

Overcoming the Barriers of Electric Vehicle Uptake in Denmark

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Sponsored by:

The Danish Consumer Council (Forbrugerrådet)
Fiolstroede 17
1171 Copenhagen, Denmark

Submitted to:

Martin Salamon: Chief Economist of Policy and Development, Danish Consumer Council
Professor Kinicki: Worcester Polytechnic Institute
Professor Taylor: Worcester Polytechnic Institute

Submitted by:

Brodie Green
Jacqueline Lynch
Lawrence McGillicuddy
Vincent Samuel

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FORBRUGERRÅDET

Abstract

Denmark has a goal of becoming fossil fuel free by 2050. Yet, they have one of the lowest rates of adoption of electric vehicles among developed countries. To understand the consumer's interests in electric vehicles, we utilized background research, performed 12 interviews, and conducted a survey with 1,092 respondents. Four major barriers to electric vehicle uptake were identified: range, price, infrastructure, and consumer knowledge. Recommendations provided to the Danish Consumer Council include: Danish charging station mobile app development, an industry review in Taenk, Value Added Tax exemption for electric vehicles, and increased standardization. This project serves as a tool for the Danish Consumer Council to aid electric vehicles in contributing to Denmark's environmental goals.

Executive Summary

As an environmentally conscious country, Denmark has developed a strategic energy plan to combat their fossil fuel emissions. They have an ambitious goal of becoming the first fossil fuel free country by the year 2050 (Somethings Green in the State of Denmark, 2012). To achieve this goal, the Danish government invested significantly in alternative energy sources such as wind power. As a result, they are now the world leader with 30% of their electricity being produced through wind power (Shahan, 2013).

Realizing the potential environmental benefits of electric vehicles (EVs), the Danish government developed a number of incentives designed to promote the industry. For example, gas-powered automobiles are taxed at a 180% rate, while electric vehicles are exempt from that tax (Bergman, 2010). Other incentives include free charging and parking in the city. Even with the offered incentives, only 647 electric vehicles were sold in Denmark in 2013 (Marth, 2013). For a country focused on sustainability, the surprising lack of EV uptake suggests there are major barriers limiting the development of the electric vehicle industry. The Danish Consumer Council (DCC) desires to promote the EV industry in order to protect the Danish consumer's interests and rights. In turn, this will aid in reaching Denmark's environmental goals.

Numerous nations are pushing to put more electric vehicles on the road; however some countries are more successful than others. Norway, for instance, has the highest electric vehicle ownership per capita and the highest total sales. They have 21,000 EVs on the road and a population of only 5 million people (The Ecologist, 2014). This strong EV uptake is in part due to Norwegian incentives including free charging, free parking, waived tolls, access to bus lane travel and other generous government incentives that equate to an estimated savings of \$8,337 per over 10,000 km (The Ecologist, 2014). With the Danish government offering many of the same incentives implemented in Norway, it begs the question why has Denmark's electric vehicle industry not seen the same success?

To achieve our main goal of providing the Danish Consumer Council with future recommendations in the electric vehicle industry, we utilized three different types of data collection techniques: internal research, a consumer survey, and semi-structured interviews.

Through sources provided by the DCC, the project group aimed to understand how the Danish Consumer Council conducts their business and what their standard protocol of action is. By doing so, we were able to align our project recommendations with the organization's standard course of action.

The second method was to conduct a consumer survey. The Danish Consumer Council publishes a quarterly magazine for their 85,000 members and distributes a survey to a small sample of these members. We posed five questions on this survey, and obtained 1092 responses representative of the entire nation. In addition to the five electric vehicle questions the project group was privy to demographic information including age, gender, and region. The survey questions posed by the project group included: type of future car purchase (gas, diesel, electric, hybrid, etc.), acceptable driving range, price willing to pay, acceptable charge time, and most desired EV improvements. The survey was sent out to 2710 consumers and had 1092 respondents, which correlates to a 40% response rate. Demographically the majority of respondents were female at 61%. 79% of the respondents were over the age of 35, and 60% were over age of 50. In terms of regions in which the respondents live, the majority come from Greater Copenhagen and Central Denmark.

Semi-structured interviews were the third method for this project. The team contacted many organizations involved with the EV industry including car dealerships, environmental organizations, and consumer organizations. These included BMW, Clever, Danish Eco-Council, Danish EV Alliance, Norwegian Consumer Council, Renault, and Tesla among others. To conduct the qualitative analysis of these interviews a process called deductive open coding was used.

By conducting twelve interviews across a range of different organizations, our team observed the electric vehicle industry from a number of viewpoints. Price and range were considered the most important barriers according to our expert interviewees. Consumer knowledge, infrastructure, Norway, and what to do moving forward were also common threads among the discussions.

After completing the data analysis, the project team determined what the contributing factors were to the lack of electric vehicle uptake in Denmark, and how the Danish Consumer Council can help combat the problem. We found there are four top barriers in Denmark for the

EV industry uptake (ranked highest to lowest): range, price, consumer knowledge, and infrastructure.

53.4% of our survey respondents said that range was an improvement that needed to be made in order for them to consider purchasing an electric vehicle. This places range at the top of the list for consumer concerns and identifies it as a major barrier to electric vehicle uptake. Through our qualitative analysis, we also determined that range is a major obstruction. However, the ability to have more in-depth research with qualitative compared to quantitative allowed the group to realize that it is not just range but range anxiety. Consumers are unaware how far they actually travel and what electric vehicles could fit their needs.

Price is the second largest obstruction to the development of the EV industry in Denmark. Current prices for the average EV are still higher than the average internal combustion engine, even with the exemption of the 180% vehicle registration tax. Micro cars are taking a high percentage of the EV market because they fit the same needs, yet are priced significantly lower (many under 80,000 DKK).

The third barrier, lack of consumer knowledge, could potentially be the best target area for the DCC to focus on. The Taenk survey participants expressed that range was the largest obstruction to uptake, but the team realized that consumers were not aware which EVs could fit their needs. When inquiring about price, the project group learned that consumers disregard EVs typically due to their initial cost. Most consumers are unaware of cost over time.

The lack of infrastructure, in this case the availability of charging stations, is identified as the fourth barrier. The fear of running out of fuel while on the road is a very real factor in potential buyers' minds. Additionally, there is a need for more standardization of charging stations. Currently, there are two main charging providers in Denmark, Clever and E.On, and crossing over from one to another is not as convenient as refueling at a gas station.

After identifying the four main barriers preventing consumers from purchasing electric vehicles, the team provided specific recommendations that fall within the Council's operations to push the EV industry. This is in accordance with objective one; understand the functions of the Danish Consumer Council.

The DCC could further benefit consumers by overcoming the barriers mentioned and

approaching three main parties listed by priority: Consumers, Danish government, and car dealerships. These groups represent different areas in the development of the electric vehicle industry.

To increase the information flow to consumers the DCC could create a product or industry review in the Taenk Magazine. These product reviews are commonplace in the magazine and would provide consumers with more information on the electric vehicle industry. In addition a major help to consumers would be the development of a mobile application and website that provides the location of all EV charging stations. Currently, there are no such apps made specifically for Denmark, which contributes to the consumers' lack of knowledge and range/infrastructure anxiety.

Recommendations for the Danish Consumer Council under Government utilize one of their main tactics, political lobbying. In the case of electric vehicles the removal of the Value Added Tax would be substantial, and has been successful in Norway. In addition, ease of interoperability is a consumer right and without which, the EV industry will be hampered. This would best be approached from a government level to enforce standardization of charging stations and plugs. Also, the expansion of current EV incentives such as free tolls and access to bus lanes will aid in the advertisement of the benefits of purchasing an EV.

It is in the best interests of the consumers for the DCC to conduct further studies to determine why dealerships are reluctant to promote their EVs. Specifically, determining the EV pricing framework compared to ICEs. In addition research on whether the consumers are receiving full benefits from the tax exemptions or if dealerships are just receiving larger profits.

In closing, this project is a valuable tool for the Danish Consumer Council's use. The impact of consumer uptake of electric vehicles will result in a more sustainable environment and be instrumental in reaching Denmark's fossil fuel goals. Information provided within this report identified four barriers to the industry's development and included recommendations on how they can be overcome.

