Business Models For The Diffusion of E-Mobility Infrastructure in Hyllie, Malmö

With Opportunities for National Scalability

— Master-Thesis —

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Abstract:

Title: Business Models for the Diffusion of E-Mobility Infrastructure in Hyllie, Malmö. With Opportunities for National Scalability

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Background: Climate change and limited natural resources are growing concerns that create both global and local challenges to societies and organizations. The Western World´s transportation system is dependent on oil, a limited natural resource that has a detrimental impact on the environment. To curb harmful impacts and maintain economic growth, alternative energy methods need to be incorporated into the transportation system. Electric mobility (e-mobility) is a solution to consider in order to reduce greenhouse gas emissions and oil dependency. The establishment of charging infrastructure is essential to the diffusion of e-mobility.

Purpose: The purpose of this report is to design a business model for E.ON to diffuse electric mobility infrastructure. The model will focus on incentives for Real Estate Developers and Parking Garage Owner to install charging infrastructure. It will be based on End-User demand and preferences, as understood through an analysis of similar projects and interviews, with Real Estate Developers, Parking Garage Owners, e-mobility experts and pilot project participants. Alexander Osterwalder's book *Business Model Generation*, will be used as a guide to create the business model for the case of Hyllie in Malmö, focused on greenfield developments, with the feasibility of scaling to a national level for the Swedish market.

Method: Data was gathered through primary and secondary research methods. Primary research included interviews with Real Estate Developers, Parking Garage Owners, an e-mobility expert, car retailers as well as a Business Model Canvas workshop with E.ON Sverige. Secondary research included the examination of existing e-mobility projects within Europe to determine key success factor and challenges to e-mobility. Limitations within the collected data were recognized and addressed accordingly.

Conclusions: Using the key-findings in the synthesized data, and feedback from E.ON, three different business models were designed. Each model has a different focus to accommodate different approaches to diffuse e-mobility and incorporate Parking Garage Owners and Real Estate Developers to different extents.

The different Business Models were compared based on a variety of categories, including a financial analysis, appeal of customer incentive structure, and effectiveness of the diffusion of e-mobility infrastructure. Comparing the three Business Models in terms of risks, limitations, opportunities and challenges, Model #3 was identified as the most feasible and effective for the diffusion of e-mobility. It addresses key findings from the research data and focuses on Real Estate Developers.

The model offers an incentive structure which addresses, financial, information and structural barriers for the key players. By targeting intermediaries like Car Dealers, key players like Real Estate Developers and End-Users, the model creates both a push and a pull in terms of e-mobility demand. Financially speaking it hits break-even sooner than other models and requires low initial investment.

Key words: Business Models, Business Model Canvas, E-mobility, Sustainability, Infrastructure, Hyllie, E.ON, Charging Box, Electricity, Energy, Customer Incentives, Electric Vehicles, Electric Cars and Charging Infrastructure.

This thesis has been written as a part of the degree project course in the Masters program “Sustainable Business Leadership” at the School of Economics and Management, Lund University. The course was based on the methodology of action learning and self managed learning. The students were all assigned to an in-company project as consultants. As a part of course the students were responsible for organizing several learning events addressing relevant issues related to the in-company projects. The students continuously documented their learning in learning journals and participated in tutorials on these journals. The assessments of the students are done partly on the written thesis, partly on the consultancy process, partly on performance in learning events and other parts of the course and partly on the ability to document and reflect on the student's individual learning and development.

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Executive Summary

This report presents three business models with the purpose of diffusing electric mobility infrastructure, and ultimately, creating demand for this new technology. The models incorporate incentives for Real Estate Developers and Parking Garage Owners to install charging infrastructure on their properties as well as incentives for End-Users, to purchase e-mobility solutions. The business models have been designed for the greenfield development of Hyllie in Malmö and are scalable to the rest of Sweden. The developed Business Models were designed using *Business Model Generation* by Alexander Osterwalder and Yves Pigneur (2010) as a guide.

Data was gathered through primary and secondary research methods. Primary research included interviews with Real Estate Developers, Parking Garage Owners, an e-mobility expert, car retailers as well as a Business Model Canvas workshop with E.ON Sverige. Secondary research included the examination of existing e-mobility projects within Europe to determine key success factor and challenges to e-mobility. Limitations within the data collection methods were recognized and addressed accordingly.

The collected data identified key findings and trends in the e-mobility sector. Analysis of the trends of the national market identified Sweden's population as highly IT-literate, with an interest in adopting new and clean technology, and a general interest in environmentally friendly solutions. At its current stage, the e-mobility market is not fully structured and opportunities for new entrants exist. The supply of energy for charging solutions however, is limited to new entrants due to the high capital investments required for energy production. Existing competitors on the Swedish market were identified as Vattenfall, Fortum and Göteborgs Energi, which all provide e-mobility charging solutions.

Through the interviews with Real Estate Developers and Parking Garage Owners, a general awareness of e-mobility among respondents was identified. The participants stated that the installation of Charging Boxes would not increase the value of their property, but when demand for e-mobility increases that could change. The investigation of current e-mobility projects illustrated that electric vehicles are in the introductory stage and identified key success factors, common to multiple e-mobility projects. Key findings from primary and secondary research are summarized below:

Success factors of e-mobility projects:

- Unlimited electricity for electric vehicle charging
- Free parking, reduced tolls, taxes and subsidies for electric vehicles
- An overall integrated solution, encompassing everything from energy supply to post-purchase, charging infrastructure maintenance

Conclusions from interviews:

- Block Engine Heaters are not necessary in Southern Sweden, and therefore not installed by Real Estate Developers in the region of Skåne
- Real Estate Developers have no interest in leasing or renting charging solutions, and would prefer to buy the infrastructure
- Real Estate Developers and Parking Garage Owners are interested in cooperating with electricity suppliers to supply e-mobility infrastructure

Various customer incentive theories, based on energy efficiency programs were examined to identify the most effective reward structures to implement in the Business Models.

Three Business Models were designed with different focuses to accommodate various approaches to diffuse e-mobility. Business Model #1 focused on Parking Garage Owners as a key partner, whereas Business Model #2 incorporated both, Parking Garage Owners and Real Estate Developers and Model #3 concentrated on Real Estate Developers. A crucial component of Business Model #3 is the incorporation of car dealers to help diffuse Charging Boxes, and sell e-mobility solutions as a key partner.

Business Model #1 was identified as the model most likely to create immediate awareness about e-mobility, but does not fully maximize End-User plug in time. Model #2 is easily adaptable all over Sweden, and addresses E.ON's interest of entering the e-mobility market with Smart Block Engine Heaters (SBEH) however, it presents a higher financial risk than Models #1 and #3. Model #3, creates a push and pull demand for e-mobility by incorporating both Real Estate Developers and Car Dealers, but is highly dependent on the willingness of Car Dealers to cooperate with E.ON.

A highlight of Business Model #2 and #3 is a Behavioural Based Billing System (BBBS), which rewards End-Users for parking and plugging in their vehicles in times of low electricity demand. A component that is consistent over all three Business Models is an E.ON smart phone application, called the E.ON App. It contains various features for the End-User, to increase convenience and expand E.ON's customer base. Additional to the BBBS, some of the suggested features include: a customer profile, referral bonus system, charging box metrics, remote charging box access, parking garage locator and bundling with other E.ON services

In conclusion, three different Business Models for the diffusion of e-mobility have been created. Addressing the risks and limitations, as well as the opportunities and potential of partnerships, Business Model #3 has been identified as most feasible due to the potential to create e-mobility demand, despite its lower initial investment.

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1 Background Information

The following section provides general information about e-mobility and key project definitions.

Climate change and limited natural resources are growing concerns that create global and local challenges to both, society and organizations. The Western World´s transport is dependent on oil, a limited natural resource that has detrimental environmental externalities. To curb the harmful impact and maintain economic growth, alternative energy methods need to be incorporated into the transportation system. A possible sustainable solution to reduce dependence on oil and reduce emissions is the introduction of electric mobility, (e-mobility) referring to vehicles running on plug-in electricity as their primary energy (FiA, 2011). The creation of charging infrastructure is essential to the development and social acceptance of e-mobility. This charging infrastructure includes Charging Boxes which enables End-Users to plug-in their cars in order to charge the vehicle battery.

It is important that the infrastructure is readily available when demand is increased to facilitate the transition. Technology shifts also introduce challenges and present opportunities for new players to act as suppliers within newly established value chain structures. Key players in the transition to e-mobility are energy companies who have the opportunity to capitalize on new business opportunities.

One of the companies entering the e-mobility market is E.ON, which one of the world's largest energy suppliers, with over 30 million customers worldwide. E.ON Sverige produces and supplies electricity and energy related services to approximately one million Swedish customers, with the overall goal to satisfy customer demands and develop an active social and environmental responsibility. This is achieved through helping customers be more energy efficient and the establishment of a growing share of renewable energy to reduce environmental impacts. (E.ON, 2012) E.ON is currently involved in a sustainable greenfield development project in the district of Hyllie in Malmö City where e-mobility will be a key component (Malmö, 2012).

E.ON has requested the design of several Business Model options which will help them enter the e-mobility market. An option of particular interest is the installation of a Smart Block Engine Heater which is a remote control device to warm-up car engines in cold weather, which can be upgraded to a Charging Box. The final Business Model should diffuse charging infrastructure for vehicles and encourage End-Users to maximize the time their vehicles are plugged in. This contributes to E.ON's electric load management, which is the optimization of electricity distribution by regulating demand rather than the power that enters the system.

Multiple Business Models were explored, using the Business Model Generation tools outlined by Alexander Osterwalder and Yves Pigneur (2010). The Models consider Real Estate Developers and Parking Garage Owners as two key actors in the diffusion of e-mobility. A Real Estate Developer refers to a multifaceted business that purchases land, finances real estate and develops property. This could also include development of parking garages in connection with the building. In the context of this report Parking Garage Owners operate and own long term parking facilities such as multi-level parking structures where vehicles are parked for hours at a time.

The analysis of data gathered from Real Estate Developers and Parking Garage Owners together with a study of similar projects forms the base for the Business Models designed for E.ON to diffuse e-mobility charging infrastructure.

A list of projects definitions has been compiled in Appendix A

2 Issues and Challenges

This section outlines the main challenges and hurdles that currently hinder the diffusion of e-mobility.

When a new technology is introduced to the market there are different types of barriers that act against its immediate diffusion. E-mobility faces various challenges including economic, social, environmental and technological aspects.

Economic barriers. High costs associated with e-mobility include the initial investment of an electric vehicle incurred by the End-User, and the high investment costs required to develop a fully functioning charging infrastructure network. Due to the large capital required, there is a hesitation from companies and End-Users to take the first step to invest in e-mobility and therefore create demand. In this cyclical dilemma, End-Users do not want to buy electric vehicles prior to the development of a charging infrastructure network, but many companies do not want to invest in infrastructure without End-Users purchasing electric vehicles.

Social barriers. The limited range of electric vehicles implies that current behavioural habits must be altered to accommodate vehicle battery charging time. Currently, the scarcity of charging stations contributes to End-User concerns about insufficient energy in their vehicles, to reach their destination.

Environmental barriers. Negative externalities related to disposal of used batteries and electricity supplied through burning fossil fuels impact the acceptance of e-mobility.

Technological barriers. Current battery technology, and therefore the range of travel for an electric vehicle, is a major challenge and reinforces economic and social barriers.

Addressing the aforementioned barriers is crucial to identifying methods for E.ON to capitalize on opportunities in the e-mobility market.

3 Purpose Statement

The following section outlines the purpose of this report.

The purpose of this report is to design a business model for E.ON to diffuse electric mobility infrastructure. The model will focus on incentives for Real Estate Developers and Parking Garage Owner to install charging infrastructure. It will be based on End-User demand and preferences, as understood through an analysis of similar projects and interviews, with Real Estate Developers, Parking Garage Owners, e-mobility experts and pilot project participants. Alexander Osterwalder's book *Business Model Generation*, will be used as a guide to create the business model for the case of Hyllie in Malmö, focused on greenfield developments, with the feasibility of scaling to a national level for the Swedish market.

4 Demarcation

The following section establishes the boundaries and limits of the project

Project demarcation:

- Research was conducted on present day views and demand for e-mobility to design a Business Model for the diffusion of charging infrastructure.
- The Business Models have been designed for E.ON, for the case of Hyllie in Malmö, Sweden with the possibility of scaling to a national level.
- Research consists of data collection about other e-mobility projects, E.ON's preferences about business models as per a Business Model workshop and interviews with Car Dealers, Real Estate Developers, Parking Garage Owners and e-mobility experts.
- The Business Models focus on the incorporation of incentives for Real Estate Developers and Parking Garage Owners for the installation of charging infrastructure.
- The Business Models focus on private e-mobility solutions and exclude public transportation.
- The Business Models focus on long term parking facilities.

5 Methodology

The following section outlines the methods used to collect empirical material, their limitations, how they were addressed and the validity of data.

5.1 Required Data

To collect necessary information, the following areas were investigated:

***Preferences* of:**

- *E-mobility Pilot Projects Participants:* to get feedback about their experiences and gain an understanding of user behavior and preferences about e-mobility.

Awareness Levels/Opinions in regards to e-mobility:

- *Parking Garage Owners* and *Real Estate Developers* to understand their perspectives on investment in e-mobility infrastructure and perceived current and future demand for Charging Boxs.

- *Academic e-mobility experts* to identify pilot project participant preferences and other trends related to e-mobility.

- *Car Dealers:* to understand the current level of demand for electric vehicles from the market.

Key success factors of:

- *Similar projects* involving e-mobility to identify positive characteristics and reasons why some projects have failed.

- *Competitors* to understand existing solutions and identify potential areas to establish competitive advantages for E.ON.

5.2 Sources of Data

Primary and secondary research was used to obtain necessary data.

5.2.1 Primary Research

Primary research was used to collect data about End-User preferences, and views of Real Estate Developers and Parking Garage Owners about e-mobility and related infrastructure. Primary data research consisted of:

Interviews with an academic e-mobility expert, Car Dealers, Parking Garage Owners and Real Estate Developers who are pursuing developments in Hyllie.

Interviews were chosen as a source of collecting empirical data as they can be conducted in person and allow for maximum interaction with the respondent. Interviews were conducted in a semi-structured way, allowing the interviewer to freely modify the order of questions to ensure that constructive responses were received. (Bryman & Bell, 2003)

The interview was divided into three different sections to create an order on the topics of the present situation, technology and predictions. The structure was designed based on Becker's (1998) idea that it is in the interviewers' interest to encourage the respondents to tell own stories and describe own experiences of different situations and actions. For further theory on interview construction see Appendix B1.

The language used in the interviews was carefully considered as none of the respondents spoke English as their native language. This was also important as several interviews required translation into Swedish.

All interviews were recorded, and immediately transcribed. The advantage of this approach, according to Bryman & Bell (2003) is that interview impressions are still clear to the interviewers and it is easier to reflect on the respondents answer. This approach also provides the opportunity to analyze data at an early stage. When reviewing the material, themes and trends can be identified, which increases the comprehension of future collected data (Denscombe, 2010).

Qualitative interviews were conducted between April 18 and May 9 and transcriptions are available upon request. For more information on interview questions see Appendix B2.

Feedback workshops with various E.ON departments were conducted to gain insight on E.ON´s thoughts about initial Business Model ideas.

The initial, trial workshop was held at Lund University on April 12, 2012 with members of E.ON's Business Innovation, Sales and Elnät (Grid) units. This was used as a first check-in point with E.ON and progress on Business Model development. As this workshop did not produce the desired results due to the limited experience of the research team facilitators, several key items were identified to incorporate in the second workshop.

The second iteration of a Business Model Workshop was conducted with E.ON on Tuesday, May 8 in Malmö, Sweden. Members representing E.ON's Business Innovation, E-mobility and E.ON Sales were present. Based on the initial trial run, each team member was assigned a role to ensure optimal efficiency and feedback documentation:

- *Main Facilitator and Sub-Presenter:* Presenting two business model overviews, keeping conversation and discussion flowing
- *Sub Facilitator and Presenter:* Presenting a business model overview and overseeing the creation of the Business Model Canvas on the white board.
- *Business Model Canvas Documenter:* Writing down any ideas vocalized by E.ON, even if they did not make it past the brainstorming stage.
- *Meeting and General Comment Documenter:* Taking meeting notes and focusing on gathering as much general data as possible.
- *Strategic Analyst:* Strategically analyzing E.ON's feedback, identifing important phrases and linking them to the approach of each E.ON department present.

For further details about the workshop see Appendix D.

5.2.2 Secondary Research

This method was chosen as a supplement to primary research (Denscombe, 2010) to gain insights about existing and comparable e-mobility projects. This provided the team with the opportunity to use existing data to formulate, crucial interview questions and challenges associated with e-mobility. The information about similar e-mobility projects was collected, categorized and provides E.ON with an overview of successful e-mobility pilot projects in the European market.

For more information on existing e-mobility projects see Appendix C.

5.3 Limitations of Data

It is recognized that limitations to the conducted research methods. The following section identifies these limitations and lists how they were addressed.

5.3.1 Interviews

There were several limitations encountered when conducting interviews.

Respondent Hesitation: Some respondents were hesitant to provide detailed company information as they were aware that the information would be used to develop a business plan for E.ON. To address this challenge, interview questions focused on current market perceptions and demand in regards to e-mobility.

Language: Most interviews were conducted in English, which is the second language of the respondent. The resulting language limitations in terms of sentence structure, comprehension and elaborating on details was recognized. In order to mitigate this, a native Swedish speaker was present for interviews, to ensure that questions or explanations could be conducted in Swedish if required.

Phone connection: During the phone interviews, it was noted that the respondent's tone of voice, and willingness to answer was negatively affected by a poor telephone connection. To address this, in-person interviews were conducted when possible.

Translations and Transcriptions: When interviews were conducted in Swedish, a translation of the transcription was required, which introduces several data processing cycles. To mitigate this, information from Swedish interviews was compared to those conducted in English, to ensure consistency and identify any anomalies.

Estimates of cost: Costs related to e-mobility infrastructure provided to respondents during interviews were estimates and therefore respondent answers about willingness to pay for it cannot be taken literally.

5.3.2 Workshop

Several limitations related to the E.ON Business Model Canvas workshop were identified:

Attendance: Having more members of each E.ON unit may have increased the amount of feedback. This was somewhat mitigated by the trial workshop on April 12, where an additional representative from E.ON Elnät (Grid) was present.

Time Constraint: The workshop was constrained to a time limit of three hours and therefore, some aspects were not given adequate time for full creative development. Due to the refined workshop structure however, the team was able to maximize the amount of brainstorming in the time available.

Facilitator Bias: The facilitator's personal style may have affected or lead the responses and thought process of E.ON personnel in a certain direction. This was addressed by having the sub-facilitator complementing the main facilitator, balancing communications and content.

Participation: Full input and participation was not observed by all participants for the full duration of the workshop. The roles of the documenters and strategic analyst were designed in order to address this challenge.

Structure: A different workshop structure or order of questions may have produced a different set of results. Although this limitation cannot be fully addressed, utilizing Edward de Bono's *Six Thinking Hats* (de Bono, 1985) was used in order to approach the workshop from as many perspectives as possible. For more details on the workshop structure see Appendix D.

Experience: The limited experience of individuals facilitating the workshop and dealing with clients may have restricted the creative process. This was mitigated by a workshop structure which approached the business models in different presentation styles and the assignment of roles in order to complement and document as much information as possible.

5.3.3 Secondary Research

Limitations related to research of similar projects were identified:

Continually evolving technology: As a result of fast paced and constantly changing technology, many pioneering projects in the area of e-mobility were not directly comparable. Consequently, it was a challenge to find similar projects with the same characteristics as in Hyllie, to mitigate this, both successful and unsuccessful projects were identified in similar geographic areas.

High levels of government involvement: An overarching trend amongst the researched projects is a high level of government involvement. Since E.ON is not a government body, it is recognized that some researched projects are less applicable than others in the case of e-mobility in Hyllie. To address this challenge, these projects were used to identify and analyze trends in End-User incentives, rather than profit opportunities.

