car batteries at this stage. When it comes to the model where utilities own the car battery and lease it to the end customer Frieser does not believe that this will happen since he does not think that car manufacturers will give away that key part of their car (Frieser, 2011). He points out that the utility does not need to own the battery to get involved in a future demand side management scenario (Frieser, 2011).

As a general opportunity Östermark pointed out that linking the electricity from renewable energy sources directly with the charging service could spur sales in both business areas of a utility (Östermark, 2011). This essentially will also boost sales and investment in renewable energy in a sort of self reinforcing cross bundling sale (Östermark, 2011). Also it deals with concerns about the environmental credentials of electric vehicles. Through linking renewable energy with the service provided, it will also be possible to target environmental conscious consumers (Ernst & Young, 2011). Others have argued that in Sweden it is difficult to make that case as there already is a high degree of non fossil fuel energy sources in the grid (Petre, 2011).

Many experts pointed out that for utilities that generate electricity it can also be an option to simply focus on selling more electricity. However, most experts argue that this is actually not that large of an opportunity for utilities. Weinmann even argues that this would be a “boring” business model and that even if the electric car has some success the added volume through electricity sales caused by electric cars is still not that significant (Weinmann, 2011).

When it comes to fast charging stations many experts expressed a principal interest but could not see how it will currently be possible to earn money with it. Many also see a threat that plug in hybrid electric vehicles, and range extended electric vehicles will lower the necessity of such fast charging stations. However there are scenarios that actors think about such as fast charging along highways (positioned at fast food restaurants or gas stations) or within public or taxi transportation services. Also there is the possibility that consumers will eventually want to have both a fast charging and a slow charging option at home or at work. Still, due to the large investment needed and uncertainty around fast charging standards business model development in the area of fast charging could be slowed down (Ernst & Young, 2011, p. 4; Jakobsson, 2011).

To include public charging infrastructure in the value proposition has not been seriously considered by many experts. Some utilities have done this because it was advantageous in terms of public relations or marketing but limited it to a low amount. Being able to offer public charging infrastructure arguably has the advantage that it can lower range anxiety. But most experts believe that it is not possible to recoup investments in that area (Weinmann, 2011). The public charging infrastructure that has been set up by utilities at the moment is hardly being used by customers (Strandberg, 2011). One of the reasons for that is the very early market stage and the lack of electric vehicles in Sweden. Also, once customers realise that for most journeys charging at home or at work is sufficient they will not be interested to pay for public charging stations. As a result experts pointed out that this will only be an opportunity for utilities if there were additional public incentives (Weinmann, 2011). There are however utilities experimenting with public charging infrastructure elsewhere. RWE one of the major utilities in Germany is offering access to their public charging infrastructure as an on top service to their home owner or company value propositions in terms of charging (RWE, 2011). Their customers can access a wide range of charging stations that are placed all over Germany with a RFID card. In essence those customers will then share some of the cost for the public charging infrastructure. Another example is a cooperation among the regional utilities of Aachen, Duisburg and Osnabrück in Germany which is called “ladenet” (Ladenetz.de, 2011). This is a public charging infrastructure network that allows customers from the participating regional utilities to charge their electric vehicles within the total area of the participating utilities. An IT system then organises the charging of roaming fees so that one is still charged on the normal energy bill at home. Since the beginning of this cooperation also other utilities have joined into the network as partners, among them Munich, Trier and many others. Also Björn Mollstedt could foresee that there may be multiple cost sharing mechanisms eventually to finance such public charging infrastructure (Mollstedt, 2011). One way to recoup the cost could be to integrate it into the parking cost as such (Lewald, 2011). Also linking the B2B and B2C charging network with public charging networks could create positive network effects similar to the mobile phone industry. The more people join the network the more attractive it will be.

For all current charging stations there is the threat that inductive charging may displace some of the current charging infrastructure. Right now however this is still in the experimental stage.

Many of the business models in the charging infrastructure are also still indirectly depending on subsidies from the government which some of the utilities were able to receive. Göteborg Energi's as well as Fortum's charging stations were indirectly supported by a fund from the Swedish Energy Agency (Östermark, 2011). Göteborg Energi in turn used all of that money to offer cheaper charging solutions to their customers (Östermark, 2011). Also the few fast

charging stations that exist in Sweden today, have partly been financed by government funding.

4.1.2 Customer interface

4.1.2.1 Customer segments

Naturally utilities are trying to leverage their existing customer base among private and business customer that they already have and this is an advantage and strength that utilities can use compared to potential competitors which do not have such a customer base (Jakobsson, 2011; Mollstedt, 2011). Especially with business customers and public authorities utilities usually have long term relationships and utilities will have the advantage to have a certain amount of trust there. Due to the liberalisation of the energy market utilities have to be much more competitive when it comes to the private customer than they were used to in the past (Frieser, 2011). Finding early adopters among the existing customer base can be one of the first moves and provides an opportunity to test different business models.

Among the customer segments the largest business opportunity is arguably among the business customers and public authorities. According to one expert electric vehicles currently represent a huge trend for companies (Jakobsson, 2011). Both, companies offering charging solutions to their employees as well as companies that want to offer solutions to their customers will have a higher demand for charging services such as maintenance and payment solutions (Ernst & Young, 2011, p. 14). Particularly companies that want to provide charging solutions to their customers like malls or restaurants will not want to be concerned with maintenance of the charging stations. Many experts pointed out that many companies are interested in the marketing and publicity aspect of setting up charging infrastructure for electric vehicles (Mollstedt, 2011; Östermark, 2011). Leveraging this early interest (from e.g. shopping malls) even though it may only be motivated by marketing interests can potentially lead to follow up contracts at a later market stage (Strandberg, 2011). If the sales figures for electric vehicles increase, there will also eventually be larger service contracts with such customers (Ernst & Young, 2011).

When it comes to company fringe cars in Sweden it has been stated by many experts that companies buying company fringe cars are usually the early adopters of new car models and not the private market (Johansson, 2011). As such this is the customer group that will be more willing to buy electric vehicles and hence will demand charging infrastructure. Electric vehicles as company fringe cars are also beneficial from the employee point of view since they provide the possibility of rather large tax reductions of about 40 percent or maximum 16,000 SEK compared to the taxation on other company fringe cars (Johansson, 2011).

Public authorities and other public organisations are also a natural customer segment for utilities and will likely remain so. Due to environmental procurement requirements those organisations will continue to demand a certain amount of charging stations. Within the national public procurement initiative, the “Stockholm upphandling”, it is primarily the group of public organisations that has placed orders for electric vehicles (Elbilsupphandling.se, 2011a; Sunnerstedt, 2011). Especially utilities with close ties to their respective municipalities will have opportunities to offer charging infrastructure services.

Utilities in Sweden are however still figuring out what extra services private customers with access to a plug for charging could be willing to pay for. An example are on top devices like special wall boxes in their houses which technically are not necessarily required in Sweden as

the charging of an average electric vehicle can be done reasonably over night without further or very little technical adjustments. Hence there is a threat or at least “non opportunity” that utilities loose out on this customer segment. Many experts argued that they can not see why private customers would want to pay for anything on top (Jakobsson, 2011; Strandberg, 2011). One argument here is that utilities could reason for higher safety if it was a separated outlet in a somewhat separated local grid (Östermark, 2011). Also making sure that the charging solution is appropriately dimensioned for winter usage is a possible advantage put forward (Östermark, 2011). Others argue that it could be a smart wall box device that detects the sufficient availability of renewable energy in the grid and through that essentially delays the charging to a time during night but at the same time boosts renewable energy sales (Mollstedt, 2011). Such a smart wall box could then also offer smart information about the car which can be sent to the mobile phone or other devices (Mollstedt, 2011). Like this smart wall boxes may provide even private customers with extra value for which they may be willing to pay (Mollstedt, 2011).