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Disclaimer

This Interactive Qualifying Project was written as a requirement for the completion of a Bachelors of Science degree from Worcester Polytechnic Institute. The authors are not experts or professionals on electric vehicles. This document was written for the Danish Consumer Council (Forbrugerrådet). This document does not represent the opinion of the Danish Consumer Council or Worcester Polytechnic Institute.

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1.Introduction

Emissions from burning fossil fuels are contributing to air pollution, ozone layer depletion, and global climate change. The world's consumption of oil has increased by 61.4% over the past 30 years due to the steadily increasing energy demands. Currently, Earth's population uses 92 million barrels of oil per day (Oil Market Report, 2014 & IndexMundi, 2011). Additionally, 61.5% of total oil consumption is in the transportation sector with 85% of that oil used in road transportation alone (Rodrigue & Comtois, 2013). Electric vehicles (EVs) provide a significant opportunity to reduce global oil consumption in the transportation sector.

Denmark, an environmentally conscious country, has developed a strategic energy plan to combat their fossil fuel emissions. They have an ambitious goal of becoming the first fossil fuel free country by 2050 (Something's Green in the State of Denmark, 2012). To achieve this goal the Danish government invested significantly in alternative energy sources such as wind power. As a result they are now the world leader with 30% of their electricity being produced through wind power (Shahan, 2013). The government also developed a number of tax incentives designed to promote the purchasing of electric vehicles and reduce carbon emissions. For example, gas-powered automobiles are taxed at a 180% rate while electric vehicles are exempt from that tax (Bergman, 2010). Even with these major incentives only 647 electric vehicles were sold in Denmark in 2013, which highlights the lack of consumer adoption (Marth, 2013). For a country focused on sustainability, Denmark is struggling in the transportation sector which suggests there are major barriers limiting the development of the electric vehicle industry.

In order for electric vehicles to reduce fossil fuel consumption, consumers must purchase and utilize electric vehicles in larger numbers. Our sponsor, the Danish Consumer Council, determines how to better represent and protect consumer interests. They have a responsibility to inform and advise consumers on the advantages and disadvantages of products and services. Regarding electric vehicles, the Danish Consumer Council wants to educate consumers on the costs, benefits, incentives, and downsides of owning an electric

vehicle. The Danish Consumer Council has a vague understanding of the general consumer opinion regarding electric vehicles, and intends to gather more in-depth information in order to identify a solution for the acceptance of electric vehicles for the near future.

Offering incentives such as free access to toll roads, free charging stations, and free parking have been instrumental in catapulting Norway to be the world leader in electric vehicles (Bevenger, 2013). Denmark has implemented many of the same incentives, but has not achieved the same level of success enjoyed by their Scandinavian neighbor. In an attempt to promote electric vehicle uptake, the Danish government backed an international electric vehicle charging program called Better Place in 2011 with a \$142 million investment (Farber, 2013). However, the program filed for bankruptcy in 2012 highlighting the fact that there are major barriers to electric vehicle uptake in Denmark. Articulating the reasons that electric vehicles have not been highly adopted by consumers in Denmark is a central objective for this project.

The goal of this project was to provide the Danish Consumer Council with recommendations on how to allocate their resources to further protect the consumers in the emerging electric vehicle industry. Electric vehicles can potentially limit the country's dependency on oil and contribute to their environmental goals. The team utilized internal Danish Consumer Council sources, personal interviews with leading experts in the field, and the Taenk quarterly survey to obtain the required data. The project team identified the main barriers limiting the uptake of electric vehicles while understanding consumer interests and opinions of them. The summation of this information will allow the Danish Consumer Council to promote the growing electric vehicle market while protecting consumer's rights.

2. Literature Review

The term consumer is defined as a person or organization that uses a commodity or service (consumer, n.d.). Consumer interests can heavily influence the products and services they use as companies fight with one another to fulfill customer needs. Stemming from competition with other companies to put the most appealing products on the market, the reliability and quality of these products is often overlooked. Therefore with the power that the companies hold in the market, consumers need protection in order to make secure and educated purchases.

In order for the consumers to purchase electric vehicles, the current electric vehicles on the market must meet consumer needs. The push for consumer adoption of electric vehicles in Denmark is directly attributed to the environmental goals set forth by the government. Unlike gas-powered vehicles, electric vehicles are eco-friendly and do not emit pollutants into the atmosphere. Consumers have the ability to reduce further ecological damage due to gas-powered vehicles by adopting electric vehicles. In order for this to take place, it is imperative that the consumer's best interests be taken into consideration. Ultimately it does not matter how efficient electric vehicles are if they are not utilized because consumer's needs are not being met. This is where the Danish Consumer Council comes in, as their job is to represent the consumer interests.

This chapter introduces the ideals of the electric vehicle industry and contrasts them against the current interests of vehicle consumers. The following sections provides in depth information regarding the importance of consumer councils, the fundamentals of the electric vehicle, the global electric vehicle initiative, and the Danish electric vehicle market. All of these aspects affect consumers, which in turn relates to the Danish Consumer Council's agenda. Later sections identify potential barriers to the electric vehicle uptake in Denmark with the aim to provide recommendations to the Consumer Council for the future of electric vehicles in Denmark.

2.1 Consumer Councils and Their Role in Implementing Electric Vehicles

Consumers need guarantees that the goods and services offered, including the vehicles they drive, are safe and reliable. On March 15, 1962 United States President John F. Kennedy addressed the U.S Congress with his vision for what consumer rights should be. He spoke about four main consumer rights which are the right to safety, be informed, choose, and be heard (Bhaksur, 1999). This was the first time any politician addressed consumer rights. This sparked the creation and development of consumer councils, which tend to be non-profit organizations that inform and protect consumers.

Consumers International, a worldwide consumer council, has 240 member organizations within 120 countries (Consumer Rights, 2014). Their mission is to protect consumers by promoting, defending, and developing consumer rights. Consumers International works within specific member locations to secure the rights of consumers. Consumers International has identified eight basic rights (see Table 2.1) that define the principles that they strive to support.

Consumers International is engaged in a wide array of activities to preserve the integrity of these rights. This work includes but is not limited to consumer advice, campaigning and lobbying, dispute resolution, networking, product testing, and publishing. While some of these activities and methods require multi-national support, others may only pertain to an individual location.

Table 2.1 – 8 Consumer Rights (Consumer Rights, 2014)

Right	Explanation
The Right to Satisfaction of Basic Needs	To have access to basic, essential goods and services: adequate food, clothing, shelter, health care, education, public utilities, water and sanitation.
The Right to Safety	To be protected against products, production processes and services that are hazardous to health or life.
The Right to Be Informed	To be given the facts needed to make an informed choice, and to be protected against dishonest or misleading advertising and labeling.
The Right to Choose	To be able to select from a range of products and services, offered at competitive prices with an assurance of satisfactory quality.
The Right to Be Heard	To have consumer interests represented in the making and execution of government policy, and in the development of products and services.
The Right to Redress	To receive a fair settlement of just claims, including compensation for misrepresentation, shoddy goods or unsatisfactory services.
The Right to Consumer Education	To acquire knowledge and skills needed to make informed, confident choices about goods and services, while being aware of basic consumer rights and responsibilities and how to act on them.
The Right to a Healthy Environment	To live and work in an environment that is non-threatening to the well being of present and future generations.

The Danish Consumer Council, also known as Forbrugerrådet, is a representative member for Consumers International in Denmark. The Danish Consumer Council consists of representatives from 27 different national organizations. These organizations include environmental organizations, women’s organizations, trade unions, educational organizations, and organizations representing the nation’s youth and elderly. ‘Tænk’, which is the Danish Consumer Council’s quarterly magazine, informs their 85,000 subscribers with current activity and progress relating to goods and services. Another goal of this magazine is to provide the consumers with tips about goods and services. Recently, the Danish Consumer Council has

been addressing complaints involving food quality, environmental protection, health services, telecommunications, and legal services. Currently, the Danish Consumer Council is investigating why consumers have been purchasing very few electric vehicles (The Danish Consumer Council, 2014).