Availability of information about energy suppliers: The amount of information about the electricity suppliers participating in e-mobility projects was limited and varied depending on project partners. As a result, the consistency of obtainable information varied and was addressed by analyzing the projects as a whole, rather than focusing on one specific category between them.

E-mobility as a new technology: Due to e-mobility and its related infrastructure being in its infancy, the information and related statistics about the success of programs are limited. The same limitation applies for published studies or projected trends for the popularity and acceptance of e-mobility. To address the resulting limitations, and gain consistent information about current market trends, key players such as Real Estate Developers and Parking Garage Owners, were interviewed.

Limited information about unsuccessful projects: The value of lessons learned from unsuccessful projects is recognized, and an attempt was made to identify e-mobility initiatives, which have failed in some way. The limited information about these projects is partially a result of e-mobility being in its infancy. This was addressed by looking at the evolution of successful projects, and identifying the iterative improvements made, looking for patterns, which would indicate any shortcomings of the projects.

5.4 Assessment of the Data Collection

The following section identifies general limitations to the project and addresses the validity of data collected.

It is difficult to predict people's future behaviour, or anticipate how quickly and willingly they will accept a new behaviour. Many interview questions, and therefore deductions of End-User preferences, are based on anticipation of future behaviour. The resulting limitation of predicting future behaviour has been addressed through the development of multiple business models with various incentive structures, to cover as many future behaviours as possible.

The legitimacy of sources was crucial to ensure data validity. The respondents chosen for interviews were a combination of companies involved in the development of Hyllie, obtained from E.ON, and therefore deemed as reliable. A bias should be noted, however, as the companies are aware that Hyllie has a high focus on sustainability and are predisposed to have a positive view of sustainable solutions such as e-mobility. The transcription of the interviews added a high reliability in regards to interview documentation.

To ensure credibility values and statistics used for market segmentation and financial analysis of business models were gathered from vehicle manufacturers or government sources.

The Diffusion of Technology Curve was used to increase the validity of predictions in several sections. This theoretical model describes the rate that innovations diffuse in society and was used to standardize market segmentation predictions and Business Model financial analysis calculations. More information on the Diffusion of Technology Curve is available in Section 6.3 Theory.

6 Theory

The following chapter provides explanations of various theories used as tools for data analysis and Business Model creation.

6.1 Choosing a Business Model Creation Framework

In order to deliver a valid business model, the search for a framework was conducted. Different frameworks analyzed include: Value Network Mapping, Strategy Diamond, the White Space Model and the Business Model Canvas.

Value Network Mapping, designed by Verna Allee, investigates how a company creates value and for whom, in both tangible and intangible ways. The model focuses on how to visualize, map, analyse and optimize an existing network to create value. The aim of this report is to create a future business model based on data gathered through research, and since Value Network Mapping does not explicitly focus on future models, it was deemed inappropriate. (Kastelle, 2012)

The Strategy Diamond is a tool developed by Hambrick and Frederickson and examines the possibilities to integrate innovation and strategy. It takes five elements into account: arenas, vehicles, differentiators, staging and economic logic. In contrast to the Value Network Mapping, this model focuses on developing a strategy however, the framework concentrates more on corporate strategies than business models. (Kastelle, 2012)

The White Space Model has been developed by Mark Johnson in collaboration with Clayton Christensen. It is consists of a four-boxed framework dealing with the customer value proposition and the profit formula while simultaneously looking into the key resources and key processes. These four boxes are merged together by rules, behavioural norms and metrics to insure the balance. This model is however focused on a manufacturing or production process and did not adequately consider distribution channels, partnerships and customer segmentation, required for the project. (Kastelle, 2012)

The Business Model Canvas is depicted in Figure 1 on page 16. This model is used to determine which direction a company should be focusing on by using nine categories or building blocks. These building blocks help create a simple view of the way the organization works by creating a common language. (Kastelle, 2012)

The nine building blocks provide opportunity to be integrated into an environment analysis with knowledge from industry forces, key trends, market forces and macroeconomic forces. For this reason, the Business Model Canvas by Alexander Osterwalder was chosen to act as the central framework when creating a Business Model for E.ON.

6.2 Understanding the Business Model Canvas

In this section the Business Model will be explained using the nine Building Blocks described by Osterwalder and Pigneur (2010). A visual of the canvas and definitions of each block is presented in figure 1.

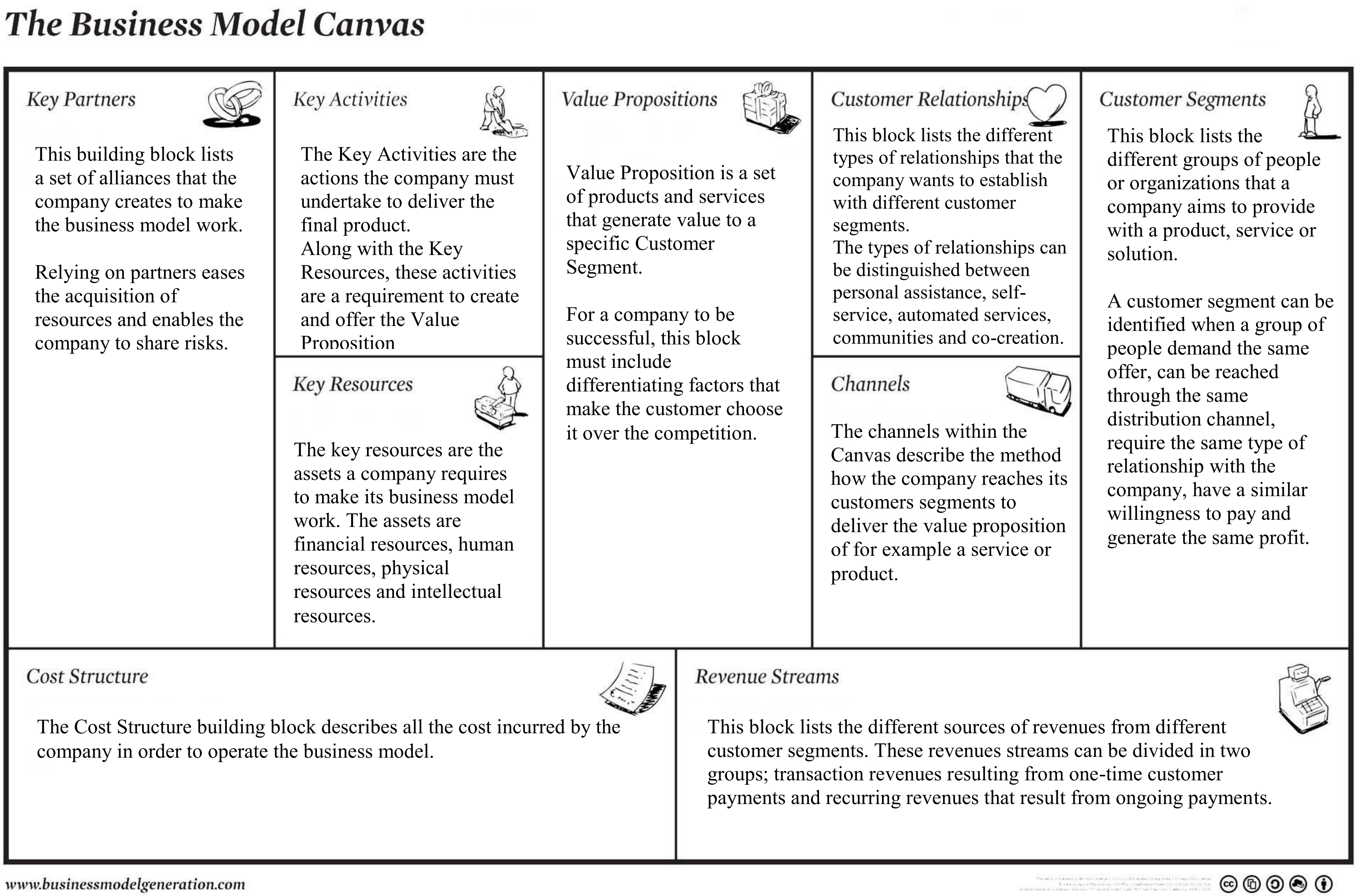

Figure 1 - Definitions of Business Model Canvas Blocks

6.2.1 Limitations of the Business Model Canvas

Several limitations of the Business Model Canvas must be considered. The most visible is the lack of focus of the canvas on social and environmental values. With sustainability coming to the forefront in the business world, it is unrealistic to focus only on financial value (Rosenberg, 2011).

The Business Model Canvas was designed to focus only on one specific point in time, making it difficult to visualize multiple staged business models or crucial opportunities for continuous improvement. The constraints of this specific focus extend to the lack of a canvas block which identifies key performance indicators, which are considered vital for business modeling. (Rosenberg, 2011)

The Canvas does not explicitly show the weight of the factors listed in each block. As an example, when considering the Cost Structure and Revenue Streams blocks, it is difficult to identify which factors have the most effect on the bottom line for the company. This weighting problem is not only a barrier for analyzing quantitative factors but also qualitative factors such as the core competences and differentiating factors that are not explicitly identifiable under the Key Activities and Value Proposition blocks respectively. (Rosenberg, 2011)

The Canvas has limitations identifying connections of the business model components across different blocks. This unspecified linkage might lead to having very similar canvases that represent completely different business models. The canvas relies in excess on the interpretation of the End-User.

Putting a structure in a creative process, may limit innovative thinking. Using the Canvas Model introduces the risk of people being too focused on filling in blocks and forgetting about the practicalities of the business model. A model is always an abstraction of reality and once the nine building blocks are fully filled, it is unclear on how to proceed and transform the canvas in a real life business model.

The Business Model Canvas is a well developed tool to identify the basic components of a business model. It is an effective method of conducting a brainstorming session and gives the possibility to include a large amount of people in the development of the business plan.

6.3 Diffusion of Innovation Curve

In order to conduct the market segmentation and the financial analysis, an approach of how to predict the acceptance of e-mobility technology was required

One approach is the Diffusion of Innovations Curve developed by E. Rogers in 1962. The approach describes the process of diffusion when an innovation is communicated through different channels over time in a social system. A social system in this model is defined as "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 2003).

The model describes the Diffusion of Innovativeness of an individual over the time. The curve divides individuals into categories based on how quickly they adopt new technology. The first category to adopt technology are innovators (2,5 % of all individuals), followed by early adopters (13,5 % of all individuals), early majority (34 % of all individuals), late majority (34 % of all individuals) and laggards (16 % of all individuals). The model is illustrated in Figure 2.

For further use, it must be considered that the Diffusion of Innovations is static and does not account unpredictable processes affecting innovation diffusion such as societal trends.

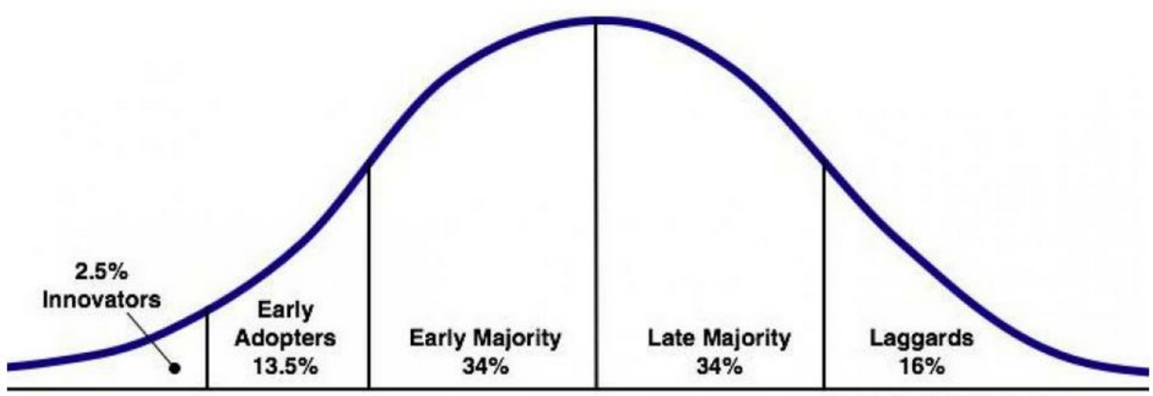

Figure 2 - Diffusion of Innovation Curve (Source: Innovate or Die, 2012)

6.4 PESTLE Analysis

The PESTLE analysis examines the macro-environment factors affecting a company and stands for "Political, Economic, Social, Technological, Legal and Environmental". It is a tool to discover macroeconomic changes such as demographics, government policies, new laws and trade barriers (Gillespie, 2007). When analysing the market, the level at which PESTLE is applied has to be considered in relation to the market being considered. For example in order to create a scalable Business Model, a PESTLE analysis of Sweden rather than Malmö had to be conducted.

6.5 Porter's Five Forces

Porter's Five Forces analysis focuses on micro environmental factors which effect market competition. The model, developed by Michael Porter of Harvard Business School in 1979, analyses the attractiveness of an industry. The investigation considers Five Forces industry rivalry, threat of substitutes, buyer power, supplier power and the threat of entry of new firms to the market. The model does not incorporate complements, the public, and the government and have to take into account in later considerations. An analysis of complementary products was however, included as a Sixth Force, as this component can have a large effect on a product's added value. (Porter, 1998)

6.6 Market Segmentation

A target customer group has been identified through geographic and demographic factors which are based on the assumption that all car owners will be targeted by E.ON's e-mobility solution. The group was further narrowed through psychographic and behavioural factors to identify the most likely customer segments, who exhibit environmental consciousness and are early adapters of technology. For the full Customer Segmentation, see Appendix E1.

6.7 Customer Incentives

In order to identify the most effective End-User reward structure, customer incentive designs were examined. There was a focus on the United States Environmental Protection Agency's (EPA) research into customer incentive models in energy efficiency projects, due to similarities to e-mobility, electricity consumption, and E.ON's aim of increasing customer energy efficiency.

6.7.1 Barriers

One of the key components of designing a customer incentive model is to identify key market barriers. In the EPA's 2010 *Customer Incentives for Energy Efficiency Through Program Offerings*, three main market barrier types are identified:

Structural Barriers: occur when specific key players are not willing or able to support the diffusion of technology to the market.

Financial Barriers: occur when the cost of the new technology is significantly higher than its traditional counterpart.

Information Barriers: occur when End-Users and key players lack the adequate information required in order to understand and make a conscious effort to accept the new technology. (Prindle, 2010)

6.7.2 Incentive Types

There are many different methods and structures for incentive design, ranging from financial incentives and fixed costs, to variable rates for services. A well-designed reward program targets the aforementioned barriers, and encourages public participation in a certain initiative or program. Dowling and Uncles (1997), recommend that a customer incentive system should be designed to encourage the buyer to make a subsequent product purchase. The EPA (2010) argues that a mix of financial and services incentives have the highest success rate when it comes to encouraging participation in energy efficiency programs. A mix of financial and service incentives successfully targets multiple customer segments , but can be resource intensive in terms of administration and technical costs. The EPA (2010) also states that bundled offerings with combinations of financial rewards and technical customer support were the most successful in terms of changing customer behaviour towards increased energy efficiency. Other, non-bundle reward methods include:

- *Direct incentives* such as rebates, subsidies and other immediate financial benefits. These are easy to administer but can result in high costs for the company, if no immediate return is gained or if long term behavioral change does not emerge.

- *Upstream and midstream incentives* provided to key partners in the value chain, such as manufacturers and suppliers who deal with customer. These rewards target multiple steps in the value chain, encouraging a more holistic approach to creating and supplying the demand for a product or service. (Prindle, 2010)

6.7.3 Rate and Price Type

The rate or price type allotted to electricity supply is an integral component to e-mobility, and the future demand for charging infrastructure.

6.7.4 Fixed Rates

Demand charges, which include a special, separate billing charge for electricity use during peak demand have been shown to pose a low financial risk to the energy supplier, while having a high effect on customer energy consumption. Conversely, a flat or fixed-bill rate, which has a constant electricity rate for a set time frame, like a year, has a negligible impact on customer energy consumption. (Prindle, 2009)

6.7.5 Variable Rates

In general, variable rate pricing has a more dramatic effect on customer behaviour than fixed rate prices, as it reflects fluctuating electricity costs, giving customers an incentive to change their behaviour and reduce their activities in peak demand times. Critical Peak Pricing (CPP) charges the customer substantially higher rates of energy consumption during CPP periods, whereas Peak Time Rebates offer a partial refund for reduced usage during CPP times, and pose less financial risk for the customer. Both price types have a low financial risk for the energy supplier and are conducive to both residential and commercial applications. (Prindle, 2009)

7 Presentation of Data

The following section presents the collected data that resulted from different research methods described in Section 5 including key findings, trends and other relevant information to support the development of the Business Models.

The following is a result of an analysis of information gathered from a PESTLE, competitor, industry and market analysis, investigation of existing e-mobility projects, conducted interviews, and customer incentive theory.

7.1 Interviews

The following section represents the major conclusions about how the interviewed Real Estate Developers, Parking Garage Owners and Car Dealers view e-mobility and its infrastructure.

- There is a general awareness among Real Estate Developers and Parking Garage Owners regarding e-mobility.
- Real Estate Developers and Parking Garage Owners did not consider the installation of Charging Boxes would increase the value of their buildings, at the present time. They did, however state that value would be added if the e-mobility demand increases.
- Real Estate Developers and Parking Garage Owners reacted positively towards suggestions of partnerships with electricity companies.
- Block Engine Heaters are not installed in Skåne and should be taken into consideration when scaling the project to northern Sweden.
- Real Estate Developers are not interested in leasing or renting Charging Boxes. Several interview participants stated that they prefer to buy the Charging Boxes.
- Among the car dealers and the test families identified, the short range of vehicles and the high current price of the vehicle was a major barrier to adopting e-mobility.

In general, the respondents were willing to share their views of e-mobility, resulting in significant amounts of research material to analyse. Some respondents were either indifferent or uninterested in investing in e-mobility infrastructure. One Real Estate Developer stated that he has no interest in providing Charging Boxes within his developments. He further mentioned that he only builds accommodations and that an e-mobility solution should be solved by the later tenants.

Parking Garage Owners had different views about the future of electric vehicles. They have an economical viewpoint and stated that e-mobility infrastructure should not come at any cost to them. Real Estate Developers expressed that they expected some financial assistance to subsidize the initial installation of Charging Boxes.

7.2 PESTLE Analysis

The PESTLE analysis presented that Sweden has a high technological development rate compared to other countries (World Economic Forum, 2011). The usage of mobile telephony, IT literacy and Internet in the society is one of the highest within Europe (Foreign & Commonwealth Office, 2012). The analysis also indicates that Sweden has high investments in clean technology and environmental sustainability initiatives. Currently, the transport sector in Sweden contains approximately 16.229 hybrids, 17.850 vehicles fuelled by biogas and 157 purely electric vehicles (The Swedish National Association of Driving Schools, 2011). The PESTLE analysis showed that Sweden is willing to adapt to new, cleaner technology and the high usage of information technology demonstrate the quick acceptance of new innovations.

7.3 Market Segmentation

E-mobility faces a challenge from many existing transportaion solutions such as public tranport, cars with internal combustion engines and hybrid vehicles. The analysis showed that most people live in urban areas and it is concluded that the limitation of electric vehicles in regards to travel distance could have a lower impact on customer behaviour than initially anticipated. (Central Intelligence Agency, 2012) For more details see Appendix E1.

7.4 Porter's Five Forces Analysis

The industry analysis illustrated the current market situation for the e-mobility sector. The key findings are discussed below.

The market seems attractive to new entrants, however it has been discovered that the entry barriers of companies with limited knowledge of the electricity market are relatively high. This is a result of the strict regulation and requirement for larger capital investments required to produce electricity. Though companies with similar knowledge bases can enter the market easier, the strong oligopoly on the market can be threatening, which reduces the number of new entrants able to compete.