In theory both customer groups can potentially also be targeted at the same time which perhaps allows the creation of a sort of multi sided platform. Arguably charging spots used by companies could also be used by private customers at certain times which is perhaps an opportunity for a particular business model design. This makes sense from an efficiency point of view since companies do not need this equipment at all times (Jakobsson, 2011). Some of the resources and systems that are needed for such a customer focus will also be very similar. This is of course a very obvious proposal when it comes to company customers but it could also include charging stations that are currently not used by employees.

According to the experts interviewed the different customer segments that will be targeted are depending a lot on the public incentives in the given country which essentially can be an opportunity or a threat (Frieser, 2011; Käck, 2011). This also means that the business models of utilities active in multiple countries will also vary a lot. Business models in countries like Norway⁴, Denmark and the Netherlands will primarily centre on private customers as the prices for electric vehicles are much lower there due to public incentives such as large tax cuts of value added tax. In countries with moderate taxes on cars like Germany or Sweden there will be a much stronger focus on company customers (Frieser, 2011; Weinmann, 2011). Weinmann states that for Sweden the focus on companies as the primary customer segment will remain so for the next 6 or 7 years if there are no changes in terms of policy (Weinmann, 2011)

In Sweden the discussion around the environmental car subsidy (“Supermiljöbilspremiem”) has already led to a heated debate. The proposed incentive is as many interviewed experts argue to low to trigger private customers to buy electric vehicles (Lewald, 2011; Lundgren, 2011). Also the proposal currently excludes companies or public organisations that in the case of Sweden would potentially be early adopters of electric vehicles (Lundgren, 2011). Thus the incentive is not reinforcing the current mechanisms of companies as early adopters of new car models.

Also the other policy instrument that could be used to spur companies and professional organisation to buy electric vehicles has its critics (Jakobsson, 2011). The national procurement initiative “Stockholm upphandling” is only supporting 1,000 electric vehicles

⁴ In Norway there are already over 4,000 EVs on the streets (Käck, 2011).

with each a maximum amount of 50,000 SEK (Elbilsupphandling.se, 2011b). Also the variety of the electric vehicles in the program is limited due to the special public procurement demands. Hence it is not yet clear if this will provide utilities with opportunities in the charging infrastructure business model for catering those clients.

4.1.2.2 Channels

Most utilities already have established channels like sales channels. Some utilities see it as one of their key strengths on which they can also rely on in the case of charging infrastructure (Strandberg, 2011). Some however are not that confident and see that electromobility will have the disadvantage that there will be a need to train their staff when it comes to charging infrastructure (Mollstedt, 2011). Hence preparing once own sales channel will be a key task. Weinmann stresses that the overall question will be if the sales volume in the business area will be large enough to justify the investment and the risk of a new or expanded sales unit (Weinmann, 2011).

Securing partner channels apart from their own channels are an important opportunity through which utilities potentially can offer their charging services and increase their outreach substantially. One of the most promising of such channels is perhaps a partner channel with a car manufacturer. Securing such partner channels can be a competitive advantage compared to other utilities or new emerging third parties. It would also pre-empt partnerships that could be made by other third party competitors. Securing such partner channels with car manufacturers early could be a substantial advantage of the business model as a whole. Almost all experts can foresee such a partner channel at the car dealership level (Frieser, 2011; Mollstedt, 2011). Also Frieser thinks that Vattenfall and Volvo will offer a package in which Volvo will offer Vattenfall's infrastructure solutions to their clients and Vattenfall vice versa will offer the V60 plug in hybrid to their charging infrastructure clients (Frieser, 2011). Other examples for such relationships already exist for the case of the Nissan Leaf and Renault in the United Kingdom where both car manufacturers have a preferential partnership with British Gas which allows British Gas to setup their charging infrastructure in peoples homes (The green car website, 2011). The United Kingdom of course has different prerequisites for charging electric vehicles, but also in Sweden this approach could have potential. This could then also be the possibility to offer other value propositions to such customers like solar panels or other services around a smart house value proposition (The green car website, 2011). An immediate opportunity could be to investigate partnerships with car manufacturers that were chosen in the national procurement program ("Stockholm upphandling") (Elbilsupphandling.se, 2011a). Another important partner sales channel is that of large parking space providers like Europark who in turn will offer such solutions to their customers (Fortum, 2011b). Overall finding partner sales channels represent a way of getting out to the market much faster (Jakobsson, 2011).

4.1.2.3 Customer relationship

A key strength in terms of customer relationship is the utility's brand. Especially many local and regional utilities have established personal relationships with the community and can leverage on those trust relationships (Strandberg, 2011). Utilities usually have dedicated sales personal that personally are responsible for a set of key corporate clients (Nordgren & Svensson, 2011).

On the other hand that brand can also be a risk. Large utilities can not risk to ruin their brand and exiting customer relationships and hence have to be more careful than e.g. start

ups or entrepreneurial companies when it comes to business model development (Jakobsson, 2011).

4.1.3 Infrastructure management

4.1.3.1 Key resources

One of the key resources to have access to is of course the charging station itself, be it slow charging stations, smart charging stations or fast charging stations. A primary debate among the experts interviewed is the question if the charging stations themselves represent a resource that can be used for competitive advantage. This leads to the question if utilities then themselves should be involved in producing or co-producing such hardware. However most experts do not consider building hardware as an opportunity or their core strength (Frieser, 2011). Also Östermark states that they will not produce electrical equipment and stresses that they “[...] are an energy company building systems out of standard components.” (Östermark, 2011). A recent report by Ernst & Young also argues that manufacturing slow charging stations and similar hardware will very fast become a commodity business with high volumes and low costs (Ernst & Young, 2011, p. 12). Utilities like E.ON that are co-producing their own charging infrastructure will face tough competition here, but may have the advantage of being able to bundle the charging stations with their core offerings (Mollstedt, 2011).

Due to the increasing smartness of charging stations and the possibilities this has for add on services like payment systems Emilia Käck from Fortum thinks that IT resources and related capabilities will be an important asset to have (Käck, 2011). Hence developing these IT capabilities and key resources or finding partners in this area may become critical relatively soon. The opportunity for add on services by relying on IT resources and capabilities increases the more customer data is available (Ernst & Young, 2011). However not all of these possibilities are yet fully tested.

4.1.3.2 Key activities

Among the key activities that were mentioned as business model design options were the maintaining, installing of equipment as well as metering, invoicing or other ways of managing data and energy (Östermark, 2011). These are activities where utilities in parts already have strengths and can leverage on them as an opportunity compared to competitors. However competitors could be more adapt on presenting that data in an appealing way through web interfaces or similar (Charge Storm, 2011).

4.1.3.3 Key partners

Partnerships in the area of charging solutions are an important aspect of the charging business model as they potentially allow the access to strategically important resources, capabilities, sales channels etc. On the other hand finding partners and suppliers can also allow the utility to focus on its core strengths. At this early stage of industry development where value chains are still very much in flux, it is at times hard to say who is a potential competitor and who is a potential partner (Mollstedt, 2011). This already has been described earlier with the threat that utilities may be bypassed by other actors in the value chain.

When it comes to the hardware for the charging infrastructure most utilities interviewed see more advantages in relying on partners and suppliers compared to owning that part of the value chain (Östermark, 2011). When it comes to smart charging however, most larger utilities have secured strategic partnerships with hardware manufacturers like ABB or Siemens in order to develop and test the potential of future smart solutions (Mollstedt, 2011). Also Vattenfall is working on developing the software and hardware together with their technology partners (Weinmann, 2011). Having such smart charging pilot projects will prove to be advantageous to develop new business models. Weinmann also does not think that in the context of smart charging there will be a threat that the relationship between utilities and hardware producers will change. He thinks that companies like Siemens and ABB will still sell hardware and utilities will put it up and operate it, even if it is in a new area like smart charging applications (Weinmann, 2011).