2.2 Electric Vehicle Timeline

First manufactured on a large scale in 1897 by the Pope Manufacturing Company, the electric vehicle (EV) has been a symbol of future technology for the past century. So why after disappearing for over 80 years is the electric vehicle being produced once again? The following timeline provides insight into its reemergence by highlighting major events in the electric vehicle industry.

The first electric motor was invented in 1834 by Thomas Davenport who utilized electromagnets and a primitive battery. The motor was not used for automobiles which had not yet been invented, but Davenport did successfully develop his motor with a model train in Springfield, MA in 1835 (Wicks, 1999). The invention of the first electric vehicle was built 60 years later by William Morrison in 1891. In the year 1897, the first large scale electric automobile was manufactured by the Pope Manufacturing Company, who produced a line of electric taxis for use in New York City (Timeline: History of the Electric Car, 2009). By 1900, 38% of all automobiles produced in the United States were electric. In the same year Professor Ferdinand Porsche created the first hybrid car (Electric Cars and History, 2013). In 1908 Henry Ford invented the Model T and in 1912 the electric starter was invented which would soon replace the hand crank. Both of these developments had a profound effect on the electric vehicle industry as gas-powered vehicles became much more alluring. By 1920 there were no electric vehicles in mass production due to their lack of horsepower, low range, and the high availability of gasoline (Wicks, 1999).

The electric automobile was a dormant technology around the world from the 1920s until the Arab Oil Embargo of 1973. Internal combustion engines were more powerful and EV battery technology had not adequately advanced. Automobile manufacturers had no reason to continue developing EVs as they already had very profitable gasoline automobiles, and

consumers had no real interest in EVs. In 1966 the United States Congress introduced the first bill endorsing alternatives to gasoline automobiles in an attempt to reduce air pollution. Then in 1973, the Arab Oil Embargo created an even larger stir in EV interest due to high oil prices and the limited availability for consumers. Dependency on foreign oil became a focal point for all non-oil producing countries including Denmark. Prior to the embargo Denmark utilized foreign oil for 90% of its energy needs (Koch, 2009). Due to the embargo, large amounts of funding for EV programs began to flow from governments across the globe. The most popular program was based around CitiCar, which sold over 2,000 units, but stopped production in 1977 (CitiCar, 2009).

Since the mid-1990s, many companies attempted to bring electric or hybrid vehicles to the mainstream market. The decade saw the return of EVs due to a host of new bills promoting their use and offering tax incentives, but consumer interest in EVs was still limited. Factors included consumer reluctance to change from gas powered automobiles, limited EV range (about 80 miles), limited charging infrastructure, and lack of manufacturer backing. The popular EV1 was released by General Motors (GM) in 1996 for lease only, but was later recalled in 2000 with no concrete reasons given. Many customers wanted to keep their EV1s but GM forced consumers to give them back. GM's public relations nightmare continued when it was discovered that GM was simply crushing the cars and "recycling" their parts even when many people had offered large sums of money to keep their car (Who Killed the Electric Car?, 2006). At the same time Toyota began developing the Prius Hybrid which was released in Japan in 1997. The Prius was not a plug-in EV but was recharged by utilizing regenerative braking which stores energy each time the car brakes. The Prius sold over 18,000 units in its first year of production and proved to automobile manufacturers that there was a global market for hybrids (Maker, 2014). Even with this emerging market for hybrids, all strictly electric vehicles ceased mass production until 2006 when Tesla Motors unveiled the Tesla Roadster. Released in 2008 with a listing price of \$98,950, the Roadster was the first modern fully electric sports car. The model had a range of 245 miles and a 0-60 speed of 3.7 seconds proving to the world that electric vehicles can be very powerful (Teslamotors, 2013). Another example of a successful

modern electric vehicle is the Nissan Leaf which was released in 2010. The Leaf sells for about 210,000 DKK and has a range of 160 miles (Nissan Leaf, n.d.).

The current situation shows that the electric vehicle is once again becoming prevalent in the automobile industry. Norway is currently the world leader in electric vehicle sales and hit a record 12% of total automobiles sales in November, 2013 (Shahan, 2013). If Denmark was to follow suit, it would go a long way towards reaching their carbon neutral goals and greatly decrease their reliance on foreign fuel. In 2014, even more automobile manufactures have begun producing electric vehicles such as BMW, Volkswagen, Kia, Mercedes, Nissan, etc. (Shahan, 2014). As market competition increases, so too will the quality of the products produced.

2.2.1 Hybrid Vehicles

Successful hybrid technology has become relevant in society today due to higher efficiency than gas powered models. A “hybrid vehicle” refers to a vehicle that uses two or more power sources (Edmunds, 2009). Hybrid vehicles have an electric motor and a separate gasoline engine that powers a generator. The gasoline motor is only used when the vehicle is maintaining speed, and the electric motor is used to accelerate (Fuel Economy, 2014). The main source of energy, combined with gasoline, is based on a technology called regenerative braking. When a hybrid vehicle slows down using the brake, the energy that would normally be lost is captured and stored for future use. This enables hybrid vehicles like the Toyota Prius to gain up to 51 miles per gallon of gasoline, and plug in hybrids like the Chevrolet Volt to gain up to 98 miles per gallon (Fuel Economy, 2014). Although the majority of hybrid vehicles operate using gasoline, they provide a cleaner alternative than the traditional gas model. Depending on consumer interest, hybrid vehicles could provide a bridge to fully electric vehicles to help solve the current environmental issue.

2.3 How Electric Vehicles Function

This section highlights the differences between gas-powered and electric vehicles. Electric powered cars use electric motors that send a current from the battery pack, to the controller, which then turns the wheels. There is no muffler, catalytic convertor, tailpipe, or

need for a clutch assembly. Instead there are needs for an electric water heater to provide internal heat, and a vacuum pump for the brakes; both of which are built into internal combustion engines (ICEs). Gas gauges are replaced with voltage meters, and the gas tank is replaced with batteries and a charging port. Aesthetically, EVs can look exactly the same as gasoline powered cars (Brain, 2002). When driving an EV the most noticeable difference is the low engine noise, and most everything else feels like a gas-powered car.

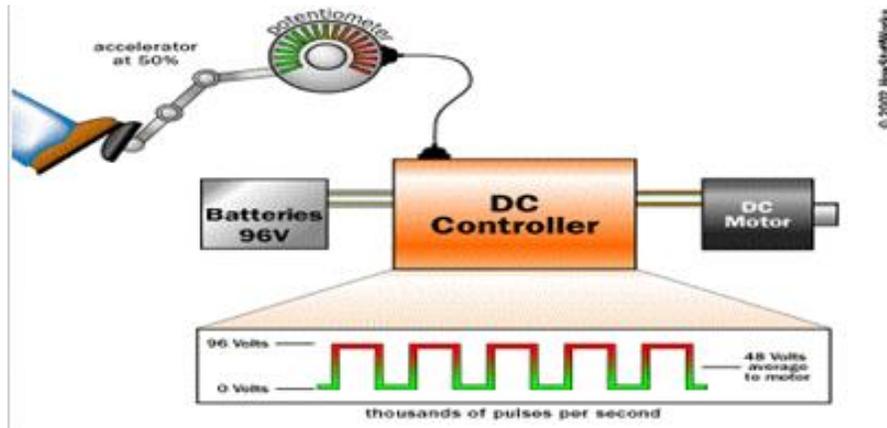


Figure 2.1 - DC Controller (Brain, 2002)

Figure 2.1 shows how a DC controller in an EV functions. The DC controller is connected to the battery pack and DC motor. When the driver pushes on the pedal, the controller determines the amount of voltage transferred from the battery to the motor which dictates the speed of the car.

Batteries are perhaps the most important technological advancement to the future of EVs. Over the past century batteries have held back the electric vehicle. Today the main type of battery used in EVs are lithium ion batteries which can store large amounts of energy but are also heavy, bulky, and can overheat. (Hiler, 2013) Lithium ions are far superior to lead-acid batteries which are just as heavy but provide less energy output and do not fare well in cold weather. (Bullis, 2013) Hybrid cars can use lithium ion, lead-acid, or nickel-metal-hydrate batteries which are found in cars such as the Toyota Prius and the Honda Civic Hybrid. Lithium-ion is the battery type used in mass production currently, but there is room for improvement. A few possible battery advancements are on the horizon that could be the reason the electric vehicle takes the next big step. One promising development is lithium-sulfur batteries which

can store almost four times as much power, but have a much shorter life time than lithium-ion (Battery Development, 2014).