The rivalry among the existing players seems high, but as a result of geographically divided areas, E.ON dominates the southern region and has potential to move into competitor's market share due to low switching cost amongst customers when choosing electricity providers. It is important for E.ON to secure loyalty of their customer base through strong incentives, relationships and offering an overall, integrated solution.

The power of suppliers is low, as E.ON supplies the energy they sell and are essentially self reliant in this specific case. Within the e-mobility sector the benefit of strong partnerships with software and hardware suppliers to ensure high quality solutions appealing to end-customers was recognized. Having a strong relationship would also provide E.ON with an advantage when the market demand for electric vehicles increases, ensuring access to required capabilities, resources and experience related to charging infrastructure and e-mobility.

A partnership with Car Dealers to overcome substituting solutions of indirect competition within the transportation sector could be a future opportunity, because of their direct link to End-Users. This relationship can be mutually beneficial, contributing to increased sales for Car Dealers, It should be noted, however that imitating this solution and partnership could be easy for competitors, who have access to similar resources.

7.5 Competitor Analysis

The investigation of E.ON, Fortum, Vattenfall and Göteborgs Energi and their current e-mobility solutions presented a variety of insights. Vattenfall was identified as a key player involved in the development of electric vehicles. Fortum and Göteborgs Energi developed solutions to lend charging stations to their customers. Almost all companies participate in e-mobility demonstration projects to gain knowledge about customer behaviour in relation to e-mobility. Vattenfall and E.ON Sverige focused on smart charging technologies with additional projects to examine the fast charging technology. Key partnerships such as Volvo and Vattenfall, Vattenfall and ABB, as well as Göteborgs Energi and SKF were identified. In conclusion, Vattenfall has made significant contribuitions to promoting e-mobility however, all companies identified e-mobility technology as a future business opportunity.

Oil companies such as Royal Dutch Shell plc and BP plc could also be considered competitors to E.ON. These petroleum companies are indirect competitors because their product is focused on cars with internal combustion engines (ICE). The investigation of oil companies towards e-mobility presented that the companies are not involved or interested in the topic. W. Warnecke, head of Royal Dutch Shell's fuel development, stated that the company see the e-mobility topic only as a hype and they do not see that the electric car will be able to compete against a car with an internal combustion engine. (Brückner, 2009). For further details on competitors see Appendix E2.

7.6 Existing E-mobility Projects

Key success characteristics from existing e-mobility projects have been identified:

Unlimited electricity: Various projects offered free electricity for a set timeframe and in the case of Source London, the program offers unlimited charging for an annual membership fee of £10 at all publicly available charging stations located at various points throughout the city (Shaw, 2011).

Free parking: Incentives for electric vehicles such as free parking in Source London or a fast tracked parking permit application process in Amsterdam significantly increased the acceptance of electric vehicles.

Reduced tolls, taxes and subsidies: This is a general success factor that is identifiable in almost all e-mobility projects. Norway encourages the introduction of electric vehicles with financial incentives such as free public parking for electric vehicles, free use of toll roads, non-recurring vehicle fees, sales tax, and eliminates congestion charge, import duty and vehicle tax. Government or municipality incentives in countries with high vehicle taxes and road tolls, have a significant impact on the acceptance and diffusion of e-mobility. (Kvisle, 2011; Shaw, 2011)

Membership fee: Another noted success factor is the introduction of membership fees for the public use of charging stations. Members of Source London pay an annual subscription fee for various benefits such as access to all public charging stations, parking areas, 100% discount on the Congestion Charge, and a service to locate the closest charging station. (Shaw, 2011)

Unified billing system: RWE in Germany and its sub company Essent in Holland provide its customers a unified and universal billing system. The customers authenticate themselves before they charge their car. The charging station is connected to a control centre that authorizes and measures the energy supply. The collected data, in combination with an existing contract, is used to generate a personal invoice to each customer. The advantage of the system is easy management, control of electricity for the customer and a clear billing system. (Shaw, 2011; RWE, 2012)

Overall integrated solution: RWE for example, provides different charging solutions, customized to each customer's needs. The company installs the Charging Boxes, provides public infrastructure to extend the driving range and gives assistance for planning an optimal infrastructure for companies and optimized use of energy for private customer. (RWE, 2012)

7.7 Customer Incentives

Based on the information gathered regarding barriers, incentives and pay structures, the following components were identified:

S*tructural barriers* will be addressed through a strong focus on incentives for Real Estate Developers. This includes not only financial benefits, but the development of a strong partnership between E.ON and developers, marketing, and use of information to demonstrate the potential benefit of e-mobility infrastructure in the future.

Financial barriers will be addressed by providing education and financial incentive to End-Users and Real Estate Developers. E.ON can capitalize on this opportunity to show the long-term benefits that result from investment in new technology such as Smart Block Engine Heaters and charging stations however, this must be done in a highly visible, and effective marketing campaign.

Information barriers will be addressed through public education campaigns and easily accessible information about e-mobility should be made available to End-Users, in order to ensure future demand. This information should be available in electronic formats, such as websites and smart phone applications, as well as through a dedicated e-mobility help line.

Based on Dowling and Uncles (1997) and the EPA's observations, it is evident that a *multi-faceted, integrated reward structure* which bundles various incentive types with appeal for different market groups would be ideal. It is anticipated that a bundled incentive structure would have the highest success rate in regards to encouraging electric vehicles owners to maximize plug-in time to help with electric load management, and drive e-mobility infrastructure installation via Real Estate Developers.

A *push and pull* for technology demand or behavioural change would be created in an ideal incentive structure

Direct incentives appeal to people's tendency to financial motivation, and would help with the initial diffusion and installation of e-mobility infrastructure.

Upstream and midstream incentives should be considered for key players within the business model, to develop strong partnerships with E.ON, increase the platform of support for e-mobility and increase the amount of channels used to reach End-Users.

8 Analysis

The following section details and explains three different business models created for the diffusion of e-mobility infrastructure.

Three business models for the diffusion of e-mobility infrastructure have been developed based on conclusions and data, presented in Section 7.0. Each model is explained through a schematic, corresponding description, and complemented by a Business Model Canvas and years to reach Break Even. The full financial analysis of each Model and related assumptions are available in Appendix F.

The three business models have different focuses in terms of channels for the diffusion of e-mobility. Business Model #1 focuses on Parking Garage Owners, Model #2 on both, Parking Garage Owners and Real Estate Developers and Model #3 concentrates on Real Estate Developers. In the following section, the term Real Estate Developers is also referred to as ***REDs*** and the term Parking Garage Owners is interchangeable with *PGOs*.

A smart phone application (E.ON App) is incorporated into to all three Business Models and is described on page 43.

8.1 Business Model #1

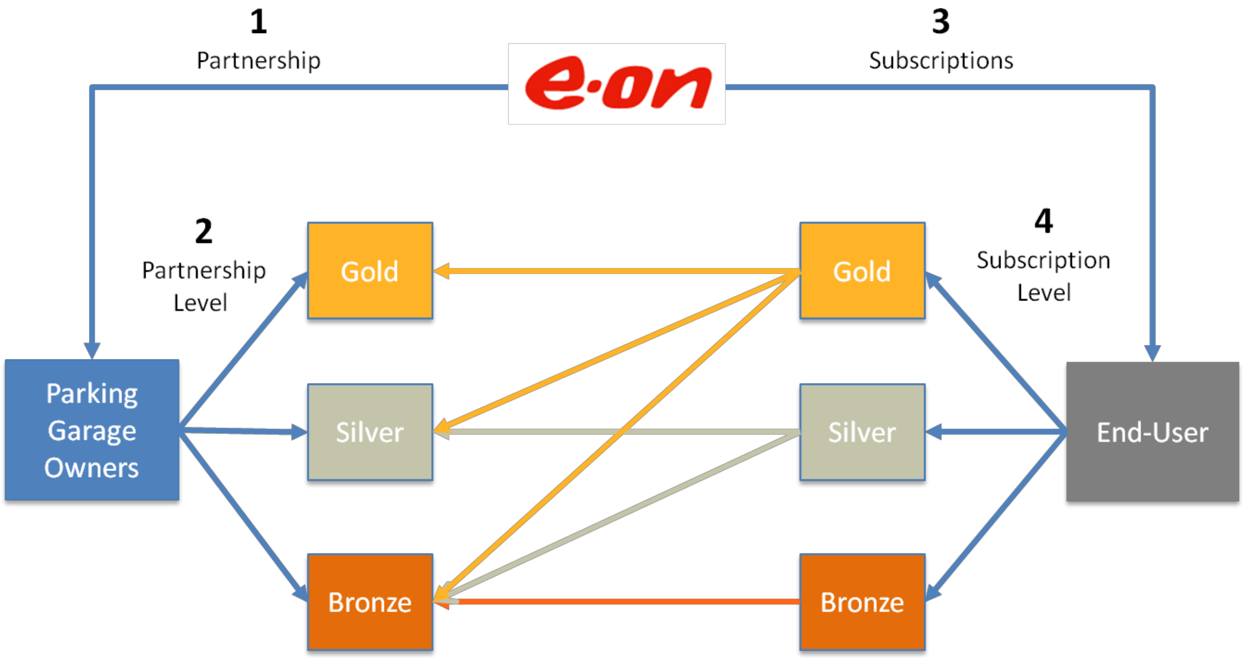

Figure 3 Schematic of Business Model #1

The following section details Business Model #1. The underlined titles correspond to the numbered steps within the model, shown in Figure 3. Italicized words in the description of the model identify key components listed within the nine Building Blocks of the corresponding Business Model Canvas. A full canvas for Business Model #1 can be seen on page 31.

The focus of this Model is to incorporate several key characteristics from successful e-mobility projects, such as Source London, with a strong focus on PGOs as the channel for the diffusion of e-mobility infrastructure.

1. Partnership

In this step, E.ON develops a partnership with *Parking Garage Owners*. E.ON offers to provide free Charging Boxes, corresponding to a percent of the total amount of parking spaces in a garage. In exchange, the *PGOs* agree to provide parking at a discounted rate for electric vehicles. This discounted rate is paid to the *PGOs* by E.ON, rather than the End-User. E.ON covers this cost through *End-User subscriptions*, described in step 4 Subscription Levels.

2. Partnership Level

The partnership level of a PGO determines the amount of free Charging Boxes provided by E.ON described in step 1 Partnership. The three partnership levels, the related parking discount and percentage of Charging Boxes are outlined in the Table 1 below.

Table 1 – Description of Parking Garage Partnership Levels		
Partnership Level	**Parking Rate Discount**	**% of Parking Spots Supplied With Charging Boxes**
Bronze	5%	10%
Silver	15%	20%
Gold	25%	30%

Once a Parking Garage Owner receives a partner level designation, it is advertised on the Parking Garage sign and online. This is a *marketing* opportunity and attracts various subscription level *End-Users*, as described in step 4. Subscription Levels. A *Parking Garage Owner* has the possibility to upgrade their partnership level at anytime, as long as they meet the parking discount criteria.

3. End-User Subscriptions

E.ON offers annual *multiple subscriptions levels* to End-Users. There are three different levels, described in detail in step 4 Subscription Levels. The cost of the subscription is calculated based on the difference in annual fuel costs for an internal combustion engine vehicle and the electricity consumption of an electric vehicle, considering average driving distances in Sweden (Frändberg, 2011). E.ON offers subscriptions which include the cost of *electricity* and access to *unlimited parking* in different parking garages, for less than the annual fuel cost and one parking spot for a diesel fuelled vehicle. Once an End-User purchases a subscription, they receive a Radio Frequency Identification (RFID) card to access the parking garages and the Charging Boxes, for 12 months, after which the subscription requires renewal.

4. Subscription Level

The three *subscription levels increase in cost with Gold being the most expensive.* What they offer to End-Users is described below:

- *Bronze: Unlimited electricity* for electric vehicle charging. Access to Bronze Level parking garages

- *Silver: Unlimited electricity* for electric vehicle charging. Access to Bronze and Silver Level parking garages and three charging station *booking credits* per month.
- *Gold: Unlimited electricity* for electric vehicle charging. Access to Bronze, Silver and Gold parking garages and ten charging station *booking credits* per month.

The charging station *booking credits*, described in the Silver and Gold *subscriptions*, allow End-Users to *reserve charging stations* in desired parking garages. This secures both, the parking spot and Charging Box for the *End-User*. It contributes to *End-User* convenience and sense of security, in terms of being able to recharge the vehicle battery. This service is available online, and contains a complementary map, which locates all parking garages and their partnership level. If either a Silver or Gold subscriber exceeds their booking credits, or if a Bronze subscriber wants to book a charging station, they must pay a *booking fee*.

8.1.1 Risks and Limitations

Business Model #1 has a medium level of risk, as E.ON requires End-User subscriptions to cover the cost of paying the Parking Garage Owners, and it will take some time for a subscription level to be established. This risk is slightly mitigated by the fact that as soon as the subscription base is established, the investment of the Charging Boxes will be paid off. In addition, once subscription levels grow and there is a demand for electric vehicles charging stations, the Parking Garage Owners will have an established relationship with E.ON and the purchase of charging stations can be negotiated. This business model is ideal for long-term parking as the amount of times an End-User will access the parking garage could be easily predicted especially, if the garage is located near an office, for example

8.1.2 Addressing Key Findings and Customer Incentives

This business model uses *Parking Garage Owners* as the main channel for the diffusion of e-mobility infrastructure and is based on the key success factors of a subscription, *unlimited electricity* and parking benefits for electric vehicles. The model is a strong way to increase awareness of e-mobility as it introduces Charging Boxes into parking garages, where they can be seen and accessed by many different people. An added benefit to E.ON is that any End-User can purchase the e-mobility *subscription*, regardless of who their electricity supplier is at home. This means that E.ON is constantly *building a customer base*, increasing *brand trust* and *establishing a relationship with their competitor's customers.*

From a customer incentive perspective, E.ON successfully combats structural barriers from *PGOs* by providing Charging Boxes, but secures themselves financially, as the revenue End-User *subscriptions* cover the associated costs. By negotiating a parking rate discount, E.ON can maximize the profit from annual *subscriptions*, while assuring revenues for *Parking Garage Owners*. A key selling feature of this model is that the presence of charging infrastructure in parking garages will make them more appealing to e-mobility End-Users. This results in a larger amount of End-Users accessing the parking garage, offsetting the slightly lower unit price of a parking spot, ensuring financial stability for the PGOs. By allowing Parking Garage Owners to upgrade their partnership level at anytime, and offering various End-User subscription levels, E.ON provides a solution that appeals to intrinsic motivators such as pride and prestige.

The following canvas (Figure 4) depicts Business Model #1 in a Business Model Canvas.

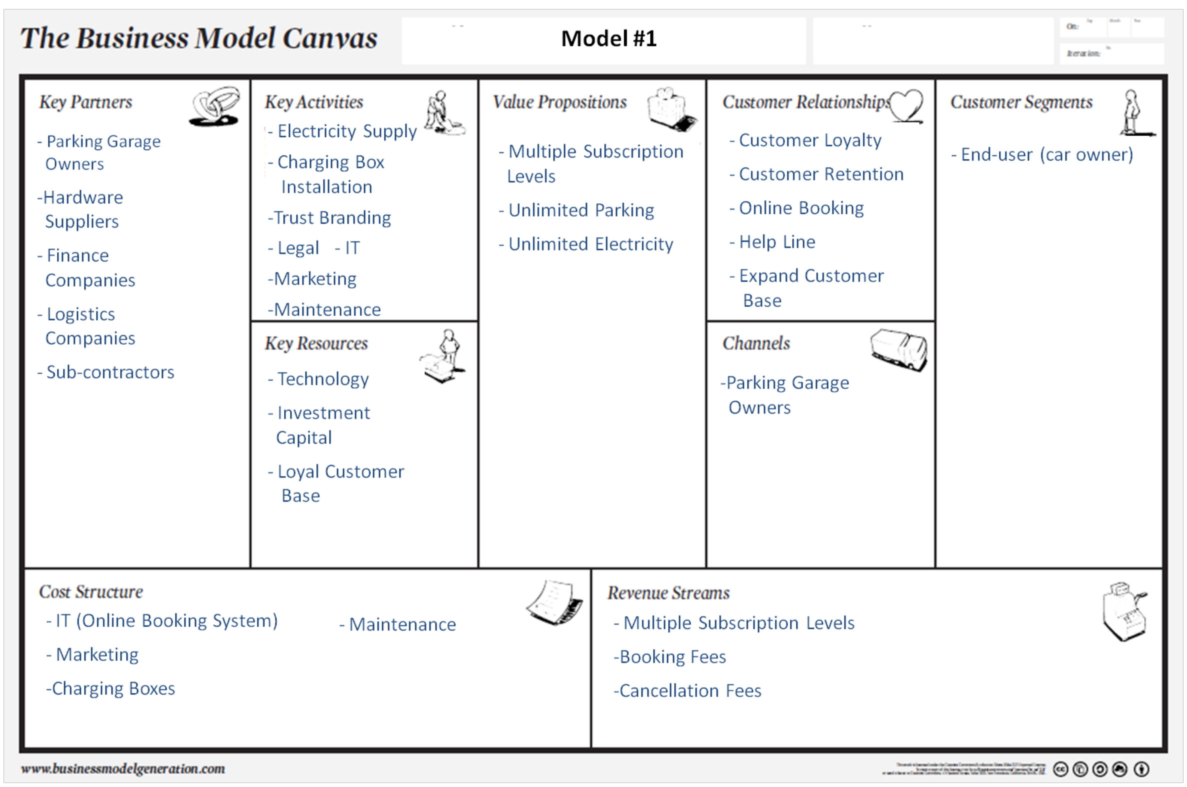

Figure 4 - The Business Model Canvas for Model # 1

Based on a financial analysis (available in Appendix F1), Business Model #1 has a Break Even Point after 3.84 years.

8.2 Business Model #2

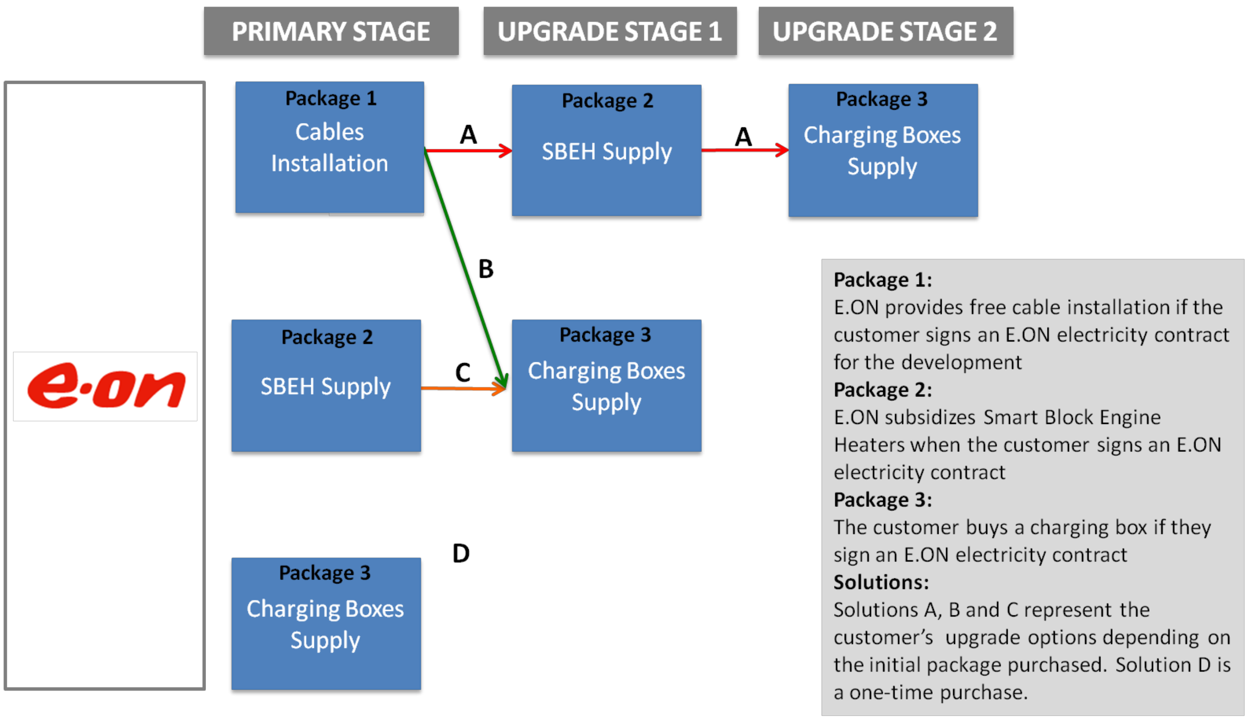

Figure 5 - Schematic of Business Model #2

The following section details Business Model #2. The underlined titles correspond to the Solution Streams from Figure 5. For example Stream A corresponds to the package boxes connected with a red arrows, labeled *A*. Italicized words in the description of the model identify key components listed within the 9 Building Blocks of the Business Model Canvas. A full canvas for Business Model #2 can be seen on page 37.