As already mentioned in the “channels” section of this chapter one important opportunity is it to secure partnerships with car manufacturers. This can potentially allow access to new sales channels and potentially also allows important knowledge exchange (Frieser, 2011). Utilities that are able to secure such partners will potentially have an advantage over competitors.

A threat in terms of partnerships is that according to Mollstedt exclusive partnerships are potentially illegal and hence it is always tricky whether a certain partnership remains legal or not (Mollstedt, 2011). According to him this often is a grey area (Mollstedt, 2011). This also depends on market share of that partnership (Mollstedt, 2011).

4.1.4 Finances

4.1.4.1 Revenue streams

One of the key strengths in the area of revenue streams and pricing mechanisms is that most utilities already have established billing and payment systems which they can leverage on in terms of billing for charging infrastructure services.

Using monthly flat rates for charging services can be a pricing mechanism that provides the opportunity to get away from tough price negotiations solely based on price per kWh (Mollstedt, 2011). In a strongly regulated market like the electricity market additional monthly revenue streams through charging services are hence an opportunity.

Östermark stresses that in the beginning it is important to actually pay for what you have used in terms of electricity, hence variable monthly fees (Östermark, 2011). This has the advantage that e.g. employees will not get the feeling that they pay for neighbouring electric car users. But after some time he can also foresee a fixed monthly fee or flat rate for the electricity (Östermark, 2011).

A large opportunity in the area of smart charging will be dynamic pricing models and flexible tariffs. This would allow giving incentives for balancing the grid and could also directly connect the real time availability of renewable energy with the charging experience. Also Mollstedt sees hourly tariffs or other time dependent tariffs as one of the future key areas (Mollstedt, 2011). Also in the eyes of Weinmann those flexible tariff structures are the key for finding a profitable business model within electromobility in the future (Weinmann, 2011).

A threat to creative pricing mechanisms is that fact that electricity is very much regulated which could limit the way it is priced (Mollstedt, 2011).

4.1.4.2 Cost structure

The general challenge in this area is the uncertainty about investments in fast charging and public charging stations. Those costs are potentially high and it is not certain if it will be possible to recoup investments. Most experts stated that they can not see a business case for both areas at this market stage (Östermark, 2011). At the same time there may be interesting opportunities to share or spread the costs for fast charging stations as well as public charging infrastructure (Mollstedt, 2011).

An opportunity for all the charging infrastructure cost is to distribute them over time so that the customer does not feel the upfront cost to the same extent (Mollstedt, 2011).

A threat in terms of possible future costs is the possibility of a higher electricity tax (Weinmann, 2011). This however is very unlikely to happen in the near future according to the Swedish Energy Agency (Lewald, 2011).

4.1.5 SWOT summary of the charging infrastructure model

Below are the results of the SWOT analysis in point form.

Strengths of utilities

- Utilities are used to operating and maintaining the grid – charging stations are not to different
- Utilities already have experience with measuring and billing systems
- Most utilities already have capabilities in the area of maintenance and support services
- Utilities already have a strong customer base to leverage on
- Utilities have a strong brand and close ties to the regional community

Weaknesses of utilities

- Utilities are traditionally a conservative industry that is not used to innovate and secure business areas that are too different from their core business
- Some experts voiced the opinion that at times utilities underestimate customer relationship

Opportunities for utilities

- One major opportunity is a partnership with car manufacturers in order to secure additional sales channels

- Smart charging and the opportunities it provides can become a major differentiator from competitors
- Should the environmental car incentive (“supermiljöbilspremien”) despite previous proposals include company customers, it can spur demand for charging infrastructure
- Possibility to link renewable energy directly with charging station business model and thus supporting both business areas
- Leverage marketing interest by shopping malls and similar actors by establishing good relationships for follow up charging infrastructure contracts at a later market stage

Threats to utilities

- Car manufacturers may circumvent utilities and offer charging solutions directly to their customers through a partnership with charging hardware manufacturers
- Hardware manufacturers directly approach customers to install charging infrastructure, which can become even more of an issue in the case of smart charging
- Emerging competition with companies that potentially offer similar value proposition like utilities e.g. Park & Charge and Charge Storm
- Customers are not interested in additional services on top of installing the charging station itself
- Customers refuse to give away ownership of the charging stations and thus limiting some business model choices
- Utilities could be reduced to the role of simply selling electricity which will only lead to small increases in profit
- Uncertainty about standards in the area of smart charging and fast charging is causing customers to wait and slow down the market
- Car manufacturers may choose not to include smart charging capabilities in the first generations of electric vehicles
- Due to limited public incentives in Sweden the electric vehicle market is only slowly developing, causing charging infrastructure to be less demanded
- Successful commercialisation of the plug in hybrid technology will reduce the need for fast charging infrastructure

4.1.6 Competitiveness within the business model

Based on the above discussion and the resulting SWOT analysis several conclusions can be drawn about the competitiveness of business models within the overall charging solutions business model and here again within the nine business model elements. In the following, some of the key points will be discussed.

Firstly, there has been some debate about whether to build or only retail or in other words contract charging infrastructure as such. Based on the arguments put forward it can be reasonably argued that one directional slow charging solution at this stage represent assets that for utilities are very close to being generic assets. Already there are many suppliers for such slow charging infrastructure and such hardware manufacturers are beyond the pre-competitive state. As such those simple charging solutions can nowadays be easily contracted which is also the reason why there are low barriers of entry for using such infrastructure by e.g. car manufacturers or other new actors. Hence there is only low risk involved in obtaining such assets and thus controlling them is unlikely to be the pure basis of competitive advantage of the business model. The only difference here is that there are different degrees of favourable design and ease of usage connected with some of the slow charging stations that could still be a slight differentiator (Östermark, 2011). Having exclusive supplier agreements for the stations that are favoured by customers for design or ease of usage reasons could be a move towards a specialised asset. Building or co-producing such slow charging stations as a utility could only be explained by attributes that specialise this increasingly generic asset. Next to the already mentioned differentiators trust in the brand of the utility can be a way to make it a specialised asset if the slow charging station is clearly recognizable as belonging to the utility's brand (Mollstedt, 2011).

When it comes to other forms of charging like fast charging, smart charging or public charging there are still many areas in which to build up or otherwise control assets and capabilities that can be the basis of competitive advantage of that business model at this stage of industry development. All three types of charging require considerable investment and risk to develop and to build or control which will be not as easy to imitate by competitors. That risk can currently be found in the question whether those types of charging solutions will be demanded on the market or else the question when they will be demanded on the Swedish market. Due to the fact that the charging market in Sweden is still characterised by several uncertainties many customers only choose to obtain simple charging solutions that do not require a lot of investment (Östermark, 2011). If a utility decides to go forward despite this and builds up fast charging networks, smart charging networks or public charging networks they could potentially develop and control specialised assets and capabilities that will be hard to imitate due to high risk or investment of doing so. Within those specialised assets could be other specialised assets like exclusive partnerships or simply an early mover advantage that will be hard to replicate. The examples “RWE” or “ladenetz” in Germany show such risky decisions in which utilities chose to decide to build public charging infrastructure despite all odds and risks. If they were right about that decision, those networks will be a specialised asset with specialised capabilities needed for operating them that requires high investment and is difficult to imitate at a later industry or market stage. It is likely that there will not be enough room in the market for an endless amount of such networks. The same arguments can apply for fast charging which undoubtedly requires even high investment and risk. It is truly uncertain if such networks will be needed due to e.g. the threat that the plug in hybrid technology will become dominant for a number of years. Smart charging technology on the other hand can be a specialised asset to control at a later market stage as the smart grid technology can become the new industry standard ones uncertainties around standards and communication protocols are resolved. All of the larger utilities investigated during the interviews are at least experimenting with that technology. The case of Charge Storm shows that already today companies believe that this is a sufficient enough specialised asset that can be the basis of competition. This seems to be very much a question of the right timing and the stage of industry development (Löfblad, 2011).