2.4 Environmental Impact and Changing Gas Prices

2.4.1 Consumers and the Environment

The impact of global climate change has been rapidly occurring on a geological scale since the first industrial revolution when humans began to release emissions into the atmosphere. These emissions result in the trapping of heat that is trying to leave Earth, which is also known as the greenhouse effect (Jenkins, 2014). Over 20% of the total global climate change pollution is directly linked to gasoline-powered vehicles (Cars, Trucks, and Air Pollution, 2013). A greenhouse gas known as carbon dioxide has increased its natural presence in the atmosphere by one-third since the industrial revolution. Gasoline-powered vehicles are a direct cause of this because the burning of one gallon of gasoline results in the emission of 20 pounds of carbon dioxide into the atmosphere (Fuel Economy.Gov, 2013). Additionally, gasoline vehicles emit carbon monoxide, which contributes to the greenhouse effect. Gasoline vehicles emit over a third of the greenhouse gases in the form of carbon monoxide and oxygen. As temperatures increase around the world, many species' habitats are changing, creating negative effects and in some cases extinction. Sea levels are rising as glaciers and the polar ice caps melt. Due to the rise in sea level there is heightened risk for floods in coastal areas, as well as increased erosion. Lastly heat waves and cold fronts are going to be reaching extreme temperatures as the greenhouse effect continues (Jenkins, 2014).

Since greenhouse gases emitted from gasoline-powered vehicles make a huge contribution to the greenhouse effect, countries around the world are working to encourage the implementation of electric vehicles in an attempt to prevent any further damage to the Earth. For example, The United States provides a federal tax credit to electric vehicle consumers of up to \$7,500 based on the capacity of the battery used in the vehicle. In Norway electric vehicle consumers are exempt from the initial car tax and have a free pass when it comes to all of Norway's toll roads. Lastly in Sweden the government can provide subsidies of up to 40,000Kr, approximately \$6093 dollars, to persons who purchase green cars

(Teslamotors, 2013). Denmark is encouraging the sale of electric vehicles by exempting buyers of fully electric powered vehicles from the current vehicle registration tax. The vehicle registration tax places a 180% tax on the purchase of any vehicle after the first 65,900 Danish Krone or \$11,987 dollars of the price of the vehicle (Berman, 2013).

2.4.2 Electric vs. Gas-Powered Vehicles from Cradle to Grave

This section focuses on the environmental impact of electric vehicles compared to their gasoline powered counterparts. EVs can play an active role in achieving Denmark’s goal of being fossil fuel free by 2050. Some questions regarding EVs environmental impact include: *Are they actually better for the environment? What if the electricity is produced by coal power plants? What are the impacts of producing and disposing of their batteries?*

To answer these questions fairly, Renault released an assessment of its Fluence sedan comparing its electric version to its gas- and diesel-powered versions. The assessment took into account the entire life cycle of the cars from raw material to completed product to waste or recycling, which is depicted in figure 2.2.

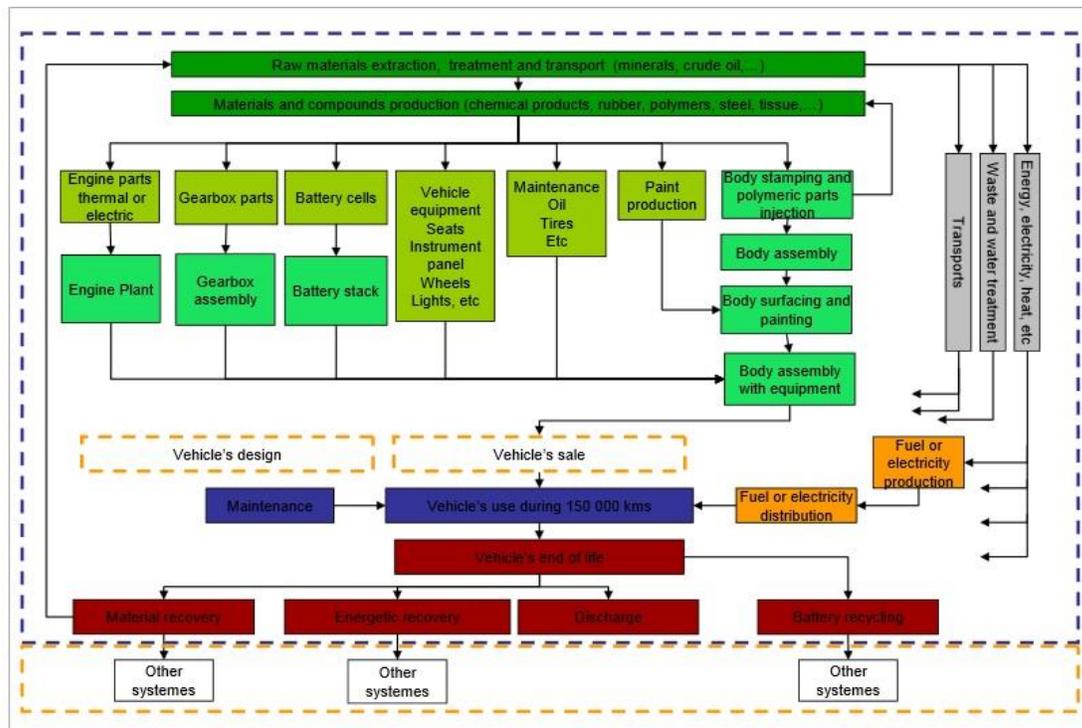


Figure 2.2 - Life Cycle Assessment (Renault, 2011)

The deciding factors that determined which car was more eco-friendly included greenhouse-gas emissions, ozone pollution, resource consumption, and total energy demand (Bullis, 2013). The results of the study were that EVs have a larger environmental impact during manufacturing due to the toxic compounds released when producing the solvents and process chemicals for batteries (Conca, 2013). However, the more impactful part of the life cycle process in terms of CO₂ emissions is product use. This is where the emissions from gas powered cars quickly pile up and overtake the gap between emissions released from manufacturing. This is illustrated in figure 2.3 which shows the CO₂ emissions from production to end of life for these models. EVs finished ahead in all factors except contribution to acid rain and cause of algae blooms, which were still very close to the internal combustion engines (Renault, 2011).

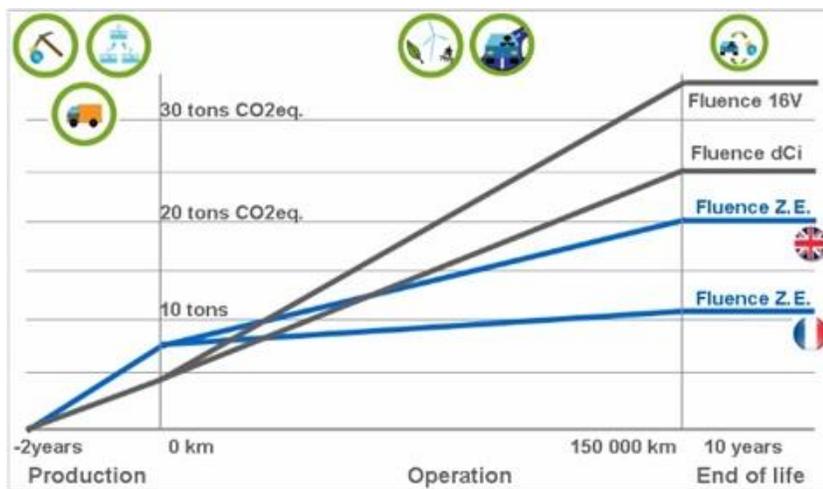


Figure 2.3 CO₂ Emissions (Renault, 2011)

According to a Renault study, EVs prove to be more environmentally friendly compared to internal combustion engines. Some opportunities to become even greener include reducing the amount of fossil fuel used to produce electricity, and developing more alternative energy sources. Continued reliance on fossil fuels for electricity production limits the emissions-reductions that could be achieved with EVs. One promising fact is that Denmark is currently the world leader in wind power, which accounts for 30% of their total energy production (Shahan, 2013). Further alternative energy production will negate the increased need for electricity from coal power plants, which have high CO₂ emissions. The recycling industries are also trying to do

their part by staying ahead by developing better practices for recycling EV and hybrid batteries. The batteries from the first generation of Prius and Honda Insight are just now reaching their end and the recycling industry is ready to begin disposing of the used batteries (O’Dell, 2012).