Business Model #2 focuses on the idea of entering the e-mobility market through the use of Smart Block Engine Heaters (SBEH), which can be upgraded to Charging Boxes at a later time. This model utilizes multi-stage upgrades to integrate e-mobility infrastructure into property developments.

In this model, E.ON develops a Key Partnership with *Real Estate Developers* and *Parking Garage Owners*. They can choose to be part of four different e-mobility solution streams, dependent on the company's preferences and desire to invest in the future of e-mobility. The four different streams are detailed below:

Stream A

In the Primary Stage, E.ON covers costs of *installing the cables* required for future Charging Box installation in 50% of parking spaces, if the *Real Estate Developer or Parking Garage Owner* signs a 3-year contract for E.ON to be the *electricity* supplier for their entire property. E.ON will put an e-mobility awareness sticker on every parking space where *cables* have been installed, alerting and educating the public about e-mobility and the possibility to install a *Charging Box* in that spot.

In Upgrade Stage 1, the *Real Estate Developers*, *Parking Garage Owners* and individual *End-Users* pay E.ON for an infrastructure upgrade to an *SBEH* and own the newly installed hardware. At the upgrade point, a new, 5-year contract with E.ON as the electricity supplier must be signed. If the original, 3-year contract has not reached its term, the new contract over rides it. This Upgrade can happen at any point in time.

In Upgrade Stage 2, the *Real Estate Developers*, *Parking Garage Owners* and individual *End-Users* pay E.ON for an upgrade to a *Charging Box*. At this upgrade point, a 1-year contract with E.ON as the *electricity supplier* must be signed. The End-User owns the hardware and pays for electricity for charging their electric cars using *behavioral based pricing*. This type of pricing determines the cost of electricity based on the amount of time an End-User keeps their vehicle plugged in. Behavioural Based Pricing is present in Business Model #2 and #3, and is described in detail in Section 8.4.1. The upgrade is likely to occur when the demand for e-mobility has increased.

This stream is most likely to be popular in areas where block engine heaters are not required, such as in Hyllie and the rest of southern Sweden.

Stream B

In the Primary Stage, Stream B has the same conditions as Stream A, described above.

In Upgrade Stage 1, the *Real Estate Developers, Parking Garage Owners* and individual *End-Users* pay E.ON for an upgrade to a *Charging Box*. Same conditions apply as in Upgrade Stage 2, for Stream A, mentioned above.

As with Stream A, this package is most likely to be popular in areas where block engine heaters are not required. In order to increase the diffusion of e-mobility infrastructure, it is beneficial to E.ON for the End-User to pursue Stream B over Stream A. In order to incentives this choice, Stream B is less expensive than Stream A, and results in the same *Charging Box* hardware.

Stream C

Real Estate Developer and *Parking Garage Owners* buy and install SBEHs. They pay for the devices, supplied by E.ON at a low cost. In exchange for this *subsidy*, the RED or PGO signs a 5-year contract with E.ON as the *electricity supplier* for the entire development and parking area. In the case of PGOs, the lock-in applies only to the parking structure or garage.

In Upgrade Stage 1 the *Real Estate Developers*, *Parking Garage Owners* and individual *End-Users* pay E.ON for an upgrade to a Charging Box. At this upgrade point, a 1-year contract with E.ON as the electricity supplier must be signed. The End-User owns the hardware and pays for electricity for charging their electric cars using *behavioral based pricing*. This stage is the same as Upgrade Stage 2 for Stream A, with the exception of the cost structure of the upgrade. The standard cost of an *SBEH* is approximately 4 000 SEK and the upgrade to a *Charging Box* is approximately 1 000 SEK. In order to entice End-Users to purchase Stream C, the *SBEH* and upgrade to a *Charging Box*, cost 3 000 SEK and 2 000 SEK, respectively. In this situation, the total costs of the stream are covered, and the End-User has a financial incentive in the Primary Stage.

This package is designed for geographic areas such as northern Sweden, which require the installation of block engine heaters. Since the installation of block engine heaters is required, E.ON does not need to pay for the cable installation in this stream. The attractiveness to buy an E.ON *SBEH,* comes from the financial *subsidy* ease of upgrade to a Charging Box. In addition, the presence of an SBEH is a marketable feature and selling point for REDs and PGOs, because the device increases energy efficiency, and is convenient, as it can be controlled remotely.

Stream D

In the Primary Stage, a *Real Estate Developer* or *Parking Garage Owner* buys an E.ON *Charging Box*. The End-User pays for the electricity required to charge their vehicle with *behavioural based prices*. Stream D has been designed for future e-mobility demand, and is applicable in all geographical areas.

Stream A, B, C and D Insurance

All four e-mobility Solution Streams mentioned above contain the option of the End-User buying E.ON *insurance* to cover vandalism and technical failures of the *SBEH* and *Charging Boxes*.

8.2.1 Risk and Limitations

A limitation in Business Model #2 is that the preferred Charging Boxes used by E.ON have two outlets, and an assumption made is that an individual End-User will have only one electric vehicle. In some situations, it would be beneficial to install a Charging Box with one outlet however, based on information received from E.ON, this would incur a larger cost on the *End-User*, and may not be desirable.

Financially speaking, having two outlets per box poses a risk to E.ON, as an End-User would only pay for half the cost of the hardware upgrade, as they would only be using one of the outlets. If this situation arose, E.ON would have to devise an "outlet lock", so that the second outlet could not be accessed without a End-User paying for the second half of the Charging Box. The question of ownership of a Charging Box with multiple outlets also results in some limitations. In order to upgrade to a Charging Box, an End-User pays for half the box, and technically owns it. However, they would not have the ability to take it with them if they move, as another End-User would be using the second outlet. This is a risk and investment for E.ON, as they are reliant on a new tenant, for revenue via electricity consumption if the first End-User relocates. Otherwise, an "outlet lock" will need to be placed on the *Charging Box*. The outlet, however, can be seen as a free *marketing* tool for e-mobility, as anyone using the parking spot sees that charging infrastructure and is immediately aware of the access to charging infrastructure.

In this model, there are several stages where E.ON provides financial *subsides* to entice End-Users. This however, is a financial risk to E.ON and the full cost of hardware will not be fully covered, immediately. This is particularly true of the Primary Stage in Stream B, discussed earlier.

8.2.2 Addressing the Key Findings and Customers Incentives

Model #2 is an effective way for E.ON to enter the future e-mobility and the current electricity market in northern Sweden, where their presence is less dominant than in Skåne (Anusic, 2008). A key feature of the model is that it secures E.ON's presence in the market when a larger demand for e-mobility is created. The approach of integrating *SBEH* into the Primary Stage of Stream B makes this model easily scalable within Sweden. It is also a beneficial marketing tool, as E.ON aims to increase the energy efficiency of their customers, and a *SBEH* is one way, which this could be achieved.

Business Model #2 addresses various key findings, such as the need for partnerships between *Real Estate Developers* and *Parking Garage Owners*, which includes financial *subsidies*. This multi-stage model also addresses the current low demand for e-mobility but is fully prepared and scalable to different geographic regions.

This model addresses both structural and financial barriers for *Real Estate Developers* and *Parking Garage Owners* not only through subsidies in the Primary Stage, but also through the customization option to purchase a package which best suits the customer at the time. In addition, the upgrade structure effectively addresses Dowling and Uncles (1997) advice to "Devise reward system, which maximizes the motivations of the buyer to make the next purchase of your product". Through strategic pricing and incremental upgrades, End-Users are encouraged to continue purchasing the next E.ON product.

Direct incentives are the dominant reward system in this model, and based on the research data into customer incentives, is something that would appeal to REDs, PGOs and *End-Users*. In addition, *behavioural-based electricity pricing* is not only an effective method to educate people and address information barriers, but intrinsically motivates people to change their behaviour and be more environmentally conscious.

Figure 6 below depicts Business Model #2 as represented by Osterwalder's (2010) Business Model Canvas.

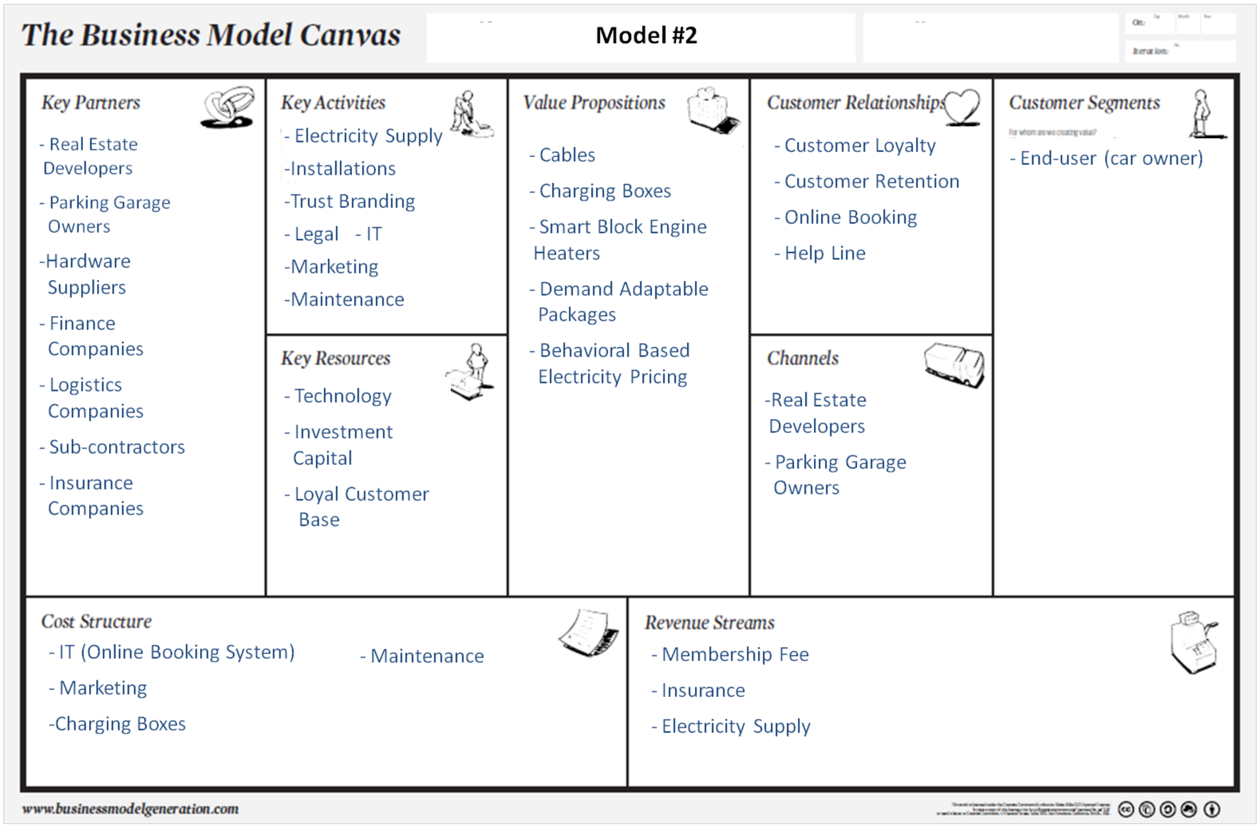

Figure 6 - The Business Model Canvas for Model # 2

Based a financial analysis (available in Appendix F2), Business Model #2 has a Break Even Point after 5.96 years.

8.3 Business Model #3

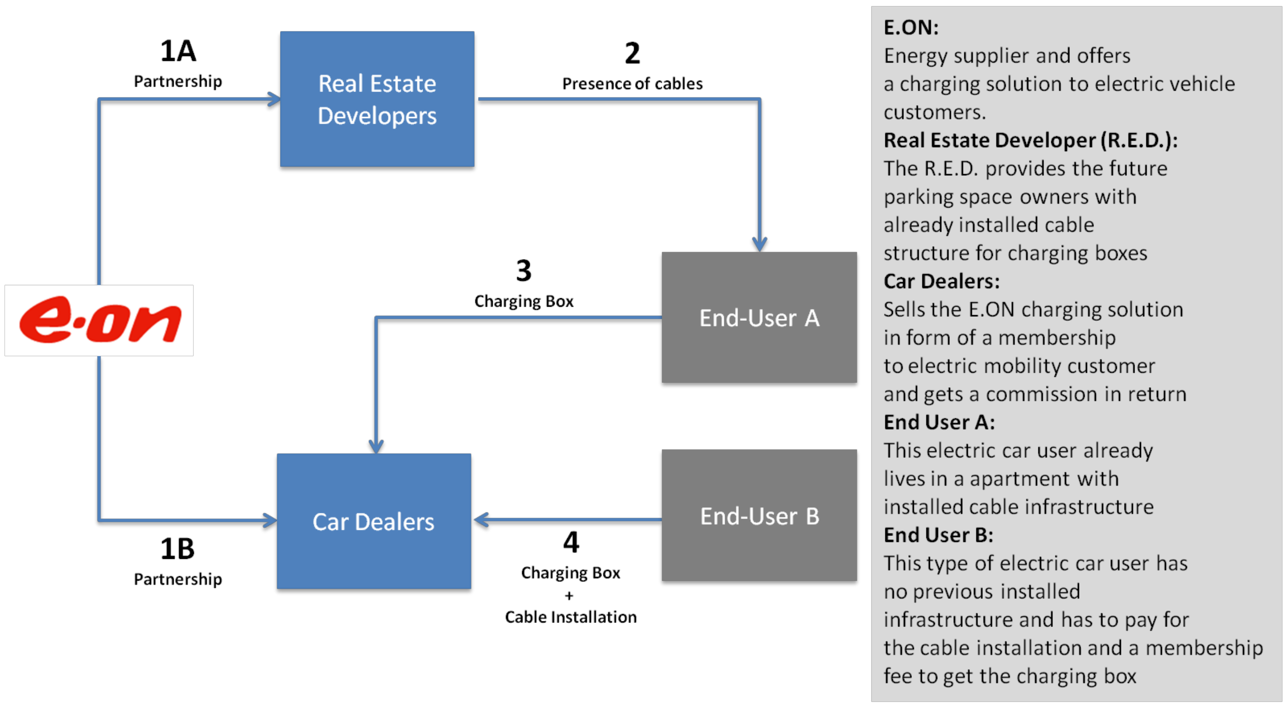

Figure 7 - Schematic of Business Model #3

The following section details Business Model #3. The underlined titles correspond to the numbered links in Figure 7. Italicized words in the description of the model identify key components listed within the nine Building Blocks of the Business Model Canvas. A full canvas for Business Model #3 can be seen on page 43.

Business Model #3 focuses on developing *Key Partnership* with Real Estate Developers and creating both a push and pull for the demand of e-mobility by incorporating Car Dealers into the model.

1A – Partnership (Between E.ON and Real Estate Developers)

E.ON provides Charging Boxes corresponding to 5% of parking spaces, free of charge on the condition that the RED pays for the installation of cables in half the parking spaces within their develop. This ensures the presence of necessary infrastructure for future Charging Box upgrades. An additional condition is that the *Real Estate Developer* signs a contract with E.ON ensuring that future e-mobility solutions for the parking lot will be supplied by E.ON, which diffuses e-mobility and secures future revenue streams. The newly established relationship between the developers and E.ON, contributes to *trust branding* and increases potential for future *electricity supply* agreements. In this step, both parties invest in their future, creating a win-win situation.

The boxes that E.ON supplies to the *Real Estate Developers* in Step 1A are the ownership of the Developers. They can use this hardware at their discretion, to optimize the appeal of their development, for example as a marketing tool, or added feature to the first customers who purchase units on the property. The End-Users who have access to the Charging Boxes identify themselves using a Radio Frequency Identification (RFID) card provided by E.ON. They pay only for the electricity used, which is *billed on a behavioral basis*. This is the same type of billing that was described in Model #2, and further details are available in section 8.4.1.

1B Partnership (Between E.ON's Partnership and individual Car Dealers)

In this step, E.ON has an agreement with individual Car Dealers, who are a channel to sell E.ON's e-mobility packages, customized to different End-User situations:

- *Package A:* monthly *membership fee* and *insurance* (explained below) and Charging Box. Ideal for End-User A, shown in Figure 7, who lives in a development where the cables and underground infrastructure have been installed (See Step 1A).
- *Package B*: monthly *membership fee*, *insurance* (explained below) and Charging Box. This package also includes a one-time cable installation fee.

Monthly membership

The monthly *membership* is a Charging Box leasing fee, which gives the End-User access to the Charging Box via a personal RFID card, which they receive when they sign up for *membership*. It includes Charging Box *maintenance* and access to an E.ON smart phone application. This enables remote controlling of the charging station and shows the End-User their *behavioural based billing* rate. The *membership* also gives access to an E.ON e-mobility phone helpline. For E.ON, the monthly *membership* initially covers the cost of the Charging Box, after which, it is a constant and assured revenue stream. The monthly *membership fees* are inversely proportionally to the length of the customer contract – the longer a customer agrees to pay a membership fee, the less they pay per month.

Insurance

This is an annual fee, which safeguards the End-User from having to pay for any vandalism that may occur to the Charging Box, and is different than the *insurance* for Model #2. The *insurance* gives E.ON an additional revenue stream, and is appealing customers, especially if they are risk averse and do not want to risk paying for Charging Box repairs. Two types of packages are available:

- *E.ON Basic:* protection against vandalism

- *E.ON Preferred:* Package 1 plus added security of a technology upgrade and moving clause, applicable for the duration of the customer contract. The technology upgrade includes the installation of a new Charging Box by E.ON if there is a change in the European standards for e-mobility infrastructure. The moving clause enables the End-User to move once during the subscription time, and E.ON will install a new Charging Box, free of charge. If the customer moves more than once in the contract time, they are responsible for covering the cost of additional Charging Boxes. From E.ON's standpoint, the cost of the Charging Box will be covered over the time interval of the customer's contract, so that E.ON does not suffer financially. In addition, this will create good rapport between E.ON and it's clients. It will help diffuse e-mobility infrastructure because charging infrastructure will diffuse as End-Users change living accommodations. If the new tenant, however, does not have an electric vehicle, E.ON must be prepared to place an "outlet lock" on the charging station and ensure it is not abandoned or vandalized.

Through this partnership, Car Dealers provide a *total solution* for buying electric vehicles. E.ON rewards them through a commission proportional to the length of the customer contract they sell. The Car Dealer, therefore benefits from larger commissions due to increased electric vehicle sales and commission on E.ON's e-mobility package.

2 Presence of Cables

End-User A lives or works in a development which has partnered with E.ON in Step 1A.
Seeing the Charging Boxes that E.ON has supplied, as well as the presence of cables ready for Charging Box installation, End-User A sees the preparatory work and convenience of installation.

This End-User wants to purchase a box for themselves and proceeds to Step 3 Charging Box, listed below. At this point, the demand for e-mobility starts increasing.

3 Charging Box

End-User A, contacts their local Car Dealer to purchase e-mobility solution. Since the cables are already installed in their place of residence, End-User A pays a monthly *membership fee* and *insurance* as described in 1B Partnership (Between E.ON's Partnership and individual Car Dealers).