Public charging networks, based on a combination of slow charging and/or fast charging, that are at the same time included into value propositions around home charging or office charging networks can together possibly provide a powerful lock in effect as well as a complementary system. These networks together could create positive externalities and on the other hand also increase the switching costs to other suppliers.

When it comes to ones own sales and communication channels several of the larger utilities reported that it requires considerable investment to adapt the existing channels towards the new business areas in electromobility (Mollstedt, 2011; Weinmann, 2011). Training, building up knowledge, finding the right approaches towards the customers necessitate investments that need to be justified and are potentially risky (Weinmann, 2011). While this may only be true to a certain extent for very simple slow charging solutions, the more complex the charging station will become the more newly developed or adapted channels will be a specialised asset. Such well adapted sales, distribution and communication channels can be an important specialised asset that is difficult to imitate. Also creating such channels will greatly increase the efficiency of the business model in the sense that it reduces some of the transactions costs in the buyer seller relationship.

When it comes to partner sales channels this can be even more the case. Getting exclusive control of car manufacturing sales channels can potentially even be a co-specialised asset that without which competitors will not be able to compete. This may be exaggerated but it demonstrates that securing such important partner channels that are somewhat exclusive, at least for some time, can be a very essential factor especially during an early industry or market stage. It will also be possible to leverage on such co-specialised assets and through them offer some more generic assets a company may have (as with the example of E.ON's own charging station). Fortum arguably also has gained access to such a scalable co-specialised asset in the form of a sales channel through their customer Europark (Fortum, 2011b).

The case of "Park & Charge" also shows that by enhancing the charging infrastructure solution by different add on services like identification, measuring, billing or payment solutions one can create specialised assets and capabilities that are slightly more difficult to replicate and perhaps also represent a sort of "uncertain immitability" to it.

The same "uncertain immitability" factor could be seen in offering charging solutions as a value bundle that offers everything that is needed for the charging experience for a monthly flatrate. Taken together this represents a system that involves processes and capabilities that potentially could make it harder to replicate the business model. Also this represents a novelty aspect compared to business models of competitors that could be an important differentiator. Still it can be questioned whether that will be enough by itself to achieve a sustainable business model as already today Göteborg Energi, Fortum and Park & Charge have very similar business models. Nonetheless, this can be a basis on which to add other products and services.

At an early market stage it can also be very interesting to think about exclusive relationships with key customers as potentially specialised assets. Securing company chains like IKEA, McDonalds or Max is definitely temporarily a basis for competitive advantage. This of course depends very much on the exact charging technology that will be used. Also the existing customer base and overall embeddedness that most utilities have to some extent is a specialised asset that at least temporarily will be hard to replicate for competitors.

Another factor that can lead to competitive advantage is the bet on the fact that other potential competitors will not want to “cannibalise” their existing sales and profits or else upsetting their business relationships. An interesting example here is the fact that many utilities are very much regional and are very connected to their community. Choosing to offer charging solutions on a national level could be such a move that other utilities do not want to follow because they do not want to upset their existing relationships.

4.2 Mobility solutions model

This is an area that many utilities have at least thought about. Mobility solutions can include all the aforementioned charging solutions, but can also include the direct retailing or leasing of electric vehicles, electric bikes or electric scooters into a package. Apart from just retailing such vehicles there is the opportunity to include on top services like booking systems, information on the car status or in other words an overall fleet management. As a result this opens up to offer mobility services as a functional sale. This however does not necessarily mean that utilities by themselves would engage in this.

4.2.1 Offer

4.2.1.1 Value proposition

Offering electric vehicles, electric scooters and e-bikes apart from the charging infrastructure will potentially allow utilities to capture more value along the value chain. It is also an opportunity to actively drive the electrification of the transport sector. Furthermore it would also give a utility a variety of products and services in the area of electromobility that can be customised to the needs of the client. Those products can come with different combinations and reinforce each other. A good example for engaging into such solutions is the regional utility of Aachen (“Stadtwerke Aachen”) in Germany which offers electric scooters in combination with access to a public charging network (“ladenetz”) and green electricity for private customers (Stawag, 2011b). For corporate customers the utility allows to configure individual packages including a large variety of charging stations, different types of electric scooters, a carport with solar panels as well as including services like installation, maintenance and a flatrate for the electricity (Stawag, 2011a). During the interviews it has only been mentioned by E.ON that they have started to experiment with such offers at E.ON in the Czech Republic (Nordgren & Svensson, 2011). As a result the retailing organisation of E.ON Sweden is at the beginning of setting up a first value proposition that includes e-bikes. During the E-Mobility Malmö project E.ON also provides electric scooters apart from ebikes and electric cars (Åberg, 2011; Mollstedt, 2011; Nordgren & Svensson, 2011). Having the variability of electric vehicles, electric scooters and electric bikes could be an opportunity to find solutions to different mobility needs of company and private customers (Jakobsson, 2011).

One step further would be a value proposition that includes services needed for fleet management for professional organisations or an equivalent proposition for private customers. This does not necessarily mean that utilities themselves have to do that, but it could be a joint value proposition together with a partner. In many ways this would be a move towards a complete mobility solution that potentially offers mobility as a service. This again can include electric scooters and electric bikes next to electric vehicles. As such it can be an opportunity for utilities to play a role along large parts of the value chain, but

presumably not on their own. Ulf Jakobsson summarises the advantage of such mobility services as follows:

“It’s always easier to buy a function when it comes to a new product because if you buy a new product it is always a risk. Especially when it comes to expensive products like cars. I believe that is a great opportunity for functional sales and product service systems to really take the next step, because it is so much easier to introduce new expensive products in the market by selling a function. So I think a lot of actors will sell functions instead of products.” (Jakobsson, 2011).

Vattenfall reported in the interview that they seriously thought about such a move from their utility point of view but after a calculation concluded that “there was not much money left” in the end (Weinmann, 2011). He also argues that the mobility area is already very crowded with strong companies like car manufacturers, car leasing companies and the like (Weinmann, 2011). As such there is the threat that competition will be too strong for utilities to establish themselves. Hence he does not see that Vattenfall will act alone there and much better could imagine collaborations with car leasing companies or different car manufacturers to offer this as a package together. Also Frieser thinks that today it would be hard to find decision maker acceptance within a utility if one proposes to engage in some sort of fleet management (Frieser, 2011). However he can imagine that a utility grows into that role.

A company that already offers mobility solutions in Sweden is Move About which is based in Gothenburg. Move About offers a complete mobility package based on the electric vehicle which includes the electric vehicle itself, a smart booking system, a billing system, a monitoring system, battery or energy management of the car which also manages the charging process, insurance, repairs, washing and cleaning (Jakobsson, 2011).

A general advantage to be able to offer a full mobility package including charging solutions into one value bundle is that this will make it more likely that customers will leave it very much up to the company which products and services will be done by whom. Also the question of the ownership of the charging infrastructure that was discussed in the charging infrastructure section could be resolved through that value proposition. Furthermore this value proposition would give utilities the prerequisites for engaging into vehicle to grid scenarios and give them better access to fleets for balancing the grid.

The value proposition of the mobility solution could also be enhanced if customers have access to “free parking” in inner city areas. This is for example an important aspect of the car2go concept in Germany or for Move About’s mobility solutions (Car2go, 2011a; Jakobsson, 2011).

4.2.2 Customer interface

4.2.2.1 Customer segments

The customer segments do not necessarily differ that much from the aforementioned customer segments in the charging solutions business model and as such opportunities and threats are also similar.