2.4.3 Cost of Fuel on Consumers

The world’s dependence on oil has a large influence on consumer interest towards the development of electric vehicles around the world. Gasoline prices are directly impacted by the price of oil because gasoline is approximately 70% oil. In reference to figure 2.4 below, the world consumption of liquid fuels on average has been higher than the world’s production of liquid fuels since 2009 (Short-Term Energy Outlook, 2014).

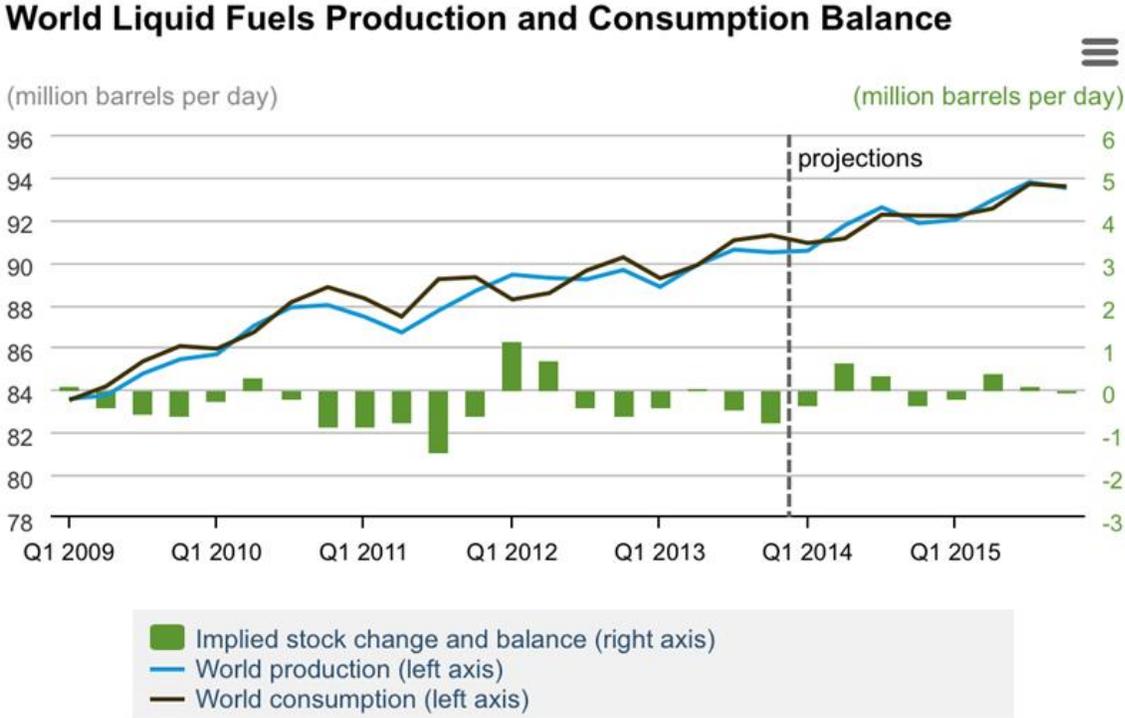


Figure 2.4 - World Liquid Fuels Balance (Short Term Energy Outlook, 2014)

In 2013, the world average consumption of liquid fuels was 90.35 million barrels a day whereas the average world production of liquid fuels was approximately 89.95 million barrels per day. The supply and demand of oil is the first of the four main components causing gasoline to be expensive (IER, 2013). The second component that impacts the cost of gasoline are taxes that are levied by federal, state, and local governments. Many countries that produce their own oil levy hefty taxes on gasoline. Some countries that partake in heavy taxing of gasoline are

Norway, Sweden, and Denmark. These taxes put the price per gallon of gasoline around \$10 dollars. Norway levies a tax of almost 50% on gasoline and feeds these taxes into national services like providing free college education and improving infrastructure. Sweden also levies heavy taxes on gasoline but does so in an attempt to reduce emissions that are contributing to the greenhouse effect. Despite these high taxes Sweden remains the 10th largest consumer of oil per capita in the world (Randall, 2013). Distribution and market costs comprise the third component as to why global prices of oil are expensive. The world's largest exporters come from a variety of countries that make up the Organization of the Petroleum Exporting Countries (OPEC). OPEC's purpose is to unify and stabilize the oil market. OPEC consists of 12 member countries: Iran, Iraq, Kuwait, Saudi Arabia, Venezuela, Qatar, Indonesia, Libya, the United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon, and Angola (Member Countries, 2014). With over 81% of the world's crude oil reserves belonging to OPEC member countries, OPEC is able to control the majority of the market. The last component that results in high gasoline prices are the oil refining costs. The cost of refining crude oil into the chemical components of gasoline on average makes up 8% of the retail price of gasoline (IER, 2014). This percentage can fluctuate depending on the accessibility to different additives and processing steps of gasoline formulations as well as seasonal changes that effect oil refining operations. Gasoline prices are an important factor to consumers when considering electric vehicles. Consumers may want to save large parts of their yearly income by switching to an EV.

2.5 Global Market for Electric Vehicles

Today, electric vehicles account for 0.2% of the globe's registered vehicles (Navigant, 2014). An opportunity for the other 98.8% to reduce their fueling costs is an alluring prospect to consumers. If humans were to convert their internal combustion engines (ICE) to EV's, there could be a large reduction on their carbon footprint. As the green movement gains more traction, nations are expressing interest in electric vehicles all over the globe. However, only a handful of these nations can boast successful implementation. Navigant's research found that consumer interest in EV's is increasing and forecasted that the sales rate of EV's will jump by 86% by 2015 (Navigant, 2014).

The European Union (EU) has recently set CO₂ emission limits for car manufacturers that will be in place for the upcoming years. There is a limit of 130 g/km of CO₂ starting until 2015 and 95g/km CO₂ for 2021 and 80% of newly manufactured cars must be within this limit. This percentage jumps every year until 2015 when a 100% goal is ideally reached. If these limits are surpassed then automobile manufacturers are forced to pay a premium for each car registered. On the other hand, the manufacturers get to count a car three times into their average if it is extremely below the limit (50g/km) or under (European Commission, 2013). These potential punishments and rewards set forth by the EU provide reasoning for manufacturers to continue developing environmentally friendly vehicles. The regulations provided give electric car manufacturers an advantage due to electric vehicle lack of emissions.

2.5.1 The Electric Vehicle Initiative

The Electric Vehicle Initiative (EVI) is a global program under the Clean Energy Ministerial (CEM) that desires to push the deployment of 20 million EV's by 2020, including plug-in EVs as well as hybrids (Energetics Inc., 2014). The current members of the Electric Vehicle Initiative are China, Denmark, Finland, France, Germany, India, Italy, Japan, the Netherlands, Portugal, South Africa, Spain, Sweden, the United Kingdom, and the United States (Clean Energy Ministerial, 2013). Currently, the Electric Vehicle Initiative boasts many accomplishments including a casebook published in 2012 providing studies on EV deployments among nine nations. The casebook's purpose is to share experiences regarding electric vehicles to better understand what the most effective policy measures are in fostering EV uptake (EV City Casebook, 2012). This information is available to the public so that consumers can learn about these deployments in other nations as well as their own.

The CEM is a global forum that shares best practices to ease the transition to a global clean energy economy (Energetics Inc., 2014). The Clean Energy Ministerial realizes the potential for EVs to change the world's methods of transportation by reducing carbon emissions and pollutants. Currently the transportation industry accounts for 10% of energy-related carbon dioxide emissions (Energetics Inc., 2014). The EVI intends to pursue their goals by ensuring to address the gaps in EV technology development. They also push to align the

concerns of relevant stakeholders (for example: government, industry, consumers) in order to focus on benefits of EV technological innovation.