If End-User A is a company, they pay the *membership fees* for the amount of Charging Boxes leased. This is a reduced fee, inversely proportional to the amount of Charging Boxes requested, and is a *marketing* tool for their employees. The employee using the Charging Box still uses their RFID card but pays only *behavioural-based electricity* prices. Other than the financial benefit, allowing companies to lease Charging Boxes at a reduced fee is beneficial as it allows for company electric vehicle fleets, increasing the presence of e-mobility.

4. End-User B wants an electric vehicle

End-User B lives or works in a development where there have been no cables or Charging Boxes previously installed. As a result of E.ON's partnership with *Car Dealers* (Step 1), End-User B can go to a *Car Dealer* to purchase an e-mobility installation package. This includes a one-time installation fee for cables. Monthly *membership* and *insurance* fees apply, as described in Step 1.

8.3.1 Risk and Limitations

This model does not directly address E.ON's desire to enter the e-mobility market via the installation of block engine heaters. This approach however, was changed to address the absence of block engine heaters in the region of Skåne, as per data collected in interviews. There is some risk to E.ON involved in this business model, pertaining to the *Charging Boxes* having two outlets. If only one person is using the *Charging Box*, they are in theory, paying for half of it and the other outlet is idle. Financially speaking, the first person will continue paying a membership fee, and therefore eventually cover the cost of the Charging Box, but this will result in delayed revenues for E.ON. The idle outlet will require an "outlet lock", as in Model #2, to ensure it is not used until a membership is purchased. As previously stated, the idle outlet can be seen as a marketing tool for e-mobility. If a person sees this free outlet, decides to purchases a *membership* from E.ON, and the first person's *membership* has already covered the cost of the *Charging Box*, the second person's *membership fee* is instant revenue for E.ON.

8.3.2 Addressing Key Findings and Customers Incentives

This model combines the benefits of key partnerships and bundled rewards to provide customers with an integrated e-mobility solution, with a strong focus on customer incentive theory. Free charging stations address the data gathered in research and interviews about Real Estate Developers requiring assistance to take the first steps to invest in e-mobility. Financial incentives for *Real Estate Developers* and investments in the appeal of their properties combat structural barriers, while a strategically designed membership fee doubles as a financing plan to reduce financial barriers.

"E-mobility awareness" stickers on cables provide insight into the ease of installing Charging Boxes and educate *End-Users*. Information about e-mobility and *End-User* behaviour is available through the E.ON App, with *behavioural-based billing* as an attractive feature. This type of billing will educate the public about energy efficiency, create an incentive to follow through with the knowledge and add to E.ON's Corporate Social Responsibility platform. Through inversely proportional membership rates and added *insurance* features, customers are motivated to buy increased access to E.ON service and therefore safeguard revenue streams for the company.

Due to the development of key partnerships, a push and pull for the diffusion of e-mobility is created, and the business model will be effective during varying stages of demand. The combination of *subsidies* by way of free Charging Boxes as direct incentives for initial technology diffusion, combined with midstream incentives, like commission for Car Dealers, create an appealing business model for E.ON, Real Estate Developers as well as End-Users.

Figure 8 below depicts Business Model #3 as represented by Osterwalder's (2010) Business Model Canvas.

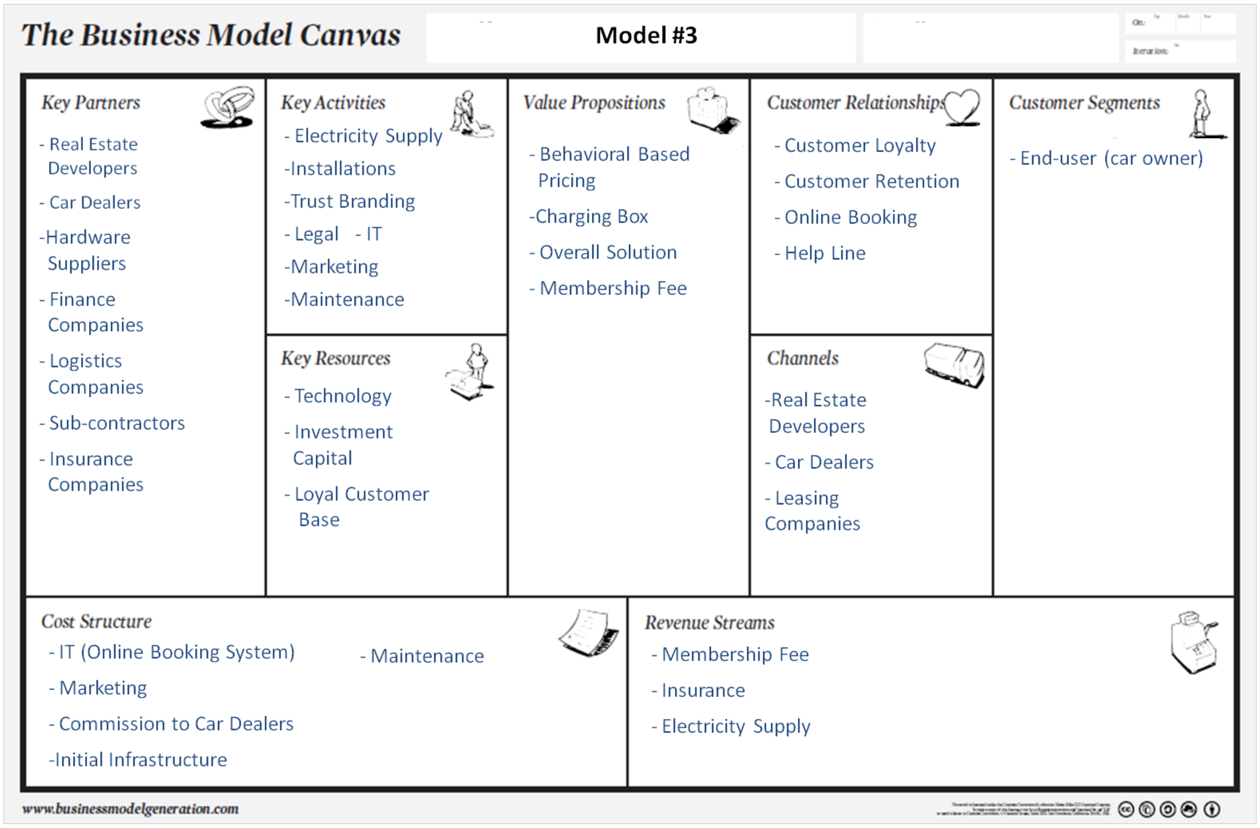

Figure 8 - The Business Model Canvas for Model # 3

Based a financial analysis (available in Appendix F3), Business Model #3 has a Break Even Point after 3.42 years.

8.4 The E.ON App

All three business models include a smartphone application, called the E.ON App. This customer friendly interface is an effective way for E.ON to connect with its customers. This is particularly true in Sweden, which has an extremely high level of IT-literacy, according to the technological trends identified in the PESTLE analysis. The E.ON App provides a channel of constant and easily accessible communication between E.ON and their customers. It also facilitates gathering information for market research purposes, strengthening future e-mobility market initiatives.

The application, available online and via smartphone, acts as a central hub for End-Users to access information about e-mobility, their E.ON subscriptions or memberships and to view their Behaviour Based Billing System (BBBS). The following section highlights several key components of the E.ON App, which complement the business models, and ultimately, the overall e-mobility solution offered by E.ON.

8.4.1 Behavioural Based Billing System (BBBS)

The BBBS is a key feature of Business Model #2 and #3 and motivates people to maximize their vehicle plug-in time. This is vital to E.ON's goal of electric load management. The following figure represents the BBBS visual in the E.ON App, and is explained below.

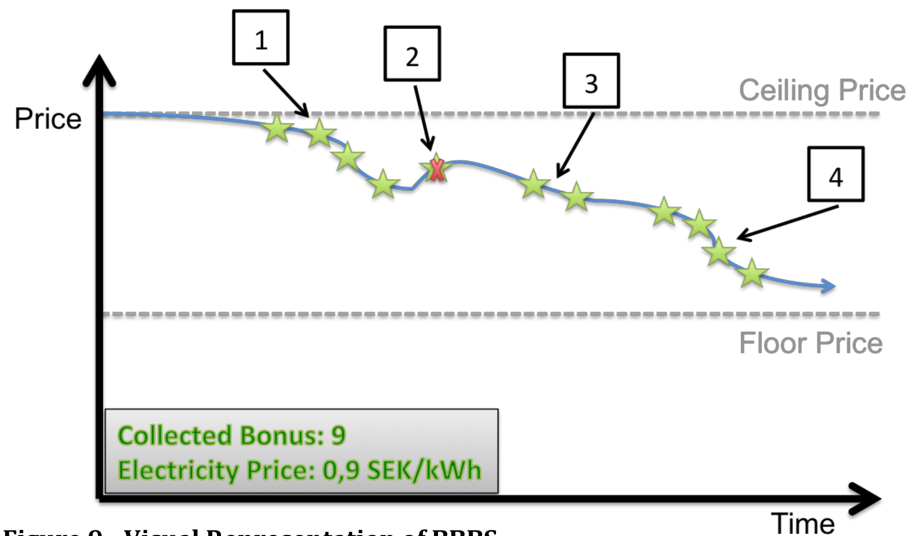

Figure 9 - Visual Representation of BBBS

The BBBS rewards End-Users by lowering the cost of electricity, when they consistently plug-in their vehicle for long periods of time, and increases the cost when they require battery charging during high demand times for electricity. This is represented by the blue line in Figure 9. A ceiling price per kWh established the highest cost possible for electricity, whereas a floor price represents the lowest, and therefore most desirable, price for the customer. These prices are established when the End-User subscribes, or buys an E.ON membership, and are depicted by the grey dotted lines in Figure 9.

In addition to lower electricity costs, the BBBS provides interactive bonus points to reinforce consistent, good behaviour. These are shown as green stars, and point 1 in Figure 9. When an End-User has positive behavioural patterns for a determined time frame, they receive bonus points, which can be used at a time when an End-User must charge their vehicle during high electricity demand or for extremely short periods of time. Therefore, the End-User can take advantage of their past, positive behaviour to safeguard themselves from an electricity price increase, on select occasions. An example of this is found at point 2 in Figure 9, where one of the green stars has been crossed off with a red “X”, and the End-User has lost a bonus point.

Points 3 and 4 on Figure 9 represent repeated positive behaviour of the customer and the collection of further bonus points. When the End-User reaches floor pricing, they continue to earn bonus points for good plug-in behaviour.

The BBBS is an effective public education tool regarding the benefits of energy efficiency, and contributes to E.ON’s Corporate Social Responsibility Platform. E.ON’s Chief Executive, Paul Golby said “Changing energy is what we’re doing – transforming every aspect: how it’s made; how it’s used and society’s understanding of it” (ActionSustainability, 2008). The BBBS directly complements E.ON’s objective.

8.4.2 Customer Profile

The smart phone application should include a customer profile with details about the End-User’s E.ON subscription (Model #1) or membership (Model #3). The profile should include a detailed breakdown of fees, details about insurance and all other legal documents. In the profile, the End-User should also find E.ON’s contact information and have the possibility to renew their e-mobility solution subscription.

8.4.3 Referral Bonuses

E.ON’s referral bonus program is an effective way to connect with End-Users and expand the company’s customer base. A referral program rewards existing customers who successfully refer a new customer to purchase either an E.ON e-mobility solution, or switch their utility supplier to E.ON. The reward could be a reduced membership fee for the upcoming month (Model #3) or additional Charging Box booking credits (Model #2). After a set number of recruited customers, there could be an exclusive reward. From E.ON’s viewpoint, the recruitment through already existing customers is desirable because personal referrals increase brand trust, decrease marketing costs and give E.ON an opportunity to gain customers for other services like district heating.

8.4.4 Charging Box Metrics

The smart phone application provides the End-User with information about the usage of their Charging Box. This includes total energy use, charging patterns, charging location history, and total plug-in time.

8.4.5 Remote Charging Box Access

With the E.ON App, the End-User has the ability to remotely control their SBEH or Charging Box. Features include programming the start and end times or durations for charging or block engine heating based on behavioural patterns such as driving to work at a certain time.

8.4.6 Parking Garage Locator

The parking garage locater is specific to Model #1 and allows the End-User to easily locate a parking garage on a city map, corresponding to their subscription level. It gives directions to the facility, using GPS and notifies the End-User of the availability of charging stations at garage. This feature provides added incentives for End-Users to upgrade their subscription levels as the higher their subscription level, the more parking garages are visible on the map, adding convenience and parking options. End-Users are also able to use this feature to reserve Charging Boxes, either paying the required fee, or using their Charging Box booking credits.

8.4.7 Building with other E.ON Services

The E.ON App has the ability to integrate with other E.ON Services such as home electricity supply, district heating and smart services. This would enable the End-User to control various services and appliances from their smart phone.

8.4.8 Social Media

Social Media opens opportunities to share thoughts and experiences around the e-mobility topic. The E.ON app includes a message or feedback function for End-Users to communicate with E.ON about their experiences about e-mobility and charging stations. This two-way communication builds a relationship between the company and customers and doubles as a customer support system so that fewer resources need to be allocated to a phone line. Additionally, a link to social media sites directly from the E.ON App would provide people the opportunity to share driving patterns and pictures related to e-mobility. Early adopters could use the tool to create hype around e-mobility and promote E.ON's e-mobility solutions.

9 Conclusion

Three different business models with the purpose of diffusing electric mobility infrastructure have been created. The models incorporate incentives for Real Estate Developers and Parking Garage Owners to install e-mobility infrastructure on their properties, and incentives for End-Users to purchase e-mobility solutions.

To gather the necessary empirical data, both primary and secondary research methods were employed. Primary research included interviews with Real Estate Developers, Parking Garage Owners, an e-mobility expert, Car Dealers as well as a Business Model Canvas workshop with E.ON Sverige. Interviews showed a general awareness of e-mobility among the respondents. Other key findings include:

- Real Estate Developers and Parking Garage Owners do not anticipate the installation of Charging Boxes will add value to their properties until the demand for e-mobility increases
- Real Estate Developers have no interest in leasing or renting charging stations and would prefer to buy the infrastructure
- Real Estate Developers and Parking Garage Owners responded positively to suggestions of partnerships with electricity companies to promote e-mobility

Secondary research included the examination of existing e-mobility projects within Europe to determine key success factors, which include:

- Unlimited electricity for electric vehicle charging
- Free parking, reduced tolls, taxes and subsidies for electric vehicles
- An overall integrated solution, encompassing everything from energy supply to post-purchase, charging infrastructure maintenance

Various customer incentive theories, based on energy efficiency programs were examined to identify the most effective reward structures to use in the business models. A combination of direct and midstream incentives with variable rates were identified as the most effective incentive structure to address structural and financial barriers.

Using the synthesized data, and feedback from E.ON, three different business models were designed, each with a different focus. Business Model #1 focused mainly on Parking Garage Owners as a key partner, whereas Business Model #2 incorporated both, Parking Garage Owners and Real Estate Developers and Model #3 concentrated mainly on Real Estate Developers.

A component that is consistent over all three Business Models is an E.ON smart phone application, called the E.ON App. A major component of the E.ON App, and a highlight of Business Model #2 and #3, is the Behavioural Based Billing System, which rewards End-Users for plugging in their vehicles for extended periods of time in times of low electricity demand. Other features in the E.ON App which increase End-User convenience include: a customer profile, referral bonus system, Charging Box metrics, remote Charging Box access, parking garage locator and bundling with other E.ON services.

The three different Business Models were compared based on a variety of categories, including a financial analysis, appeal of customer incentive structure, and effectiveness of the diffusion of e-mobility infrastructure. Business Model #1 is the model most likely to create awareness for e-mobility. Taking into account that the Charging Boxes are in public places, it presents major opportunities for marketing E.ON's infrastructure. It does not however, encourage maximum End-User plug in time, which is desirable for E.ON's electric load management. Although this Model generates awareness, there is the risk of not creating sufficient demand in crucial, initial stages of the introduction of e-mobility. Models #2 and #3 are not as likely to create awareness but are more likely to create demand.

From a financial perspective, Business Model #1 and #2 rely the most on an initial investment to push the demand for e-mobility. Business Model #3 requires less investment, achieves the break-even point the quickest and based on a 10 year prediction, generates more revenues than the other two models.

All three models have potential for national scalability. Model #2 provides the possibility of entering the e-mobility market by first installing Smart Block Engine Heaters with the option of upgrading to a Charging Box. This fact makes it more suitable for Northern Sweden, although the Smart Block Engine Heaters can be incorporated into the other two Models. Model #2 does however, present a higher financial risk to E.ON than Models #1 and #3.

Comparing the three Business Models in terms of risks, limitations, opportunities and potentials of partnerships, Business Model #3 has been identified as most feasible and effective, due to the potential to create e-mobility demand, despite its low initial investment. A crucial component of this Model, based on data suggesting that key partners, additional to Real Estate Developers and Parking Garage Owners, were required is the incorporation of car dealers to help diffuse Charging Boxes and sell E.ON e-mobility solutions. Although this model takes several years to Break Even, this should be expected when considering the diffusion of technology still in its infancy. Model #3 is dependent on the willingness of Car Dealers to cooperate with E.ON however the financial benefits of increased commission are anticipated to address any hesitations. Model #3 creates a push and pull for e-mobility demand, which is crucial to the diffusion of a technology, currently in its infancy.

Business Model #1 and #3 provide the possibility of being implemented simultaneously. This bundling has the advantage of serving customers with different preferences or customers that have the need to access Charging Boxes not only at home, but also in the city. It has the added benefit of targeting both, Parking Garage Owners and Real Estate Developers while including Car Dealers. Although the benefits of incorporating Model #1 and #3, can be identified, more analysis would be required to confirm financial feasibility.

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11 Appendix

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A. Definitions

Application: Also referred to as an app. It is a software applications, usually designed to run on smart phones and tablets.

Block Engine Heaters: A device used to warm-up car engines in cold weather in order to ease the start of the vehicle.

Smart Block Engine Heaters (SBEH): A block engine heater which can be controlled, programmed and activated remotely via smart phone.

Charging Box (CB): Hardware, which facilitates the flow of electricity to an electric vehicle battery, to recharge it.

Customer: Refers to any party that pays E.ON for energy supply services to their development or property. This includes Real Estate Developers, Parking Garage Owners and private property owners

E.ON's Solution: The Business Model that E.ON chooses to implement for the diffusion of e-mobility infrastructure.

Electric Mobility (e-mobility): This refers to any type of vehicle or mode of transportation, which is powered by electricity, and requires a charged battery to function. This can include fully electric plug-in or hybrid vehicles.

Electric load management: The optimization of electricity distribution as done by regulating the demand, or load, instead of the amount of power entering the grid.

End-User: For the purpose of this report, this term refers to someone who uses the electricity supplied by E.ON for e-mobility purposes, by plugging in and charging their vehicles.

E-mobility Infrastructure: Any facilities, systems or technology required for e-mobility. This includes components such as cables, charging boxes, electric plug, but excludes electric vehicles themselves.

Business model: describes the rationale of how an organization creates, delivers and captures value. It demonstrates the logical flow of how a company intends to make money (Osterwalder & Pigneur, Business Model Generation, 2010).

B1. Interviews

In order to design a business model tailored to the preferences of Real Estate Developers and Parking Garage Owners, interviews were conducted with different members of these two sectors. The core theme of the interviews was the respondents understanding of the e-mobility market with a focus on its infrastructure.

The word "why" was avoided in the questionnaire. Studies show that this word can be perceived as threatening and lead the respondents to take a defensive approach. By asking "how?" instead, the question becomes less restricted and the respondents can answer in the way that suits them (Becker, 1998). In this particular project, question to the word "how" provide more useful information for the reason that they generate a more open dialogue.

The interview structure was designed based on Becker's (1998) idea that it is in the interviewers' interest to get the respondents to tell their own stories and describe their own experiences of different situations and actions. This approach encouraged respondents to share their individual understanding and knowledge, helping them focus on the things they identified as significant.