The opportunity in operating multiple car fleets is however that both professional organisations and private customers could potentially use the same fleet within an inner city

context. This also reduces idle times of such fleets, especially during night time, weekends or during holiday periods. This approach is being used by Move About within their public fleets (Jakobsson, 2011). The car sharing company car2go in Germany also operates with the same fleet to attract both corporate and private customers (Car2go, 2011c). For company customer such solutions could be attractive as they potentially reduce some of the fix costs of company's own car pools. They could also provide a complement that can react to higher or lower demand for mobility.

The attractiveness of the value proposition for the different customer segments will again depend a lot on the public incentives provided as they can reduce the cost for such business models. As has been voiced before the proposal for the environmental car incentive that is planned to be introduced at the beginning of 2012 at the moment does not foresee professional organisations as targets (Jakobsson, 2011; Sunnerstedt, 2011). Experts argue that it is those organisations that may be more willing to take the risk of lower residual value of the electric vehicle and the battery after some years (Käck, 2011). One problem is that most companies have an upper limit for purchasing company fringe cars which is often below the price of current EVs⁵. This could be addressed by public incentives for those companies. The national procurement program "Stockholm upphandling" allows corporate customers to participate, but only the first 1,000 cars will be eligible for financial incentives with a maximum of 50,000 SEK each (Sunnerstedt, 2011). Also the Stockholm upphandling limits the choice of cars to few selected models (Elbilsupphandling.se, 2011b; Sunnerstedt, 2011).

4.2.2.2 Channels

Similar to the charging infrastructure business model also the mobility solutions business model requires changes in the utility's own sales channel. Making those investments can be a risk and hence a threat for business model development. Also for this business model securing other partner sales channel and increasing the outreach to customers will be important for the success of the business model.

Arguably offering mobility in one form or the other will be an unconventional move for utilities that as such will also require changes in the communication channels.

4.2.2.3 Customer relationship

Arguably the customer relationship towards the different customer segments can be a very different one if one also includes mobility solutions into the business model. Compared to the charging infrastructure solutions it potentially provides the utility the opportunity to develop its brand more towards a company that engages with e.g. the private customer segment. Operating fleets, car sharing or other mobility solutions are much more visible and hence offer opportunities to engage with user communities or even engage in co-creation where customers actively shape parts of the business model. An example here can be the car sharing company car2go which through their presence in social networks actively engage with customers to get feedback on their business model (Car2go, 2011b). According to Mollstedt this can also include all sorts of gamification which allows to e.g. compare with neighbours, other employees or the like (Mollstedt, 2011). In general such feedback systems

⁵ In the case of Lunds energi this limit is at 300,000 SEK (Strandberg, 2011).

can be important for customer acquisition and customer retention. Automated feedback systems through E-mail and text messaging need to be in place to succeed (Jakobsson, 2011).

4.2.3 Infrastructure management

4.2.3.1 Key resources

The key resources for this business model are first of all the electric vehicles, electric scooters and electric bikes themselves. Among the experts there have been doubts about the question if Sweden will be a primary market for car manufactures of electric vehicles as public incentives are lower than elsewhere in Europe (Frieser, 2011; Käck, 2011). A threat is that during the coming years there will only be a limited variety of electric vehicles available on the Swedish market (Elbilupphandling.se, 2011a; Jakobsson, 2011). Also only few electric vehicles are currently capable of smart charging which at least currently limits some of the potential for business models in the area of mobility solutions (Mollstedt, 2011).

When it comes to mobility solutions that are sold as a function and that rely on booking systems and fleet management the core resource and capability will be in IT systems and software development (Jakobsson, 2011). As Jakobsson sees it all the knowledge will be systemised into the IT system (Jakobsson, 2011). Being able to leverage on IT resources and capabilities as well as increasing data amounts will be an opportunity.

4.2.3.2 Key activities

Arguably for this business model primary activities like marketing and sales are important aspects. When it comes to understanding the key activities that are necessary for mobility solutions sold as a function utilities potentially have weaknesses compared to competitors. Here it will be a question of partnerships in order to get access to such activities and the capabilities that lay behind them.

4.2.3.3 Key partners

The different mobility solutions will necessitate utilities to access capabilities and resources which they currently do not have and which are not in their current core business areas. As such this is an area where utilities will have certain weaknesses compared to other competitors. This is the reason why there are multiple opportunities for partnering with companies that are already active in the mobility market in the wider sense. As Weinmann sees it Vattenfall would not enter the mobility market alone and would rely on partners coming from the car manufacturer or the car leasing industry (Weinmann, 2011). Also being a partner to car pools or car fleet companies in this area could give utilities access to knowledge on how charging a whole fleet could be leveraged on.

In the area of partnerships in mobility Vattenfall already made a surprising move by engaging into a joint venture to co-produce Volvo's V60 plug in hybrid. However there are different opinions within Vattenfall about the strategic usefulness of this move. Weinmann does not think that Vattenfall should be building cars since they do not know enough about that business (Weinmann, 2011). He thinks that this was a one time move and that Vattenfall should focus on its core business (Weinmann, 2011). Frieser agrees that this perhaps was a one time move that was possible due to a lot of trust and a good relationship between the relevant Swedish actors from Volvo and Vattenfall (Frieser, 2011). Frieser however sees the

strategic value not in the discussion about core business or not, but in the opportunity to actively push forward the electrification of the transport sector while at the same time getting insights in the current and future business models in the car industry (Frieser, 2011). According to Frieser, after being offered that opportunity it came down to the question if Vattenfall was serious about the growth potential in the electrification of the transport sector or not (Frieser, 2011). As such it was hard to say no at this time, but Frieser states that he believes in it and that he can see a good business case behind it (Frieser, 2011).

Due to the limited range of electric vehicles also interesting opportunities could develop to integrate the service with other transport modes and foremost public transport (Jakobsson, 2011). One first way to integrate those modes of transport is by using similar RFID card technology (Jakobsson, 2011). In the area of partnerships with public entities it can also be very advantageous to secure agreements with regards to parking in inner city areas. The same of course also applies to parking space providers.

4.2.4 Finances

4.2.4.1 Revenue streams

Apart from retailing and one time sales of electric vehicles, electric scooters or electric bikes this business model also allows the usage of multiple recurring payments and pricing mechanisms including selling the mobility as a monthly flat rate where the customers only pay for function (Jakobsson, 2011).

A revenue stream that is already being used by the company Move About is that of selling advertisement on their cars since those fleet cars are very visible in an inner city context (Jakobsson, 2011). This represents an opportunity to lower the price for the mobility solution as such (Jakobsson, 2011). Many potential customers will be interested in co-branding such fleet cars.

Fleets also represent an opportunity to create communities where members pay a monthly fee for being a member and paying per hour for the actual usage of mobility (Jakobsson, 2011). This is as such very much the car sharing value proposition.

Operating fleets and selling mobility as a function allows future revenue streams in the area of vehicle to grid which for example the company Move About can foresee as an additional revenue stream where they could buy and sell electricity at different times of the day.

4.2.4.2 Cost structure

If one relies on selling mobility as a function and does not only retail electric vehicles the primary threat will be that it may be a much more capital intensive business model. Also there are still large uncertainties around the residual value of the electric vehicle as well as the battery which will lead to higher costs. Also it is so far uncertain how fast charging exactly will impact the value of the battery (Konnberg, 2011). Most experts are of the opinion that it will potentially decrease the value of the batteries (Jakobsson, 2011). As a result banks and other financing institutions are currently very conservative during the calculation of leasing model for the electric vehicle (Petre, 2011)

4.2.5 SWOT summary of the mobility solutions model

Below are the results of the SWOT analysis in point form.