2.5.2 Leading Nations in the Electric Vehicle Industry

Numerous nations are pushing to put more electric vehicles on the road, however some countries are more successful than their counterparts. Norway, for instance, has the highest electric vehicle ownership per capita and total sales with 21,000 EVs on the road (The Ecologist, 2014). The two top selling vehicle models in Norway in 2013 were EVs, Tesla’s Model S and Nissan’s Leaf. This massive uptake is in part due to Norwegian consumers enjoying free charging, free parking, waived tolls, and other generous government incentives that equate to an estimated savings of \$8,337 per vehicle (The Ecologist, 2014). Following Norway the other leading nations in order are Japan, Ireland, the Netherlands, France, United States, Denmark, and Switzerland, although Norway is far and away the leader.

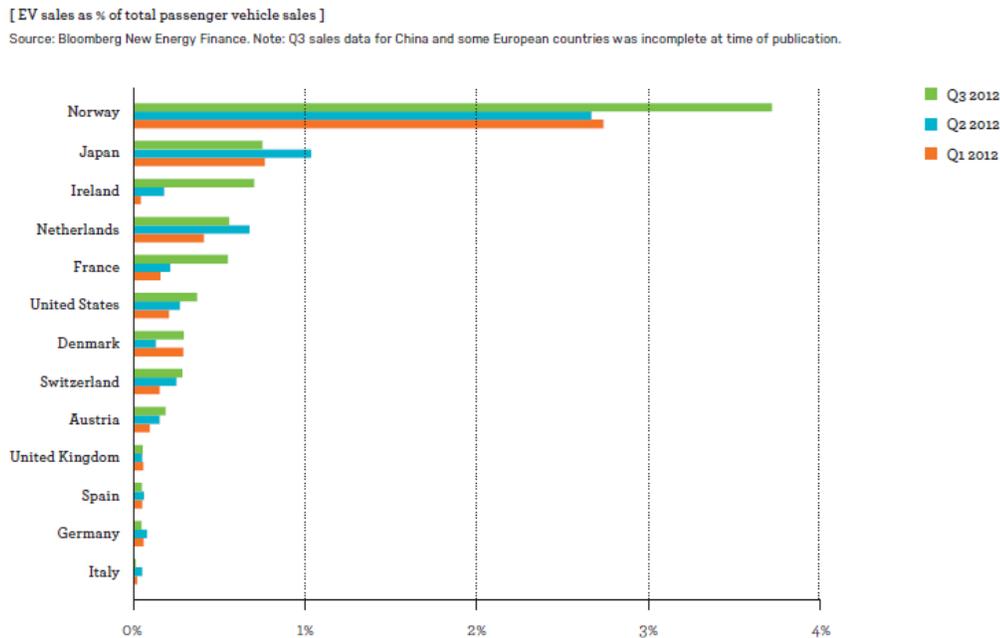


Figure 2.5 - Leaders in EV Sales (Greenbang, 2012)

Figure 2.5 displays the electric vehicle sales as a percentage of total vehicle sales for these countries as of 2012. To put it in perspective, 16 cities account for one-third of all electric vehicles in use globally (Greenbang, 2012). Table 2.2 discusses the top ten cities for owning

electric vehicles based on the number of EV's on the road, as well as their corresponding infrastructure.

Table 2.2 – Top 10 Cities for Owning Electric Vehicles (Deloitte, 2014)

City	Electric Vehicles Owned (#)	Charging Stations(#)
Kanagawa Prefecture, Japan	2,183	450
Los Angeles, California, US	2,000	106
Shanghai, China	1,633	9 stations, 687 charging poles
Portland, Oregon US	1,300	225
Rotterdam, Netherlands	1,000	100
BrabantStad, Netherlands	755	500
Amsterdam, Netherlands	750	350
Barcelona, Spain	480	249
Berlin, Germany	350	220
Hamburg, Germany	350	200

Numerous countries are pushing for electric vehicles because they are considered to be the next generation of personal mobility (Deloitte, 2014). The reduction of the world's carbon footprint as well as various incentives for EV owners, are factors to be considered by the global consumer body. For this reason countries around the globe are providing initiatives to promote implementation.

2.6 Denmark's Market for Electric Vehicles

Within the past decade, the Danish Government began pushing for the implementation of electric vehicles instead of the more popular gas powered options. With increased realization of human impact on global climate change, the Danish population is beginning to

take actions to limit carbon emissions. According to a survey by Better Place in 2009, 34% of Denmark's population stated that they would be willing to purchase an electric vehicle or a hybrid form as their next vehicle ("Drivers and inhibitors of electric vehicles", 2011). The Danish Government introduced consumer incentives to provide an opportunity for car buyers to eliminate emissions. Despite the green movement in Denmark, electric vehicles and hybrids have not found the support that gas-powered vehicles have.

2.6.1 Consumer Influence on Transportation in Denmark

Denmark has an aggressive plan to reduce carbon emissions in the transportation sector. One aspect of this plan is to replace individual gas-powered vehicles with electric ones. In the year 2013, only 647 electric vehicles were sold in Denmark, 533 to individuals and 113 to the government (Marth, 2014). The number of EV sales in Denmark is still small even when considering the small amount of Danes that own vehicles. According to a 2012 census, only 3.5% of families in Denmark bought a car within the past five years (Dalbro, 2012). Furthermore, only 29 % of Danish families own one or more cars, compared with the 95% of citizens who own a bicycle (Troy, 2012). The percentage of Danes who drive and own vehicles is low partly because of the established preference for bicycling. Over 35% of employed citizens commute to work via bicycle in the capital of Copenhagen ("Denmark.dk", 2011). Copenhagen, along with other main cities in Denmark, has converted from an automobile oriented city to a bicycle friendly one. Despite common use of bicycles in Denmark, the few vehicles driven continue to negatively impact the environment. The Danish Government invested in Better Place with the objective to increase clean energy transportation.

2.6.2 Consumer Implications on Fallout of Better Place

The recent bankruptcy of Better Place, in May 2013, negatively affected the general consumer opinion of electric vehicles. Better Place was a company founded on the idea of quickly swapping dead vehicle batteries with fully charged batteries. Better Place teamed up with Denmark's leading energy company Dong Energy. Dong Energy produces 20% of their energy from wind power, but is forced to export this power because they have no way to store the energy. By investing in Better Place, Dong Energy could store energy in Better Place's

charging stations. This system was intended to provide an inexpensive recharge that would reduce charging time from 8 hours to approximately 5 minutes (Pearson, 2013). Additionally, consumers would be less affected by the limited range of electric vehicles (Deloit, 2011, pp. 6). In 2011, the Danish government made a substantial investment of \$142 million in Better Place with the objective of developing a stable EV infrastructure.

Due to a number of issues, Better Place declared bankruptcy in May, 2013. They only had one contract, with Renault, to produce and implement compatible batteries with the charging stations. Since Renault only made one vehicle model with Better Place's battery technology, the quantity of vehicles capable of utilizing the charging stations was very low. Better Place was only able to install 17 battery swap stations and numerous charging points (Danish Infrastructure Experiences, 2013). A major problem was that Better Place attempted to develop infrastructure in multiple countries simultaneously (Pearson, 2013). The inability of Better Place to convince multiple vehicle company to adjust their models to their battery swapping technology, partially lead to the bankruptcy of Better Place. A company called E-ON is a relatively new charging infrastructure company in Denmark who purchased all of the battery swapping stations as well as regular charging stations that were built by Better Place. Currently E-ON has been successful with maintaining their charging infrastructure.

2.6.3 Government Taxation Removal as Incentive Strategy

As mentioned in earlier sections, the Danish government is attempting to promote EV use by consumers through multiple incentives. One incentive is the elimination of the vehicle registration tax for fully electric vehicles. The tax states that the first 65,900 DKK of the vehicles price will be taxed 105%, while the remainder, if any, will be taxed at 180% (Marth, 2014). The Danish Parliament decided that the tax exemption on electric vehicles will continue through December of 2015 and be reevaluated in the start of the following year (Jankovic, 2013). Removing the tax provides the financial capability for the everyday consumer to acquire new electric vehicles. Other financial benefits for electric vehicles are exclusions from road taxes and free city parking (Trigg, 2013). These incentives affect the consumers by providing an additional opportunity to save money and add to ease of use.