All interviews were recorded, and transcribed, immediately after they were conducted. The advantage of this approach according to Bryman & Bell (2003) is that the impressions are still clear to the interviewers and it is easier to reflect on what was said during the interview. This approach also provides the opportunity to analyze data at an early stage. When reviewing the material one gets the chance to identify and define themes, which increases the comprehension of future collected data (Denscombe, 2010).

According to Denscombe (2010) some answers are predictable, which may introduce bias to the interview structure. It is also possible that the respondent tailors their answer to what they believe the interviewer wants to hear, which leads to distortion of data. Using semi-structured interviews, where respondents are allowed to talk spontaneously with guidance from the interviewer, can reduce these problems (Denscombe 2010).

Another aspect to consider is the risk of respondents not telling the entire truth. The respondents may not fully want to expose the weaknesses and shortcomings that exist in the organization or they may be afraid to be blamed for any perceived errors. It is important to keep in mind that open-ended questions were used, and the result of the survey will not be fully comparable with results from other similar studies. The results cannot be viewed as facts but as an interpretation of the interview material (Denscombe, 2010).

Selection - Respondent Groups

The selected respondent groups were Real Estate Developers, Parking Garage Owners, Car Dealers and an e-mobility expert. Real Estate Developers and Parking Garage Owners were chosen due to E.ON's desire to gain an understanding of their preferences in regards to e-mobility.

Real Estate Developers were contacted through the contact list provided by E.ON. This gave the project team direct access to companies developing properties in Hyllie. Initially, all the Real Estate Developers on the list were contacted via email, where the project was briefly explained and the Developers were asked to do an interview. This was followed up by a call to all the respondents. Almost half of the developers contacted were willing and able to conduct interviews. Two were not interested and did not want to comment. The remaining developers could not be reached and no contact was established.

The two major Parking Garage Owners in Malmö, P-Malmö and Q-Park were contacted. They provided useful insight into the infrastructure already in place and what they anticipate about the future needs for e-mobility infrastructure based on growing customer demand.

Interviews with Car Dealers were conducted because they have first- hand contact with end-users. Four dealers were selected: Volvo/Renault, Toyota, Citroen/Honda and Nissan. These dealers are either currently selling electric vehicle, plug-in hybrids or will be, within the next year.

Contact was also established with the Lund University professor responsible for analyzing the data of E.ON's e-mobility test project in Malmo. Data was extracted from this interview about end user preferences on use of electric vehicles in everyday life.

Design and Structure of Interviews

The design of the interview structure was carefully developed in order to optimize data collection related to the purpose statement. Each question was developed to provide insight and an understanding of the respondent's approach and personal opinion about e-mobility. The interview was divided into three different sections to create an order on the topics: the present, technology and predictions. Bryman & Bell (2003) highlights the issue of comprehensive language when constructing an interview guide. The team carefully considered the use of language as none of the respondents were native English spearkers. This was also important as several interviews required translation into Swedish.

Qualitative interviews were conducted between April 18 and May 9. All interviews were recorded digitally and notes were taken during the interviews in order to remember the non-verbal communication such as gestures and facial expressions. The interviews were carried out using an interview structure that the respondents did not have access to before the interviews, except for IKANO Bostad, who requested a draft of the interview structure prior to agreeing to conduct the interview itself.

Car Dealers were asked whether or not they had any electric vehicle in their product line. They were also asked about customer demand and awareness. The Car Dealers could provide useful information about progress within the industry and challenges regarding electric vehicles related to the presence of parking spaces, electricity outlets and the perceived future demand for e-mobility.

Real Estate Developers were first asked general questions about their developments in Hyllie and what their current relationship with tenants is. The second section of the interview was focused on their awareness of the cost of infrastructure and what it would do to their property if they had it installed. Finally questions about partnering with energy companies were asked.

Parking Garage Owners were asked questions to get insight of their views regarding e-mobility infrastructure and what kind of investments cost they are prepared to make. Focus in both cases was to get an understanding of barriers and opportunities for the diffusion of e-mobility infrastructure.

When the researcher responsible for the test families in the E.ON e-mobility project was interviewed, questions about e-mobility such as whether or not she had any insights from previously successful projects and what was their key for success. In order to identify challenges for e-mobility, the e-mobility expert was asked how to approach various stakeholders. After that, questions were raised about test families in the project. The questions were outlined to cover patterns of behavior, experience, barriers and positive outcomes.

B2. Samples of Interview Questions

Real Estate Developers

1. Do you have real estate projects in Hyllie?
2. What is the reason you want to be involved in developing Hyllie?
3. How do you think that participating in the development of this area will affect the image of your company?
4. Do you build parking spaces in all of your developments? How many per unit?
5. Do you have a connection with your customers once the developments are complete (i.e. resident associations)?
6. Do you have outlets for Block Engine Heating for the car owners within your property development?
7. Does your company consider the future demand for e-mobility and the need for its infrastructure?

    a. YES: In what way?
    b. b. NO: Why?

    The aim of this project is to identify the best way to provide the future citizens of Hyllie with infrastructure that enables them to charge electric vehicles. We want to consider not only the end-user (car owner) but also the Real Estate Developers and Parking Garage Owners that will be a channel for the diffusion of this infrastructure.

8. What impact do you think installing charging boxes in your new developments would have to your properties?

    Block Engine Heaters are a common device installed for cars all over Sweden. Installing outlets in parking spaces to plug BEH is common practice.

    Smart Block Engine Heaters aim to not only save energy but also to enable users to program when they want the motor to be heated and remotely control the device trough a smart phone application.

1. Is your company aware of the cost of smart block engine heaters?
2. Would you be willing to pay for the installation of Smart Block Engine Heaters?
    a. YES: How much?
    b. NO: How come?

c. IT DEPENDS ON THE PRICE: Would you be willing to pay 4000SEK/SBEH

After having SBEH outlets installed, there is the option of doing an upgrade for a charging box that can also be remotely control and enables the user to charge their electric car.

1. Is your company aware of the cost of charging boxes?

The approximate price for the indoor installation of the device (either CB or SBEH) is between SEK 1000-2000 per parking spaces. The price for outdoor installation is between SEK 1000-5000 per parking spaces.

2. Would you be willing to build the infrastructure (cables)?

The approximate price for the charging box is SEK 6000 per CB or SEK 2000 per CB if a BEH is present.

3. Would you be willing to pay for the charging boxes if the underground infrastructure was already in place?
   a. YES: How much?
   b. NO: How come?
4. How do you think having charging boxes installed on your property will affect its value?
   a. Do you think it would make it more attractive/easier to sell?
5. Would you prefer to lease, rent or buy the charging box?
6. What barriers do you see in lease, rent or buy?
7. Would you be interested in collaborating with electricity suppliers in order to provide e-mobility infrastructure?
8. If the infrastructure was installed by a specific electricity supplier would your company be willing to use them as the electricity provider for that development?
9. Would your company be interested in being part of a cross subsidy program with an electricity provider in order to install e-mobility infrastructure? Such as, paying a small portion of the installation cost.
10. If your competitors have electric mobility infrastructure would your company be willing to install charging boxes?

Garage Owners

1. Do you have garage projects in Hyllie?
2. What is the reason you want to be involved in developing Hyllie?
3. How do you think that participating in the development of this area will affect the image of your company?
4. Do you have a connection with your customers once the garages are complete (i.e. maintenance of the garages)?
5. Do you have outlets for Block Engine Heating for the car owners within your property development?
6. Does your company consider the future demand for e-mobility and the need for its infrastructure?
    a. YES: In what way?
    b. NO: How come?

    The aim of this project is to identify the best way to provide the future citizens of Hyllie with infrastructure that enables them to charge electric vehicles. We want to consider not only the end-user (car owner) but also the residential developers and Parking Garage Owners that will be a channel for the diffusion of this infrastructure.

7. What impact do you think installing charging boxes in your garages would have to your properties?

    Block Engine Heaters are a common device installed in cars all over Sweden. Installing outlets in parking spaces to plug BEH is common practice.
    Smart Block Engine Heaters aim to not only save energy but also to enable users to program when they want the motor to be heated and remotely control the device trough a smart phone application.

8. Is your company aware of the cost of smart engine block heaters?
9. Would you be willing to pay for the installation of Smart Block Engine Heaters?
    d. YES: How much?
    e. NO: Why not?
    f. IT DEPENDS ON THE PRICE: Would you be willing to pay 4000SEK/SBEH

After having SBEH outlets installed, there is the option of doing an upgrade for a charging box that can also be remotely control and enables the user to charge their electric car.

11. Is your company aware of the cost of charging boxes?

The approximate price for the indoor installation of the device (either CB or SBEH) is between SEK 1000-2000 per parking spaces. The price for outdoor installation is between SEK 1000-5000 per parking spaces.

12. Would you be willing to build the infrastructure (cables)?

The approximate price for the charging box is SEK 6000 per CB or SEK 2000 per CB if a BEH is present.

13. Would you be willing to pay for the charging boxes if the underground infrastructure was already in place?
    a. YES: How much?
    b. NO: Why not?
14. Would you prefer to lease, rent or buy the charging box?
15. What barriers do you see in lease, rent or buy?
16. Would you be interested in collaborating with electricity suppliers in order to provide e-mobility infrastructure?
17. If the infrastructure was installed by a specific electricity supplier would your company be willing to use them as the electricity provider for that development?
18. Would your company be interested in being part of a cross subsidy program with an electricity provider in order to install e-mobility infrastructure? Such as, paying a small portion of the installation cost.
19. If your competitors have electric mobility infrastructure would your company be willing to install charging boxes?

Car Dealers

1. What is your opinion of electric vehicles?
2. What is your opinion of plug-in hybrids?
3. Do you sell any electric vehicles or plug-in hybrids today? If yes, how many? If no, why not?
4. Do you recommend e-vehicles to your customers?
5. Do you think there is a market for electric vehicles?
6. Do customers show interest in electric mobility?
7. Is there an awareness regarding e-mobility?
8. From a customer perspective, what do you think are the barriers for e-mobility?
9. What are the customers concerns regarding e-mobility?
10. What is the feedback from the ownerss of electric vehicle or plug-in hybrids that you have sold in the past?
11. Who would be a potential customer?
12. What characteristics do they possess? (e.g Environmental conscience, income)
13. Are there any political incentives for buying electric cars?
14. Do you offer any incentives for buying electric cars?

E-Mobility Researcher

1. Currently, there is a chicken and egg problem with electric vehicles and the related infrastructure. In your opinion, which single key player has the most potential to make the first push to successfully diffuse e-mobility and the related technology? (i.e. Government, Infrastructure Suppliers, Electricity Suppliers, Customer Demand, Electric Car Manufactures)
2. In your opinion, what are the biggest barriers for e-mobility in regards to:
   a. Infrastructure?
   b. Car industry?
   c. Government?
3. In your opinion, which are the most successful electric mobility projects in the world?
   a. Why are they successful?
4. In your opinion, which are the least successful electric mobility projects?
   a. Why are/were they unsuccessful?
5. What lessons can we take from them?
6. Is there any technology that can affect the future of e-mobility? What type of technology is this, and why is a competitor to e-mobility?
7. Presently, the demand for electric mobility is scarce. What do you think has to be done to increase the demand?
8. What do you think is the best way to diffuse e-mobility infrastructure?
9. Do you see any potential in the industry for cross-subsidies programs to diffuse e-mobility infrastructure? (example?)
10. How do you recommend that we approach Real Estate Developers that do not want to currently commit with the investment of installing e-mobility infrastructure?
11. From your experience and research, can you suggest any incentives that could be explored in order to encourage the diffusion of e-mobility infrastructure by using Real Estate Developers and Parking Garage Owners as the channel, for this diffusion?

TEST FAMILIES

1. Can you give an overall explanation of what the test family project in Malmo is and what its aims were?
2. How often and for how long did families plug in their cars?
3. What challenges and limitations did families encounter? (i.e. driving range)
4. What positive outcomes did families point out?

5. After this experience, do families want to buy an electric car?
6. Did the opinions of families change over the course of the experience?
7. From this project, can you identify some key incentives that would encourage families to continue using electric vehicles?
8. What would you do differently if you conducted the project right now, or for a second time?
9. What challenges did E.ON encounter that they were not expecting?
10. Where you involved in the installation of the infrastructure? What barriers did you encounter?
11. What is your overall opinion of this project and how it relates to e-mobility?

C. E-mobility Project Analysis

This section contains a description of several successful e-mobility projects and their key success factors. In order to maximize the applicability of the data to the Swedish market, the focus is on projects within Europe. The following section outlines the highlights, key success factors and challenges of e-mobility projects.

Current Projects

Data collection of existing The city of London in partnership with surrounding municipalities created, what is arguably one of the most developed and successful e-mobility projects in Europe, called Source London. The project currently offers 622 charging points, which will be increased up to 25000 by 2015. The 25000 charging points include private and publicly available standard (13-19 A) and fast charging (32 A) stations. The publicly available charging boxes are offered on-street in dedicated parking bays and in car parks. The concept is that the home stations are the main charging points and the publicly available charging boxes are used to "top-up" the battery. (Shaw, 2011)

In the Netherlands a collaboration of several companies founded a project called "Foundation E-LAAD". The goal was to create a publicly accessible charging network in the Netherlands. In contrast to other projects, this project focuses only on public stations. Currently, there are over 1.000 charging boxes available with an end goal of up to 10.000 stations. (E-laad, 2012)

Several cities in Germany, such as Munich, Berlin and Hamburg boast extensive charging station network. In particular, the City of Hamburg partnered with Vattenfall to install 200 charging boxes. In general, the projects are used for market research and technology development. (Vattenfall, 2012; RWE, 2012)

Customer Surveys

The existing e-mobility projects provided first-user evaluations. Owing to the fact that a majority of the projects are still in the introduction stage, the available information has its limitations. However, two projects "Drive eCharged" from BMW in Munich and the collaboration of Volvo and Vattenfall already presented preliminary data. The first project, established in Munich by BMW provided private and industrial users access to 40 Mini E cars, which are fully electric cars. Within 10 months of usage, all cars had a total distance travelled about 300.000 km and almost every user connected the driving of an electric vehicle to a feeling of enjoyment. An interesting insight is that for 88 % of the users, charging at home and at work was more convenient than going to a petrol station. Finally, 79% of the participants agreed that the environmentally friendly aspect is a significant advantage of the electric car. (Automobil Produktion, 2011)

The study of Volvo and Vattenfall presented similar results in terms of participant satisfaction. During 2010, 30 test drivers participated in a study where Volvo provided two V70 plug-in hybrids instead of their ordinary cars. The average use of one car was 1 month per participant. All participants had charging opportunities at home and at work. The study showed that these two places were the most used charging locations. The evaluation presents that 60% of all charging was complete at home and 25% of the charging was at work. Similiar to the Mini E study, the participants agreed that it was more convenient to charge the car where they parked it, compared to traveling to a petrol station.

Positive feedback about environmentally friendly aspect of the electric car was also echoed in this study. In contrast to the BMW project, the participants had concerns about the pure electric driving range, which is 50 km, and almost all agreed that the range was too short. The driving range remains a general concern about the electric car and the participants indicate that this could be a factor affecting the purchase of an electric car. (Tollin, 2011)

Challenges

The Source London project, however demonstrated negative externalities due to its success. The many benefits offered by the project resulted in an increase of people using electric vehicles for commuting purposes, rather than taking public transit. The main preference of the municipalities involved, was for people to choose public transit over private vehicles, and therefore the project was not a total success. The overall goal to decrease the vehicles on the street failed, leading to the removal of the free parking benefit. (Shaw, 2011)

D. Workshop

A business model feedback workshop was conducted with E.ON to creatively collaborate and discuss several business models. The initial, trial workshop was held at Lund University on April 12, 2012 with members of E.ON's Business Innovation, Sales and Elnät units. This was used as a first major check-in point with E.ON and the team's progress on business model development. Based on this trial run, key items to refine for the main workshop were identified:

- Creating a concrete structure to the meeting
- Finding a specific method to facilitate a creative workshop
- Having set roles for team members to ensure a unified message was being communicated
- Presenting key background research
- Presenting several business model ideas to encourage brainstorming

The second iteration of a Business Model Workshop was conducted with E.ON on Tuesday, May 8 in Malmö, Sweden. Members representing E.ON's Business Innovation, E-mobility and E.ON Sales were present.

The structure of the session began with listing the key findings from the team's background research and how they impacted the business model design. This was followed by a presentation of three main business models that the team had developed. Each business model was discussed, critiqued and questioned. The final component of the workshop was a detailed Business Model Canvas discussion about the third model, which was most favourably received by E.ON.

To ensure optimal efficiency and feedback documentation, an agenda for the meeting was designed and each team member was assigned a role:

- *Main Facilitator and Sub-Presenter:* The aim of this person was to present two business model overviews, keeping conversation and discussion flowing, and guide feedback in a way that effectively covered the Six Thinking Hats Method.
    - *Six Thinking Hats:* A technique design by Edward de Bono in order to encourage brainstorming and analysis outside a person's usual thinking style, focus thinking and encourage clear communication. De Bono notes that many people tend to analyse in a very rational way and may overlook creative and intuitive approaches. The method consists of six different "hats" or ways of thinking. The blue hat

represents process control and should be worn by the meeting facilitator who encourages the various thought approaches. The white hats focuses on available data, the red hat on intuition and emotion, and the black hat on pessimism and weaknesses in ideas. Conversely, the yellow hat helps to think in a positive way, reflecting strengths in an idea. Finally, the green hat represents creativity and is present to encourage free brainstorming and free of criticism. (de Bono, 1985)

  - The brainstorming session evolved in a way that covered a majority of the hats with minimal mediation with the pessimistic hat being the only one that required specific direction.

- *Sub Facilitator and Presenter:* This person was tasked with presenting a business model overview and overseeing the creation of the business model canvas on the meeting room white board. The main and sub facilitators were meant to complement each other's dialogue, creating conversation with E.ON without having too many inputs from the remainder of project team which may have introduced bias.
- *Business Model Canvas Documenter:* This role was designed to ensure that the team had an identical copy of the business model canvas in electronic format and on a business canvas page. The documenter was to write down any ideas vocalized by E.ON, even if they did not make it past the brainstorming stage, to enable the team to identify potential creative channels not explored previously.
- *Meeting and General Comment Documenter:* This documenter was to take meeting minutes and focus on gathering as much general data as possible. This data was to be discussed in a team brief to ensure the team understood E.ON´s feedback in a unified manner.
- *Strategic Analyst:* This role was designed and assigned based on previous experience. Due to this person's work experience, their task was to strategically analyze E.ON's feedback, identify important phrases and link them to the approach of each E.ON department present, in order to identify the most important points to refine in the model. Noting body language and tone were crucial to this role.

After the workshop, the team documented their observations. A debrief was conducted where each team member shared their insights and observations about the workshop.

E1. Market Segmentation

A segmentation of the consumer market was required to define the target group. The segmentation was completed by using variables within geographic, demographic, psychographic and behavioral factors. (Kotler, 2002)

The target group has been identified through geographic and demographic factors which are based on the assumption that all car owners will eventually be targeted by E.ON's e-mobility solution. This group will be further narrowed through psychographic and behavioral factors to identify the most likely customer segments.

Table 1 - Segmentation of Geographic and Demographic Factors

Segmentations variables:	Specified (our target group)
Geographic: (Central Intelligence Agency, 2012)	
Country:	Sweden (9 495 113) (SCB, 2012)
Density:	Urban (85% of total population)
Climate:	Temperate in south with cold, cloudy winters and cool, partly cloudy summers; subarctic in north.
Demographic:	
Household size:	1 – 4
- Average household size in Sweden	1.99 (OECD, 2011)
Car owners: (STR, 2011)	4 408 749
- Hybrids	16 229
- Electric vehicles	157
Drivers license in year 2011	6 077 000 (Transport Styrelsen, 2011)
Drivers license between ages 20 to 64	4 546 000 (Transport Styrelsen, 2011)
Income in 2011:	Average SEK 296 000 (Ribe, 2011)
Occupation:	Employed
- Employed people in Sweden	4 028 500 (Statistiska Centralbyråan, 2012)
Education:	Predominately college and university degrees
Social class:	Working class to upper middle class

It has been established that 4 546 000 people between the age of 20 to 64 are registered with a driver's license in Sweden, which means they are potential electric vehicles drivers. With an average income of SEK 296 000, Sweden is classified as a high-income country by the OECD, which together with the high education levels, makes the sale of electric vehicles more likely in terms of price. As a point of reference, a hybrid from Toyota costs between SEK 173 500 – 187 900 (My News Desk, 2012).