Strengths of utilities

- Experience in coordinating different products and services into a system

Weaknesses of utilities

- Relative lack of knowledge in the area of mobility
- Lack of knowledge when it comes to fleet management

Opportunities for utilities

- Partnerships with car companies, car sharing companies as well as car fleet companies or similar mobility companies (e.g. Move About)
- Partnerships for retailing electric vehicles, electric scooters, electric bikes
- Actively pushing the electrification of the transport sector
- Possibility to offer a complete solution for mobility
- Additional on top software services possible in the future
- Integration with other business models in the area of charging infrastructure and smart housing

Threats for utilities

- Utilities will be circumvented as a player in the value chain due to the fact that the market is already crowded with strong players like car manufacturers, car leasing companies, newly developing car sharing companies or the like that will try to offer additional mobility solutions
- Strong established competitors
- Potentially high risk and capital intensive
- The uncertainty about the residual value of electric vehicles and their batteries could result in additional cost for the business model due to unfavourable financing models
- Sweden could remain a low priority market for electric vehicle manufacturer as public incentives elsewhere are much higher. This could limit the choice of electric vehicles available for mobility solutions.

4.2.6 Competitiveness within the business model

Within this business model a lot of the competitive factors are a result of the very early development state of the industry or even pre competitive state in many ways. Almost all complementary assets that are needed to succeed in this business model arena can be somewhat specialised or co-specialised assets and capabilities that are difficult to imitate. It has to be stressed that this is primarily due to the early development stage and will change over time.

Firstly it is likely that electronic scooters and electric bikes are assets that will very fast or already are generic assets which are relatively easy to obtain and while doing so not too much of a risk is involved at least if one relies primarily on retailing them. Electronic scooters and electric bikes are already a mass market in places like China and hence it is not likely that they will be the sole basis for competition. Still, to the knowledge of the author no utility in Sweden is offering those products at the moment and as such they can at least temporarily provide some level of specialisation.

Due to the early market stage the ability to obtain a variety of electric vehicles can be a specialised asset on which to leverage on. Car manufacturers only serve certain key markets at the moment and obtaining an exclusive access to an electric vehicle that is being appreciated by the customers can represent a specialised asset. This holds even more true if that car is able to be used for fast charging or smart charging should that be the underlying prerequisite (Mollstedt, 2011).

The importance of channels for sales, distribution and communication applies similarly as in the charging infrastructure scenario. Getting control of at least temporarily exclusive sales channels will provide the basis for a specialised asset. This holds even more so for one's own channels as mobility represents an area where not many utilities will have knowledge existing within current sales channels. Taking risks and investing money in adapting those channels or by creating new ones will be a decision that is risky to imitate.

Packaging the aforementioned assets (EVs, electric scooter and bike) into a mobility service or mobility function package including other elements like a flatrate for renewable electricity, including charging stations, including booking, payment or other IT based systems can together represent a system that involves processes and assets that produce the wished “uncertain imitability” factor. Especially the IT system and software development provides a specialised asset that will be essential for this business model. This has been demonstrated by Move About which repeatedly stated that their know how and experience is systemised into the IT system and that this is the factor which is very difficult to copy (Jakobsson, 2011). In many ways systemised knowledge is the key term here. Apart from these factors such a value proposition would be an extreme novelty factor for utilities that can be leveraged as a differentiator.

Engaging in mobility solutions could also allow utilities to make use of the third isolating mechanism that Teece coined as “cannibalism”. Utilities that take the risk that of engaging in mobility potentially could upset existing sales and profits in other areas or else upset current business relationships. If they do so however there will be utilities that will not want to “cannibalise” their existing business models for the same mentioned reasons. This could also be due to the fact that many utilities are quite conservative and hence do not want to upset internal relationships within the company (Mollstedt, 2011; Weinmann, 2011).

4.3 Usefulness of the applied framework

Osterwalder's "Business Model Canvas" is a useful tool to understand business models as it is one of the most comprehensive business model frameworks by using nine different business model elements (Osterwalder, et al., 2010). This provides the actors involved and the research with a common language as a base for discussion as business models are often understood very differently. However, due the strategic and sensitive nature of the topic it has been difficult to get access to all the in depth information that potentially would be needed. The framework as such is limited to the extent that it is mostly mapping out different business model elements. It does not give sufficient reasoning to make informed choices about which business model option to choose. For that reason the author has first relied on a SWOT analysis in order to give more explanatory power to the framework. This has helped to get first insights on the advantages and disadvantages of different business model design option that are possible. Perhaps the most useful additional framework used was Teece's model on complementary assets which is a framework that is academically close to the resource based view of the firm (Teece, 2006). It gives a deeper understanding on which complementary assets, resources and capabilities will be important for a competitive business model. However, even that framework is limited by the uncertainty that is still prevailing about which assets and capabilities will play that decisive role in order to gain competitive advantage.

4.4 Suggestions for further research

As the developments in the electromobility area are still very dynamic and will remain so for some years to come, there will be a continuing need for further research in multiple disciplines. When it comes to business model development and electromobility there will remain large uncertainties for some time as the uncertainty around standards, competing EV technologies and high costs cause many customers to wait. As this thesis was mostly concerned with the country case of Sweden with a focus on the utility sector it could be fruitful to investigate other industries like the car manufacturing industry or the hardware manufacturing industry within Sweden in more detail. When it comes to the business model developments among utilities it can be beneficial to conduct a series of case studies on "best practises" of concrete utilities across Europe. This would result in a much broader variety on different business model element ideas compared to focussing on just one country.

Concerning the evaluation of business models in the area of electromobility it would be interesting to conduct empirical research on which business model design themes⁶ or business models in control of certain specialised assets actually perform better financially. This of course in many cases is not possible at this stage, but will be interesting once the EV and charging market grows.

⁶ Please refer to the NICE framework in the business evaluation framework section of this thesis.

5 Conclusions and recommendations

This research used an explorative research approach by primarily relying on semi-structured interviews. This was needed due to the very early market stage in Sweden. After investigating the different business models among utilities in Sweden and interviewing experts it is clear that no dominant business model design has emerged yet. However, it is possible to see different business model patterns and scenarios that may become the dominant business model design. Due to the early market stage the author can only give first preliminary insights on how business models for utilities could look like.

The first key objective of this thesis was to find out why utilities engage in electromobility. Here it can be clearly said that most utilities see business opportunities in the electrification of the transport sector as this is likely to support their core business. Others see the possible business models as a way to achieve customer retention by being able to provide additional services and products on top of existing customer relationships. Other utilities have been more concerned with marketing and public relation efforts as they see in electromobility a way to positively develop their brand and let their core product, namely electricity, appear in a positive light. Concretely, engaging into the market has so far been characterised by the fact that some already put commercial offers onto the market with potentially high investment and risk connected and try to secure market share (Frieser, 2011). Some wait and monitor developments while others wait and do a lot in the background (Frieser, 2011). There are however also utilities that see no business potential for them in the area at all. Concluding, one can say that many of the activities by utilities are about getting yourself in position in order to be ready when the mass market starts (Frieser, 2011). If one actively engages into business model development one can also influence and shape the directions of the search. If one develops the business models now one can make an informed choice whether one really wants to enter the mass market or not (Frieser, 2011).

The second objective was to investigate the current differences and similarities in the business models among the utilities in Sweden. This research objective was somewhat limited by the early market stage of business model development in Sweden. However, it can be said that currently most utilities focus on the charging infrastructure side of the value chain and try to develop winning value propositions in that area. One key differentiator so far has been the option between retailing and installing charging infrastructure as a one time sale or the bundling of the charging infrastructure with services ranging from installation, maintenance, operation as well as verification, measuring and payment solutions as a recurring payment. Here notably Fortum, Göteborg Energi, Park & Charge and Charge Storm have put forward commercial offers. In the future however there will be much more potential for major differences due to evolving areas such as smart charging and fast charging. In addition, the question of public charging networks is still not finally answered as cooperation and other cost sharing mechanisms could lower costs. Another future scenario will be the difference between utilities that engage in mobility solutions while others will step away from those opportunities. Also the integration of charging and mobility business models into an integrated business model around smart housing will be an interesting possibility for differentiation.