2.6.4 Infrastructure Challenges

The Danish Government is met with the challenge of providing a reliable electric vehicle infrastructure. To eliminate consumer skepticism about low battery capacity in electric vehicles, charging stations have become a high priority to the success of electric vehicles. There are only 750 charging stations in Denmark compared to thousands of gas stations and signage (Danish Infrastructure Experiences, 2013). In order to meet consumer's needs there must be infrastructure capable of supporting the shift to electric vehicles.

The high demand for gas vehicles resulted in a century of infrastructure development. The large quantity of gas stations in Denmark provides consumers with a reliable and convenient way to refuel. On the contrary, the low number of charging stations located in Denmark can be correlated to the lack of demand. In order for the stations to make a profit, the quantity of electric vehicles must increase. A limiting factor for electric vehicles is the lack of a sustainable infrastructure. Potential buyers must consider the infrastructure when comparing gas and electric models. The dilemma arises when there are not enough electric vehicles for charging stations to succeed, but the lack of a charging infrastructure negatively affects electric vehicle sales. The government attempted to solve this dilemma by investing in Better Place which negatively influenced consumer opinion of electric vehicles in Denmark (Berman, 2013). Denmark has yet to develop the required infrastructure needed to convert from gasoline vehicles to electric ones. This dilemma outlines the struggles of the government to implement electric vehicles and reach their set goal of becoming fossil fuel free.

2.6.5 Future Plans for Electric Vehicles in 2014

The Danish Energy Agency's projected numbers for 2014 represent substantial growth in the sales of electric vehicles ("1500 New Electric Cars for Denmark", 2013). Funding through the Danish Energy Agency is expected to double the number of electric vehicles over the next two years. The plan involves providing charging infrastructure for 400 cars in Copenhagen, partnering with private companies to bring 500 electric vehicles to the streets, and numerous small business partnerships which could lead to 400 new electric vehicles ("1500 New Electric Cars for Denmark", 2013). Along with the Energy Agency's funding, BMW is revealing its new model, the i3, in May 2014. The BMW i3 already has 1000 orders logged in Denmark (Marth,

2013). The future is uncertain in the EV market, but the government has created the potential for growth.

In order for the electric vehicle industry to tap into this potential growth it must cross the chasm between early adapters and the early majority. This is the most important step in the technology adoption life cycle. The cycle has 5 consumer adoption levels: innovators, early adopters, early majority, late majority, and laggards. Innovators are the first individuals to adopt an innovation, are willing to take risks, and like to be on the bleeding edge of technology. Early adopters are similar to innovators but are slightly slower to adopt a new technology. Early majority consumers adopt a technology significantly slower than the first two groups and but account for 34% of the market. This is compared to only 15% combined for innovators and early adopters. The most difficult step in the cycle is to “Cross the Chasm” between the early adopters and the early majority. The EV industry needs to find a small niche market in the early majority in order to begin selling in large volumes. Once this niche market is found the technology can diffuse through the rest of the culture and begin to be adopted by the majority. The EV industry in Denmark is somewhere between innovators and early adopters.

2.6.6 Danish Consumer Council Future Plans

The Danish Consumer Council represents the opinion of consumers regarding numerous topics. Currently, the Consumer Council is looking to represent public interest regarding the future of electric vehicles in Denmark. The government’s goals may not align with the interests of the consumers regarding the implementation of EV’s. The government wants to replace gas vehicles with electric vehicles to propel the country closer to being fossil fuel free. The Danish population may agree to this, but the negatives associated with electric vehicles are just as evident as the benefits. Electric vehicle and battery technology is constantly improving, but the consumer’s needs have to be met for the EV movement to reach its full capacity. In order to better understand the Danish consumer’s interests and concerns our team identified the major barriers to EV uptake through the use of interviews, a survey, and research. The protocol for obtaining data through these processes outlined in the following chapter.

3. Methodology

The goal of this interactive qualifying project is to provide the Danish Consumer Council (DCC) with recommendations on how to allocate their resources moving forward in regard to electric vehicles. The adoption of electric vehicles by consumers will contribute to Denmark's goal of becoming fossil fuel free and significantly reduce the Danish dependency on oil. Communicating the consumer's perspective along with the industry barriers to overcome will enable the Danish Consumer Council to better protect consumer rights.

The objectives of the project are the following:

1. Understand the functions of the Danish Consumer Council in order to align our project with their vision and strategy.
2. Identify the barriers limiting major uptake of Electric Vehicles by consumers in Denmark and how they can be overcome.
3. Determine the interests and concerns the Danish consumer regarding electric vehicles.

The project team has utilized various data collection methods to understand the interests and concerns of Danish consumers regarding electric vehicles. The group has conducted interviews with diverse parties affected by electric vehicles including different consumer organizations, current EV owners, and EV manufacturers. The team utilized the Danish Consumer Council's quarterly Taenk survey to gain a general understanding of the consumer's perspectives towards electric vehicles. The information gathered has been analyzed and relayed to the DCC so that they can better protect consumer interests.

3.1 Flow Chart: Objectives to Methods

Our project is broken down into five main sections: problem statement, objectives, methods, analysis, and deliverables. Figure 3.6 below shows a simplified version of the progression of our project. The remainder of the methodology chapter discusses how we addressed each objective in order to create a final deliverable.