Although the segmentation identifies that any household of 1 to 4 people with a car is eligible for an electric vehicle, most Swedish households are on average 1.99. These factors leave the segment with a size of about 4 529 614 potential buyers.

Further narrowing this group by psychographic and behavioral factors provides the following information:

Table 2 - Segmentation of psychographic & behavioral factors

Segmentations variables:	Specified (our target group)
Psychographic	
Lifestyle:	Environmentally oriented
Personality:	Innovators and early adapters
Behavioral	
Benefits:	Green Image, economy, new technology
Usage status:	First-time users, potential users
Usage rate:	Light
Readiness stage:	Little awareness to moderate[1]
Attitude toward product:	Indifferent to positive

Based on the Diffusion of Technology Curve, the customer segments most likely to initially adopt e-mobility are innovators and early adapters. Using this information, 15% of the aforementioned segment size results in 67 944 potential buyers. This number is based on assumptions and is perceived as high.

Through this analysis it has been discovered that there is a potential to create awareness around electric vehicles, which will be embraced. The fact that the attitude toward the product is indifferent to positive shows that more push onto the market is required for e-mobility.

E2. Competitor Analysis

This section will analyse E.ON Sverige's current situation in relation to its closest competitors in the Swedish e-mobility market, which have been identified as Fortum, Vattenfall and Göteborgs Energi.

Fortum

One of E.ON Sverige's competitors on the Swedish energy market is an energy provider primarily owned by the Finish State, called Fortum (Albrecht, 2011). Fortum focuses its operations on Nordic countries, Poland, Russia and the Baltic Rim area (Fortum, 2012). The company provides its customers with over 100 charging boxes for electric cars in Scandinavia. The company offers a complete solution installation, electricity and maintenance for its customers charging boxes. Fortum introduced the concept Charge & Drive that provides recharging services for companies and municipalities. (Fortum 2012)

The installation of charging boxes is available for indoor and outdoor facilities and the stations can communicate through GPRS and 3G. The charging boxes can be accessed by mobile phone, RFID card, and an iPhone App that is available free of charge in the App Store.(Fortun 2012)

Fortum collaborates with the cities of Espoo, Kurikka and Stockholm to develop a charging infrastructure and network, and prepare the company for an extensive introduction of electric vehicles in the upcoming years. The IT system provides customers with information about available charging boxes in Scandinavia, verification and a payment solution all available in the Internet or a smart phone. One of the target customer segments of Fortum is Parking Garage Owners. (Fortum 2011)

In addition to the publicly available charging boxes, Fortum has several demonstration projects. For example, Fortum provided a test field in front of its headquarters in Keilaniemi to investigate different charging boxes types such as 3kW, 50 kW and 250 kW. Fast and ultra-fast charging technologies are tested as they open up the opportunity to charge the car within 5 minutes and could completely change the way car batteries are charged. (Fortum 2011)

Vattenfall

Vattenfall sells charging infrastructure and offers an overall solution which includes pre-studies, planning, electricity, installation and maintenance, as well as security guarantee (Vattenfall, 2012a). The solution is customized to each customer and Vattenfall distinguishes itself from its competitors by offering its solutions all over Sweden (Albrecht, 2011).

Moreover, Vattenfall provides its customers solutions with a Charging Box upgrade if the international charging standard changes (Albrecht, 2011). Similar to E.ON, Vattenfall sees opportunities in upgrading block engine heaters to charging solutions and has been developing smart charging.

What distinguishes Vattenfall from its competitors are the establish partnerships with hardware supplier and car manufacturers. In collaboration with ABB, a Swedish-Swiss corporation, Vattenfall invested in public charging solutions coupled with payment systems a Home Wall Box solution (Tollin, 2011). The Home Wall Box is a smart charging solution with customer oriented services such as control of charging, charging statistics and history, alarms in case of charging problems, and a measurement of energy used (Vattenfall, 2012d). Moreover, the Wall Box, recognizes driving patterns and the user can access the service easily via web-interface, SMS or iPhone App (Vattenfall, 2012d). A second partnership is a joint venture with the car manufacturer, Volvo, to research and develop a plug-in hybrid car based on Volvo's V60 model (Tollin, 2011).

Vattenfall is also involved in several demonstration projects to evaluate the Home Wall Box and the plug-in hybrid Volvo V60. The company anticipates the future demand for fast energy stations and is involved in the development of this technology.

Göteborgs Energi

Göteborgs Energi operates mainly in Western Sweden and provides its customers with energy services, broadband, district heating, cooling, natural and electricity supply network (Göteborg Energi, 2012a). Göteborgs Energi offers a complete e-mobility solution to its company customers and public authorities, which includes the installation and maintenance of charging boxes combined with locally produced wind energy. Similar to Fortum, the company rents out its charging boxes to the customer. The customer has to pay a monthly fee for the charging boxes to use them. Additionally, the customer pays a variable fee that is based on consumed energy. Owing to the fact that the company owns the charging boxes, it guarantees its customers an upgrade if the international charging standard changes. Göteborgs Energi focuses on slow charging boxes rather than smart or fast charging boxes, due to the fact that the company does not see the market demand for these charging technologies. (Albrecht, 2011) The company has partnerships with the Chalmers University in Göteborg, Volvo and SKF a Swedish electronics manufacturer (Göteborg Energi, 2012b)

F. Financial Analysis

The following section details the financial analysis of the three Business Models presented in Section 8. With the aim of comparing the revenues of each model, a standard hypothetical scenario was defined. The scenario chosen was a residential development with 100 apartments and 60 parking spaces. This scenario was chosen due to the fact that in the interviews conducted with Real Estate Developers the project group was informed that the city of Malmo requires a minimum of 0,6 parking spaces per apartment unit.

The energy consumption of an electric vehicle was calculated taking in consideration the average driving distance of 7013,30 km per year in Sweden (Frändberg, 2011). Furthermore, the analysis assumes that the battery of an electric vehicle has a capacity of 25 kWh (BilSweden, 2012), which results in a driving range of approximately 100 km between full re-charging. Therefore, the battery has to be fully charged 70,13 times per year. The average energy consumption per car is 1753 kWh/year. The electricity profit is estimated to be 0,02 SEK per kWh.

F1. Business Model #1

The scenarios in the financial analysis for Model #1 were simulated considering the aforementioned hypothetical scenario (parking lot with 60 parking spaces). It was assumed that after 10 years, there would be 50 customers per parking lot using an electric car and with an annual subscription. Progressive purchase of subscriptions was modeled according to the Diffusion of Technology Curve (see Section 6). The following graphs simulate revenues for end-users with a specific subscription level, parking in garages with the same partnership level. For example end-users with Gold subscriptions only park in Gold level parking garages. This approach was taken to make the financial analysis more comprehensible while including all partnership levels. The Break-Even point is listed in the top right corner of each graph.

The cost of the subscription is calculated based on the difference in annual fuel costs for a diesel and electric vehicle, considering average driving distances in Sweden. Fuel and electricity consumption were based on the top selling car in Sweden (Volvo V70) and the charging of a 25kW electric car battery with a 100 km range, respectively (BilSweden, 2012).

Table 3 Annual driving costs of a Volvo V70 and Peugeot i-ON

		Volvo V70			25kW Electric Vehicle		
Annual Parking Fee in Hyllie (SEK)	Average Mileage/Year in Sweden (km)	Diesel Fuel (SEK)	Fuel Economy (l/100 km)	Cost Fuel/Yr (SEK)	Electricity Cost (SEK/kW.h)	Full Charges/Yr (SEK)	Cost Electricity/ Yr (SEK)
10560	7013,3	14,7	5,5	**5666,4**	0,92	70,1	**1613,0**

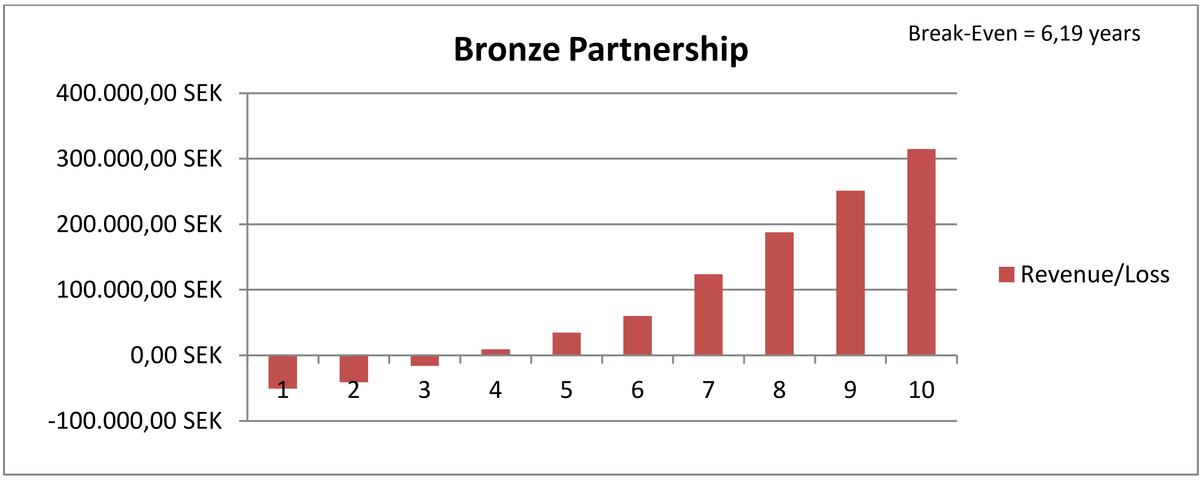

Figure 1: Revenue and Loss for Bronze Partnership in Model #1

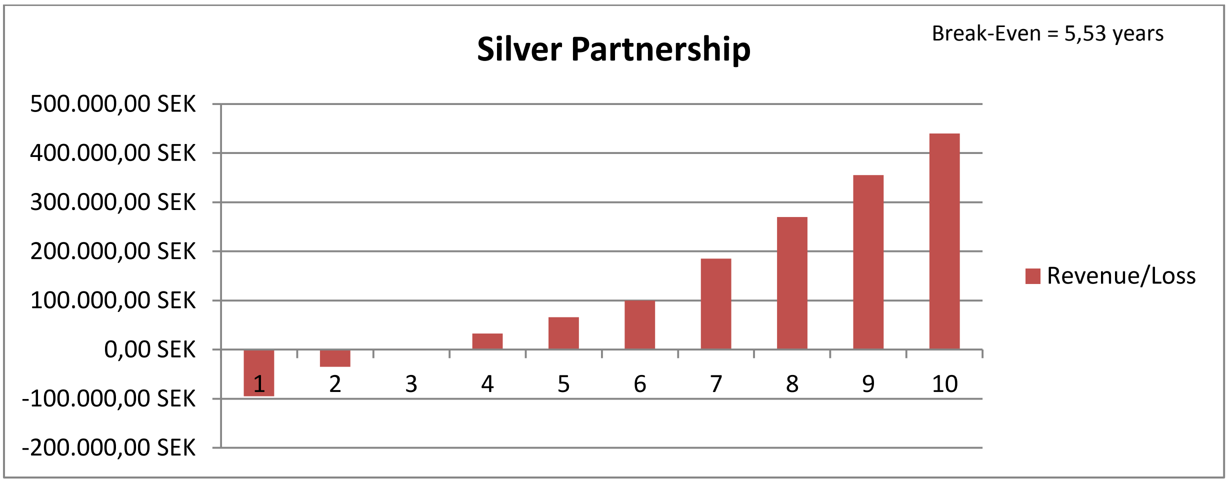

Figure 2: Revenue and Loss for Silver Partnership Model #1

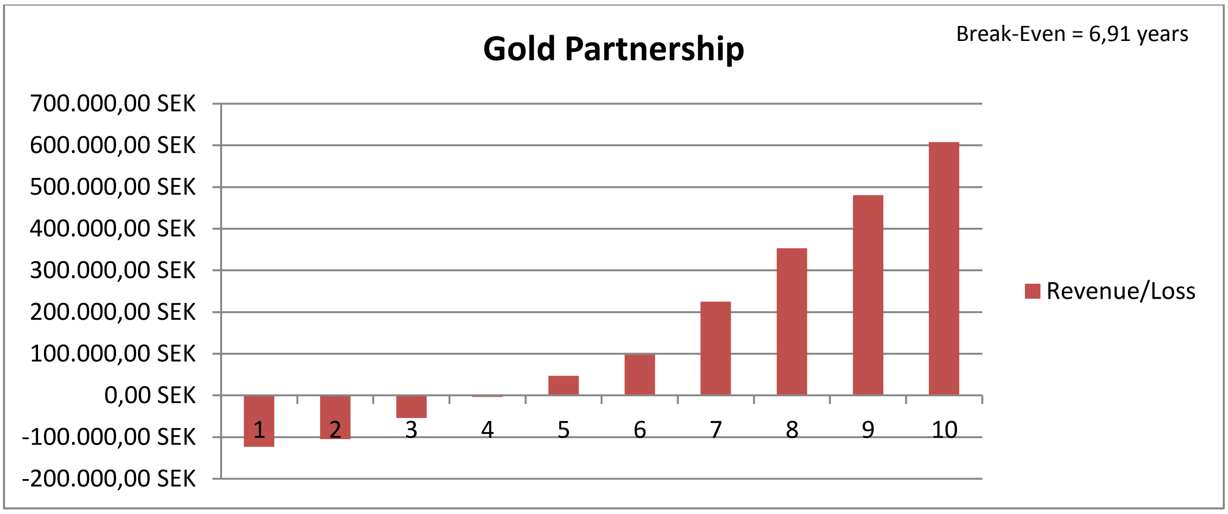

Figure 3: Revenue and Loss for Gold Partnership Model #1

To gain an overall view of the model and the three types of subscriptions were combined in a scenario where three different parking garages each have a different type of partnership level (Bronze, Silver and Gold). Each of these hypothetical parking garages contain 20 parking spaces and 16,7 customers after 10 years. The revenues and losses where summed and are depicted in Figure 4, on the next page.

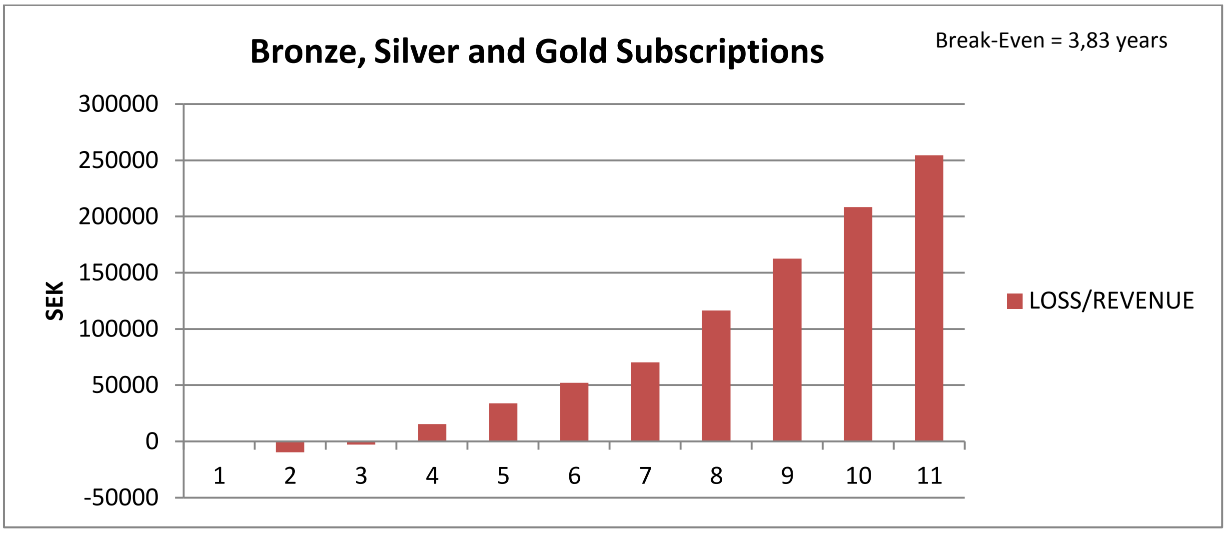

Figure 4: Revenue and Loss for Bronze, Silver and Gold Partnership Model #1

F2. Business Model #2

Each stream, described in Section 8.2, was simulated considering the hypothetical scenario described at the beginning of Appendix F (development with 60 parking spaces and 100 apartments). In Upgrade Stage I and 2 the progressive purchase of Packages 2 and 3 (Smart Block Engine Heaters and Charging Boxes) were modeled according to the Diffusion of Technology Curve. The different streams were first simulated individually and then analyzed all together to see the potential profitability of the model. The Break-Even points are listed in the top right hand corner of each of the graphs.

In each stream the cost of the Central Controller required to remotely operate charging boxes was included and distributed over 10 years.

Stream A

In the first stream of the Business Model, E.ON's investment of installation of cables in 50% of the parking spaces in the development was split over 3 years. This distribution of costs was made due to the fact that in return, the Real Estate Developer signs a 3 year contract with E.ON as their electricity supplier for the property development.

Figure 5, shown on the next page represents the profit and loss for Stream A.

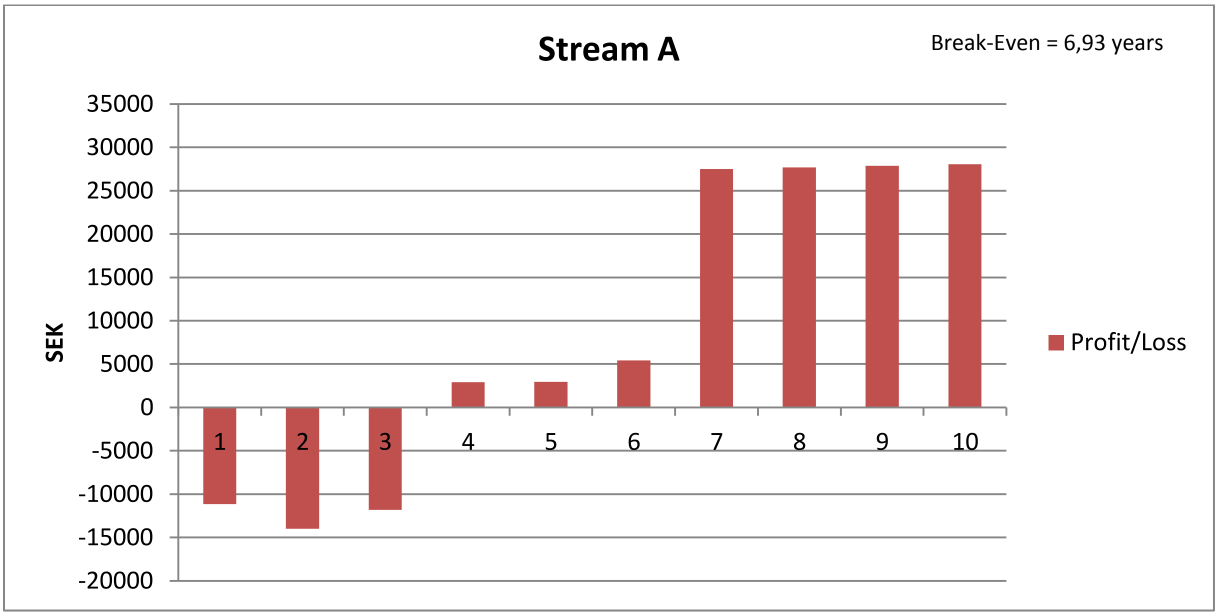

Figure 5: Revenue and Loss for Stream A in Model #2

Table 4 and 5 detail the costs, and sales price of the charging infrastructure available in Stream A.