The third objective of this thesis was to identify the advantages and disadvantages of these emerging business models based on a SWOT analysis approach. When it comes to the charging infrastructure business model it can clearly be said that this plays to the strengths of

utilities, as they are used to operating and maintaining the grid and in that sense operating and maintaining charging infrastructure is not too different. Engaging in this area also has the advantage that utilities often can rely on existing resources and capabilities in the area of support service and maintenance as well as metering and billing systems. For many corporate customers utilities are the natural partner to approach as they already have long lasting business relationships with them and in general have close ties within their region. What has been noted as a potential weakness of utilities when it comes to private customer relationships is their lack of experience as a consumer brand. Smart charging and the opportunities it provides can be a major opportunity for differentiation in the future as not all utilities currently have invested in smart charging stations. Also securing new sales channels and customers with potentially large outreach is a major opportunity in the charging business that has to be tapped early. The major disadvantages around the charging infrastructure business model is that there are several other actors in the value chain that will want to circumvent utilities as a player and offer charging infrastructure themselves. These include for example car manufacturers and the charging hardware manufactures. Furthermore, other new competitors such as Park & Charge and Charge Storm will want to establish themselves as a new mediator between customers and utilities. Also there is the risk that both corporate and private customers will not see the need for anyone to operate their charging infrastructure. Hence, there will be a need for convincing services and arguments to enter this customer segment. Within the mobility solutions business model there are a lot more risks involved as it potentially is much more capital intensive. In addition, utilities have not many natural advantages in the mobility area apart from the possibility of building a convincing system out of products and services. In this business model utilities will need to find partners in order to tap some of the advantages that could lie in combining mobility, charging and smart housing solutions. Possible partners are companies that already are active in the mobility area which includes car manufacturers, car fleet companies or other mobility firms. This indicates the disadvantage that this area is already very crowded with strong established competitors.

With a focus on business models, the overall research question of this study was formulated in the following terms: “How can utilities in Sweden ‘competitively’ and ‘sustainably’ engage in electromobility?”. Answers to that question will be given in the recommendations below.

5.1 Recommendations for “larger” utilities

At this market stage it is hard to provide meaningful recommendations as many potential customers, both corporate and private, appear to have a low risk strategy when it comes to charging solutions or mobility solutions. Many corporate customers only install a few charging stations for public relations reasons as well as marketing reasons or want to first get sufficient knowledge about the technology.

The analysis and discussion sections of this thesis nevertheless show that especially for large utilities it will be key to secure partnerships at this early stage of business model development. This is interesting for many reasons. Firstly, it potentially provides temporarily exclusive access to certain sales channels like car dealerships that could help to commercialise e.g. charging infrastructure solutions on a national scale. Such partnerships could also be meaningful due to the opportunities that it provides when it comes to the integration with smart charging. For similar reasons early commercial relationships with potentially large customers like fast food chains, large retailers, malls etc. can be an interesting way to establish scalable prerequisites for a time when the mass market starts.

In the area of mobility solutions it can be an interesting differentiator to start retailing electric scooters, electric bikes and potentially also electric vehicles. This could be the added value that may make undecided customers more willing to also buy charging solutions and other services in conjunction.

Furthermore, apart from thinking about business model design on paper one of the most important recommendations that can be made in business model development is to test as many business model element combinations as early as possible with real customers. Only investigating customer needs and reactions to the value proposition can lead to a successful business model. If this is done at this early stage one can make more informed choices when the electric vehicle market enters the mass market. Latecomers may face less risk now but they also potentially miss out on strategic partnerships that can be a major specialised asset for the business model.

5.2 Recommendations for “smaller” regionally based utilities

Regional or smaller utilities will at some point need to ask themselves to what extent they have the resources to engage into business model development in the area of electromobility at this market stage. Most regional and local utilities that were investigated in this thesis prefer to wait until the market is more mature or even think that there will be no business opportunities at all.

So far many regional utilities have interpreted their role as one of facilitating knowledge exchange, knowledge development or else supporting the development of electromobility. Nonetheless, also smaller utilities can offer simple charging solutions and similarly to other utilities try to secure key customers already at an early market stage.

Also, there are examples in other countries, notably in Germany where utilities do not just cooperate for knowledge exchange but also engage together in cooperative business models, e.g. in the area of public charging networks. A strategy forward for smaller utilities could be to find ways to share critical complementary assets together with other regional utilities.

5.3 Key policy recommendations

The institutional alignment is one of the most important aspects when it comes to the introduction of new technologies (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008). During the course of the research it became very much apparent that policy is influencing Swedish business model development in electromobility on many levels and in many of the outlined nine business model elements investigated.

It can already be seen that there is the willingness to change certain legislation in favour of the upcoming electromobility market. One such example is the proposal to simplify the installation of charging infrastructure by exempting the charging stations from the grid concession. Also early problems around the reservation of parking spots for electric vehicles in public spaces have been resolved even though there remain legal problems in case that one wants to also exempt electric vehicles from the parking fees (Sunnerstedt, 2011). This is an area that will need attention as the legal situation is unclear.

To jump start or accelerate business model development however it is more important to make use of the way or the current system with which new cars are brought to the market in Sweden and adapt it to the needs and extra costs of the electric vehicle or similarly environmentally beneficial cars. This is already being done partially by favouring PHEVs and BEVs when it comes to the company fringe car benefit taxes of employees. This would however be much more reinforced if the employers themselves had an extra incentive to buy EVs. Buying the EVs without such incentives currently still seems unlikely due to the high cost of EVs, company policies on the upper price limits for company fringe cars and the expensive financing which in turn is due to uncertainty about residual value.

One existing instrument that tries implement this is the national procurement program for electric cars (“Stockholm upphandling”). As this is a public procurement program it had high safety and other data requirements which some electric vehicle manufactures have not been able to fulfil as some electric vehicles have just not been tested in detail yet. This limits the choice for corporate or professional organisations to only a few selected models. For example it is unclear to some experts why one of the most sold electric vehicles worldwide, the Nissan Leaf, has not been part of that process (Jakobsson, 2011). Also the monetary incentive will only be enough for about 1,000 EVs. While this is a step in the right direction experts argue it is not a strong enough long term signal to establish the market and reduce uncertainty.

The other incentive that is planned for the future is the “Supermiljöbilspremier” which is the environmental car incentive worth 40,000 SEK that is planned to be introduced at the beginning of 2012 and in its current proposed form would be sufficient for about 5,000 EVs. This proposal has been highly criticised by many of the experts interviewed because it is excluding companies from the incentive. Excluding companies and other professional organisations is counterproductive since the reality in Sweden is that most interest for electric vehicles comes and will come from companies, municipalities or other public authorities.

In conclusion, the policy instruments currently used need to be coordinated better so that they reinforce each other and most importantly provide a clear long term incentive that addresses professional organisations like companies, municipal organisations etc. (Lewald, 2011; Weinmann, 2011). Apart from the existing instruments one way to do that could be to reduce taxes for environmentally friendly cars e.g. the value added tax. This approach has been successfully used elsewhere in Europe and provides a sufficient and clear long term signal (Frieser, 2011). At the same time the mobility costs of non-environmental friendly cars could be increased (Frieser, 2011).