Table 4 - Costs Related to Stream A

	Cables Installation	Charging Box
Sale Price	-	5.000,00 SEK
Cost	1.000,00 SEK	4.000,00 SEK
Profit	-	1.000,00 SEK

Table 5 - Estimated Costs and Prices for Stream A

	Cables Installation (SEK)	SBEH (SEK)	Subsidy SBEH (SEK)	Charging Box Upgrade (SEK)
Sale Price	-	5000	-	5000
Cost	1000	4000	2000	1000
Profit	-	1000	-	4000

Stream B

In stream B of the Business Model, E.ON's investment on installation of cables in the development was split by the first 3 years. This distribution of costs was made due to the fact that in return the Real Estate Developer locks-in with E.ON as its electricity supplier for that specific development for also 3 years.

The revenue regarding the charging boxes and the electricity supplied to the parking garage was simulated taking in account the aforementioned diffusion of technology curve.

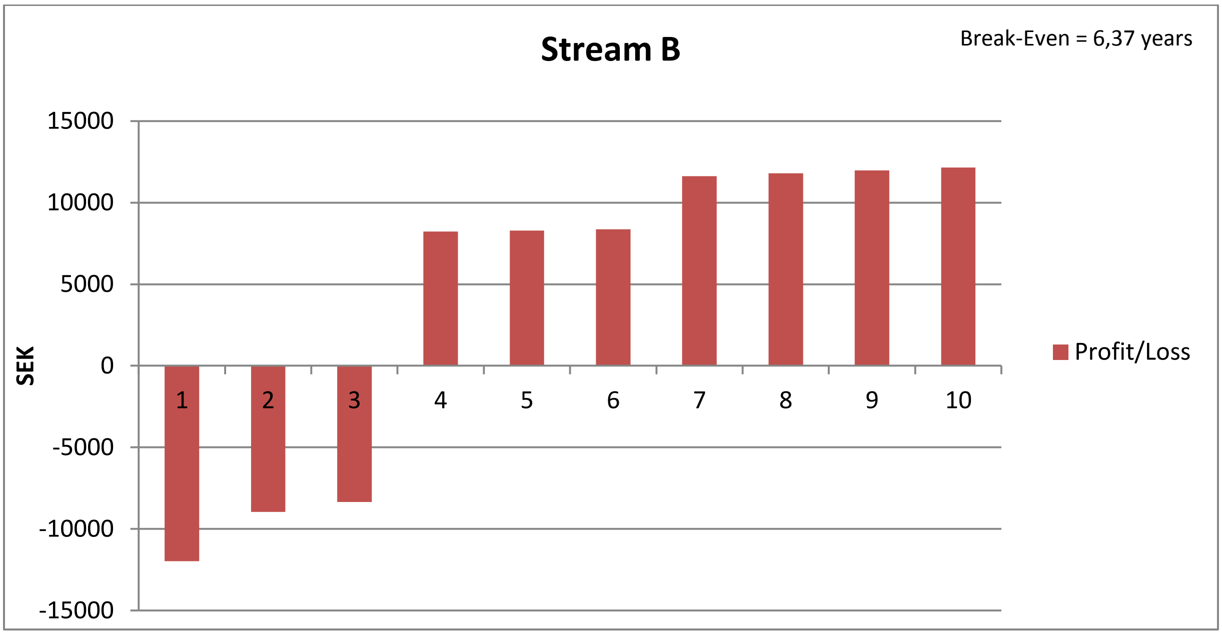

Figure 6: Revenue and Loss for Stream B in Model #2

Costs and prices of charging infrastructure components are the same as Stream A and are provided in Tables 4 and 5.

Stream C

In this stream the revenues of cables installation and the cost of the subsidy provided by E.ON for the installation of SBEH are split by 5 years, due to the fact that the acquisition of the subsidized SBEH by the Real Estate Developers involves a 5 year electricity supplier contract with E.ON.

As in the previous stream, revenues regarding the charging boxes and the electricity supplied to the parking garage were simulated taking into account the Diffusion of Technology Curve. Revenues and Losses for Stream C are depicted in Figure 7.

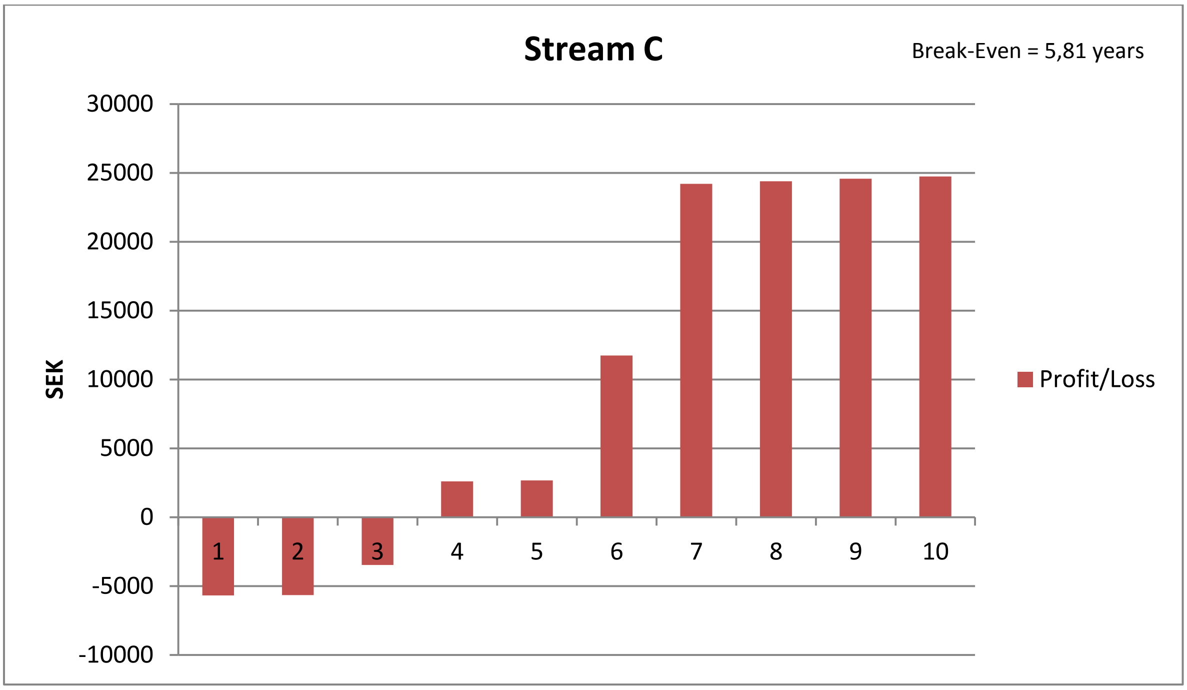

Figure 7: Revenue and Loss for Stream C in Model #2

Table 6 - Costs Related to Stream C

	Cables Installation	Charging Box
Sale Price	1.500,00 SEK	5.000,00 SEK
Cost	1.000,00 SEK	4.000,00 SEK
Profit	500,00 SEK	1.000,00 SEK

Table 7 - Estimated Costs and Prices for Stream C

	Cables Installation	SBEH	Subsidy SBEH	Charging Box Upgrade
Sale Price	1.500,00 SEK	5.000,00 SEK	-	5.000,00 SEK
Cost	1.000,00 SEK	4.000,00 SEK	2.000,00 SEK	1.000,00 SEK
Profit	500,00 SEK	1.000,00 SEK	-	4.000,00 SEK

Stream D

Stream D is tailored for the future and the assumption of high demand for e-mobility, due to this fact E.ON does not provide any subsidies. The installation of Cables and Charging Boxes represents a onetime revenue, is this stream the sale price of the Charging Box is 6000 SEK and the sale price of the Cables Installation is 2000 SEK. This represents a onetime revenue of 60000 SEK.

Combined Streams A, B, C and D

For this model to be compared with Model 1 and 3, the 4 different streams were compiled in one loss/revenue graph. To be able to include the four streams, a situation with 4 different developments with 15 parking spaces and 25 apartments was assumed, so that the total of the streams is the previously assumed 60 parking spaces per 100 apartments.

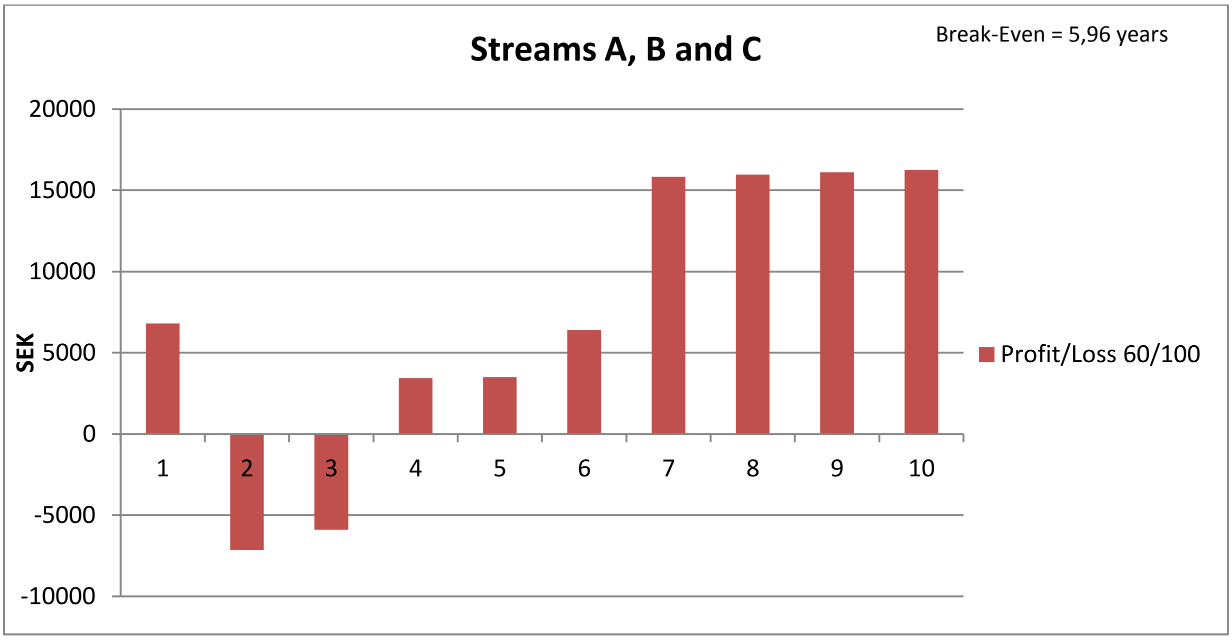

Figure 8: Revenue and Loss for Stream A, B and C in Model #2

F3. Business Model #3

The simulation of the third business model requires the establishment of additional data, which includes the insurance revenue stream, the car dealer commission and the discount for membership fees when buying long-term contracts. The extra revenue stream by offering insurance in combination with membership is based on the assumption that E.ON has a profit margin of 4,7%, according to the profit margin of the insurance company Allianz (Allianz, 2011). The insurance price is determined to be 99 SEK per month. The insurance price is deduced from the Apple IPhone 4S, which has with approximately 5795 SEK (Apple, 2012) a comparable price to a charging box and the mobile telephone provider Telia sells insurances in combination with the iPhone for 99 SEK. The analysis assumes that all people that buy a membership buy insurance as well. Moreover, Car Dealers get a commission on the membership contracts they sell. The costs are calculated with 2% from the membership fee for selling short-term contracts, 4% for middle-term contracts and 6% for long-term contracts. Furthermore, the customer who buys a membership fee gets a discount for signing a long-term contract. The cost of a membership fee decreases by 4% for middle-term contracts and 6% for long-term contracts from the short-term price. The short-term price of a membership is 500 SEK per month.

Figure 9 depicts the profit and loss of E.ON over 10 years by only considering the first stream of Model 3 with End-User A. The evaluation of the calculated values shows the relative high investment in the first year and profits in the later years. The high investment in the beginning is due to the free charging boxes, which are 5% of 30 parking spaces with already installed cables. Furthermore, a remote controller is necessary to access the charging boxes through a smart phone or the Internet. It is also noticeable that in the first 3 years there is small revenue from the small amount of existing electric vehicle owners. The revenue of the stream grew when the amount of memberships increased. The break-even point is achieved after 6,07 years. In year three the Car Dealers sell the first memberships due to the fact that the electric vehicle owners initially use the free charging boxes.

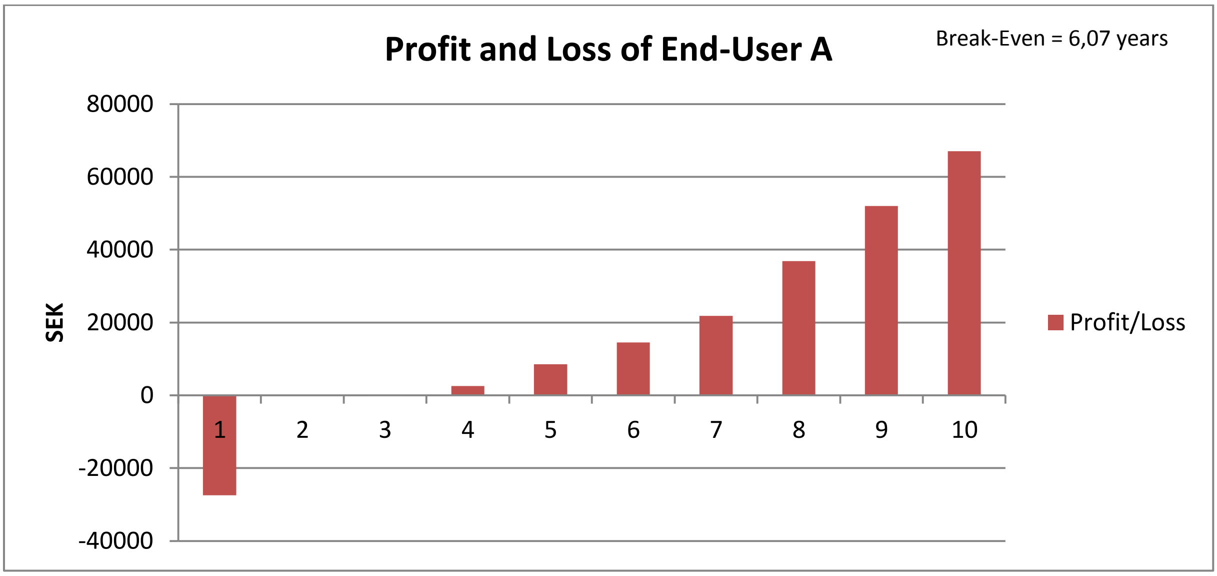

Figure 9: Revenue and Loss for End-User A in Model #3

The profit and loss of the stream with End-User B is shown in Figure 10 on the following page. In contrast to stream 1 with End-User A, stream 2 with End-user B has no initial investment costs of free charging boxes. Therefore, the first customers have to purchase a membership and the largest initial investment is the remote controller. The break-even point in this stream is achieved after 4,02 years. In comparison to stream 1, Figure 10 depicts that the memberships in the beginning are higher. This verifies the approach that the memberships cover the initial investment and are responsible for the higher revenue and profit.

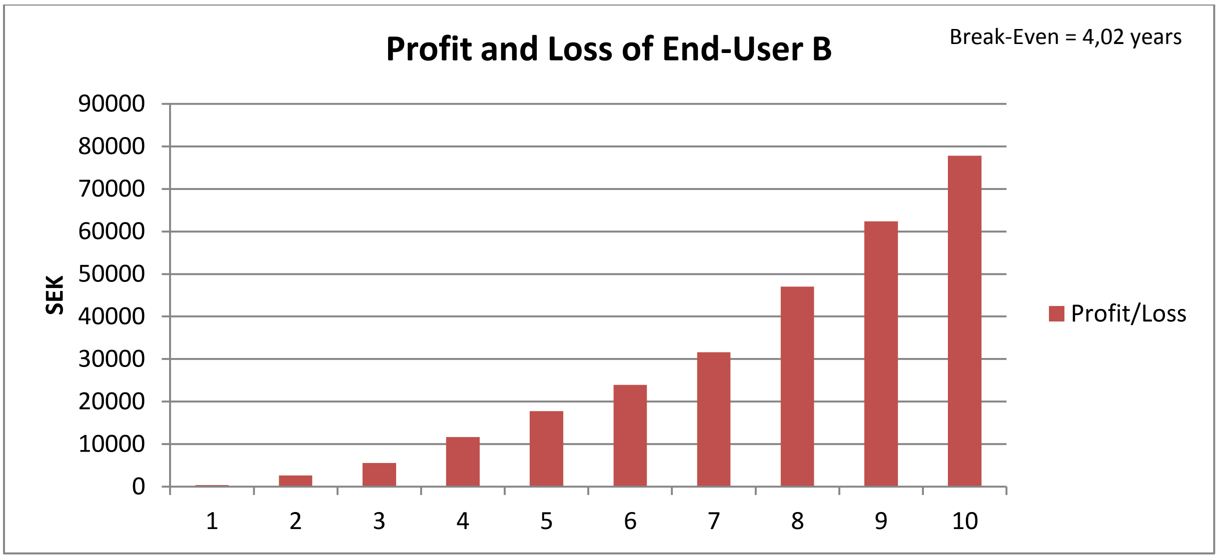

Figure 10: Revenue and Loss for End-User B in Model #3

Figure 11 depicts the sum of both streams. The calculation shows that the memberships of both streams reduce the break-even time, which is computed as 4,2 years. However, the model shows good results and demonstrate that profits will increase over time without any further investments.

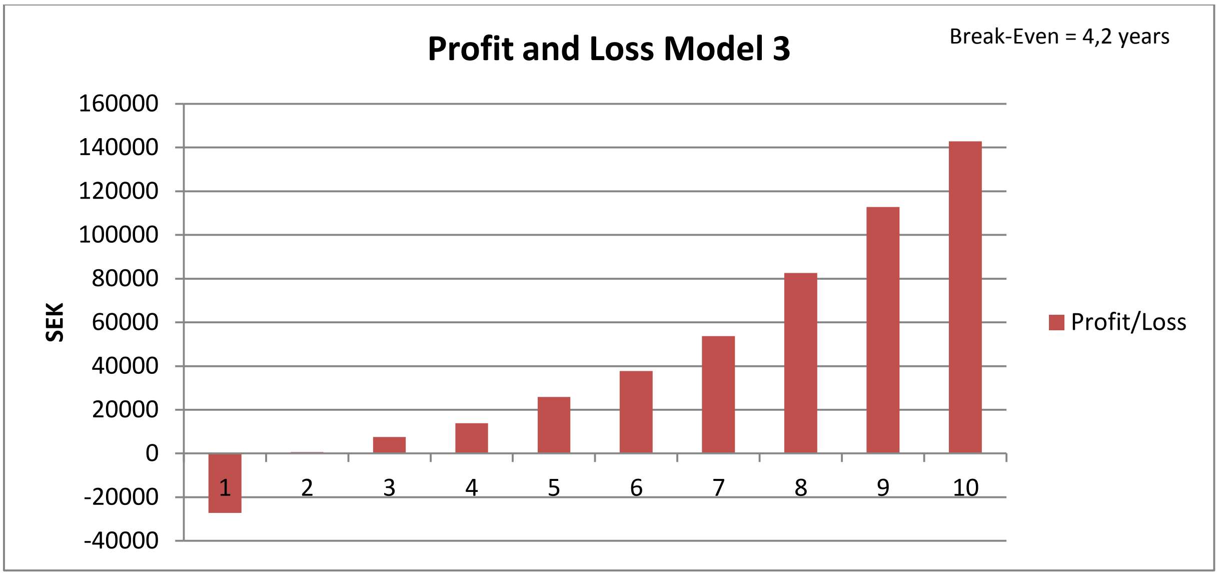

Figure 11: Revenue and Loss results for Model #3