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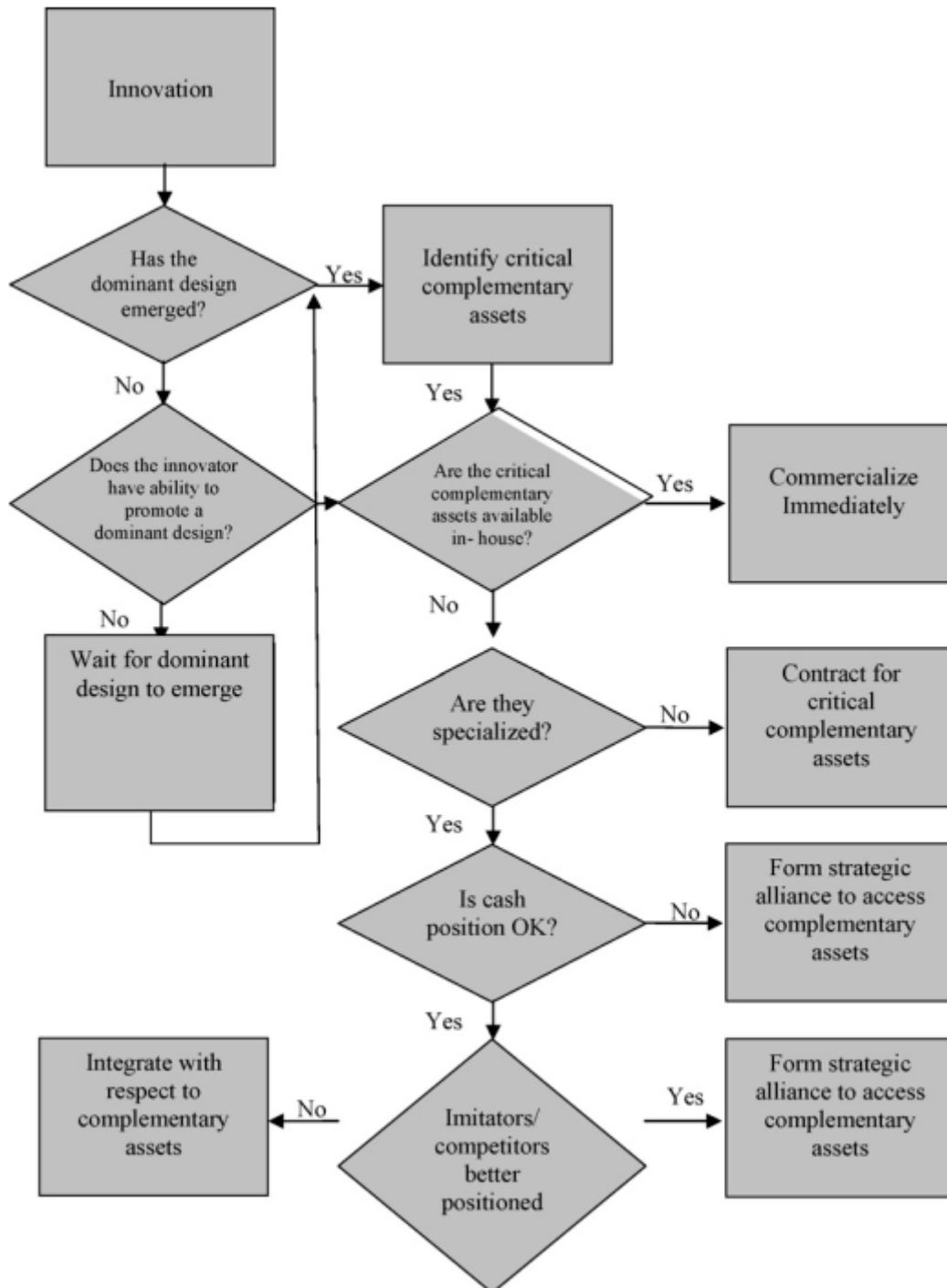
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Appendix

Figure 3 Teece's market entry strategies



(Teece, 2006, p. 1139)

Table 1 Derived business model elements

Business model element	Design options			
Offering				
Value proposition	Product		Service	
	Conventional		Smart	
	Charging infrastructure solutions	Mobility solutions	Housing package	Complete Integrator
	Conversion of motor engine heaters	Retailing EVs, E-bikes or E-Scooters	Micro renewable energy production	...
	Retailing infrastructure	Fleet management		
	Installation of infrastructure	Mobility as a function		
	Operation of infrastructure			
	Maintenance of infrastructure			
	Selling electricity (renew.)			
	Stationary batteries			
	Public charging network			
	Fast charging			
	Guarantees for upgrade or safety			

	Identifying charging point user			
	Metering or measuring the electricity used by that user			
	Billing the identified charging user			
Customers				
Customer segments	B2B	B2C	B2P	
	Companies that want to provide EVs to their employees	End customers that have access to charging e.g. private villa	Public organisations and authorities e.g. municipalities	
	Companies that want to provide EVs to their customers e.g. parking space providers, restaurants, facility owners or multi dwelling house owners, retailers (supermarkets, large warehouses, malls)	End customers with no direct access to charging (multi dwelling houses) (can also be seen as a company customer as a result)		
	Car pool companies			
Channels	Own channel		Partner channel	
			Car manufacturers / Car dealership	
			Car leasing companies	
			Car pooling companies	
Customer relationship	Personal		Automated	
	Website	Call centre / phone	Email	SMS
	Automated feedback systems			
Infrastructure				
Key resources	EV	Charging infrastructure	IT	

Key activities	Marketing		Public relations		Measuring and tracing of customer data		
Key partnerships	Car manufacturers	Car leasing	Charging hardware producers	Service & Maintenance	IT	Battery manufacturer	
Finances							
Revenues	One time				Recurring		
					Leasing		
					Subscription		
					Dynamic		
					Flatrates		
Costs	EVs including battery		Slow charging stations		Electricity		IT system
	Installation of charging infrastructure		Fast charging stations		Parking spots		Salary

Table 2 List of interviews

Name	Organisation	Position	Date
Bergman, Sten	ElForsk	Senior Adviser and Project Manager	July 11, 2011
Frieser, Ulrich	Vattenfall	Development Program Manager E-Mobility	July 12, 2011
Haglund, Tomas	Accenture, Sustainability Services	Manager Accenture Strategy	August 24, 2011
Ivarson, Fredrik	E.ON Nät AB	Business Developer	July 6, 2011
Jakobsson, Ulf	Move About AB	Managing Director	July 5, 2011
Johansson, Olle	Powercircle	Project Manager	July 12, 2011
Konnberg, Johan	Volvo Car Corporation	Senior Adviser at the Special Vehicles MSS; Commercial and Business Manager for the C30	July 5, 2011
Käck, Emilia	Fortum	Project manager “Charge and Drive”	July 7, 2011
Lewald, Anders	Swedish Energy Agency	Responsible for EV R&D projects	July 1, 2011
Lindblad, Anna & Zinkernagel, Roland	Malmö City, Environment Department	Responsible for E-Mobility Malmö	March 3, 2011
Lundgren, Per	Öresundskraft	Project manager for electromobility	August 22, 2011
Löfblad, Elin	Siemens	Business Developer	August 10, 2011
Mollsteadt, Björn	E.ON Sverige AB	Manager within the Innovation and Environment unit	Summer, 2011
Nordgren, Malin & Svensson, Lotta	E.ON Retail	Marketing and sales team	July 8, 2011
Petre, Anna	Saab	Responsible for all Society contact	July 14, 2011
Strandberg, Göran	Lunds Energikoncernen AB	Business Developer	August 9, 2011
Sunnerstedt, Eva	Stockholm City, Environment Department	Project Manager Stockholm Upphandling	August 23, 2011
Weinmann, Oliver	Vattenfall Europe Innovation GmbH	Managing Director	July 8, 2011
Wingfors, Henrik	Svensk Energi	Senior Advisor Energy Efficiency & Electric Vehicles	July 12, 2011
Zelaya De La Parra, Hector	ABB AB	Senior Principal Scientist	July 13, 2011
Åberg, Malin	E.ON Sverige AB	Project manager E-Mobility Malmö	May 11, 2011
Östermark, Ulf	Göteborg Energi	Programme Manager of the Smart Grid	August 11, 2011

		Programme	
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Table 3 List of conferences

Name	Organiser	Topic	Date
Renewable Energy for the Transport Sector	Öresund Ecomobility	Sustainable energy sources for the transport sector (bioethanol, biodiesel, biogas, hydrogen, electric cars etc.)	May 23, 2011