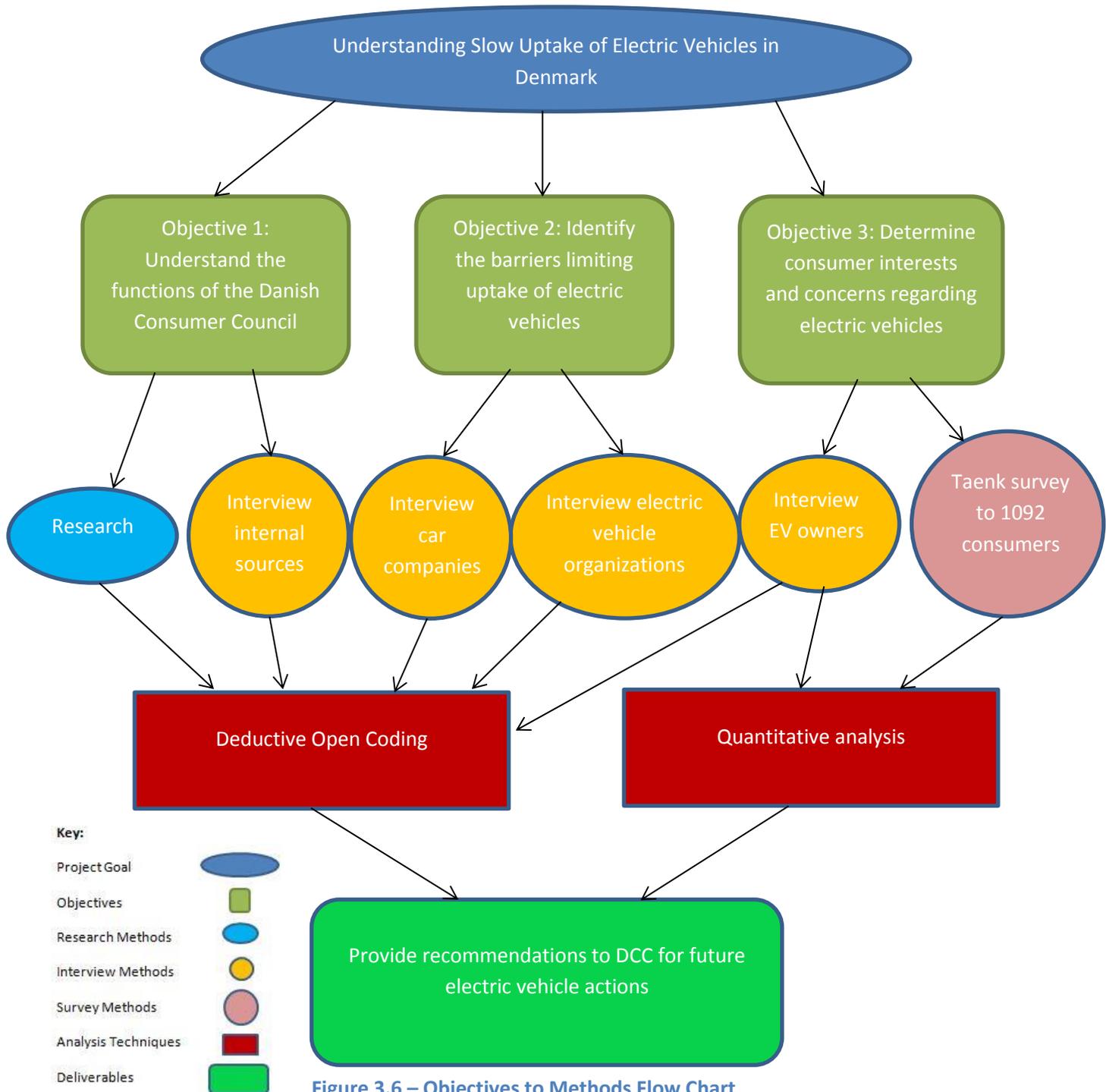


Figure 3.6 – Objectives to Methods Flow Chart

3.2 Methods Procedure

The study utilized research, interviews, and the Taenk survey to achieve the three main objectives. The procedure for each technique is listed below. Each section also provides an explanation on how and why the group made every decision during the project duration.

3.2.1 Research

This project included conducting more research on our sponsor through online sources to gain a better understanding of what they do. This investigation utilized online resources provided by the Danish Consumer Council to fully understand their typical process of action. We were given the history and vision of the Danish Consumer Council as a basis for this research. This influenced our recommendations for the Danish Consumer Council involving the future of electric vehicles in Denmark.

3.2.2 Semi-Structured Interviews

Semi-structured interviews were a primary method of research to complete all of our objectives. We organized our interviewees into three separate groups: electric vehicle organizations, potential electric vehicle owners, and electric vehicle dealerships. Table 3.3 shows the list of organization and dealership interviewees, which is organized alphabetically inside each color-coded group. The listed interviews brought to this research a broad range of perspectives from a number of affected parties and assisted in determining the consumer viewpoints of electric vehicles. The Danish Consumer Council provided the names of individuals and organizations that coincide with our list, and we have made a number of contacts through our own research. We attempted to contact individuals initially via phone call and if that was unsuccessful via email. Appendix B and C list our email and phone protocol respectively. A confidentiality boilerplate was read or paraphrased before each interview was conducted and it can be found in Appendix A.

Table 3.3 - List of Interviewees

Organization	Contact	Position	Purpose
Clever	Lisa Kirkegaard	Senior VP for Communications and Marketing	To learn about charging infrastructure availability and other related aspects of electric mobility.
Copenhagen Electric	Kare Albrechtsen	Secretariat	To understand what current activists are doing to propel the industry.
Danish Eco-Council	Jeppe	Transport Policy	To get a better understanding of the impact of electric cars in the Danish green movement.
Danish Electric Vehicle Alliance	Laerke Flader, Magnus	Branchechef,	To determine the purpose of pushing an electric vehicle uptake from a professional perspective.
Danish Standardization Organization	Regnar Schultz	Senior Consultant of Standardization	To understand standardization regulations for electric cars and their infrastructure.
E-Drive	Kurt Rene Jensen		To determine the purpose of pushing an electric vehicle uptake from a professional perspective.
Federation of Danish Motorists	Torben Lund Kudsk	Head of Public Affairs	To help determine the opinion of Danish car owners regarding their type of vehicle.
Federation of Danish Electric Vehicle Drivers	Steen Frederiksen	Chairman	To understand what current activists are doing to protect EV consumers
Norwegian Consumer Council	Gro Mette Moen	Advisor in Transport Division	To better understand why electric vehicles have had a successful uptake in Norway.
BMW Danmark A/S	Martin Storm	BMW i Department	To help determine potential buyers opinions on electric vehicles including pros and cons
Renault	Peder Klink	Salesman	To help determine potential buyers opinions on electric vehicles including pros and cons
Tesla Motors Copenhagen	Viktor Gudmundsson	Product Specialist	To help determine potential buyers opinions on electric vehicles including pros and cons

The project’s interview process included two to three group members per interview, each with designated roles. The team members rotated through the following roles: Leader, Secondary Questioner (optional), and Secretary. The Leader was responsible for running the meetings, ensuring the interviewees time is being used effectively, and asking pre-determined questions. The Secondary Questioner, if present, came up with new questions throughout the

interview. This position was designed to aid the Leader in the discussion. The Secretary was responsible for taking notes or recording the interview. In the following days, the Secretary was then required to transcribe the interview for analysis purposes. The remaining group members who did not attend the interview were then responsible for the first five steps of the open coding process, which can be found in section 3.4. Our team developed a standard list of questions for each interviewee group including vehicle organizations, car manufacturers, and electric vehicle owners. The corresponding standard questions were asked at the beginning of each interview in order to learn the demographics and be able to easily compare and contrast the different interview results. Below are the lists of the standard questions that were asked to each grouping of organizations, car manufacturers, and vehicle owners.

Standard Electric Vehicle Organization Questions:

1. Please state your name and title at your organization.
2. What is your organization's purpose? What methods do you use to achieve your goals?
3. Does your organization have any relations to electric vehicles?
4. What are the barriers preventing the Danish electric vehicle industry from developing?
5. In general, what is the opinion of the Danish population concerning electric vehicles?

Questions 1,2,3: The main purpose of these standard questions was to gauge a demographic from the interviewee as well as have on record their name, organization, and their organizations purpose. The project team used this demographic information to compare and contrast the different interview responses across the separate companies to judge what each industry's stake is regarding electric vehicles.

Questions 4,5: Were aimed to directly address objectives 2 and 3 respectively.

Electric Vehicle Dealership Questions:

1. Why do you think there are more EV sales in Norway than Denmark?
2. On average, how many people per day contact your dealership looking for an electric vehicle? Gas vehicle?
3. What is your electric vehicle strategy for the future? Are there any new strategies being put into place to help push the sales of electric vehicles?
4. What have you found the major concern to be for potential EV buyers?
5. Would you purchase one of your own models?
6. What are some of the main barriers holding the Danish consumers back from purchasing electric vehicles?

7. If Denmark is to see a developed electric vehicle industry within the next few years, what needs to be the industry's top priority?
8. Have consumers of your electric models typically purchasing these cars as their primary vehicle? Or are they being purchased as a secondary vehicle?
9. Is (name of company) working with Denmark to see a larger infrastructure for electric vehicles throughout the country?

Questions 1, 3, 5, 7, and 8: The project team asked these questions to understand what the major barriers preventing EV uptake in Denmark are (Objective 2).

Questions 2, 4, 5, 6, and 7: The team asked these questions to gain insight on current consumer thoughts, positive and negative, of electric vehicles (Objective 3).

Question 9: The team asked this question in order to see the level of commitment a company has towards advocating for their electric models and further developing the electric vehicle industry.

Potential Electric Vehicle Owners Questions:

1. Do you own a car?
2. If so, what kind of car? (gas, diesel, electric, hybrid, etc.)
3. Would you consider purchasing an electric car? Please explain either why or why not.
4. What needs to be changed in order for you to further consider purchasing an electric car?
5. What aspect (range, charge time, price, aesthetics, etc.) is most important to you when purchasing a new vehicle?
6. Do you think electric cars will make an impact in the future towards Denmark's fossil fuel free goals?
7. How would you describe the general public's opinion on electric cars?

Questions 1 and 2: The team asked this question for basic demographic information that was later used for grouping in the analysis phase.

Question 3, 5, 6, and 7: The project group asked these questions in order to gain a better understanding of consumer concerns regarding EVs (Objective 3).

Question 4: This question determines the consumer's thoughts on the major barrier preventing the uptake of EV's. (Objective 2)

The team planned the interviewing trips in an effective and manageable way by mapping out the location of each site in figure 3.7. This visualizes the interview locations so that the team was well prepared for traveling.

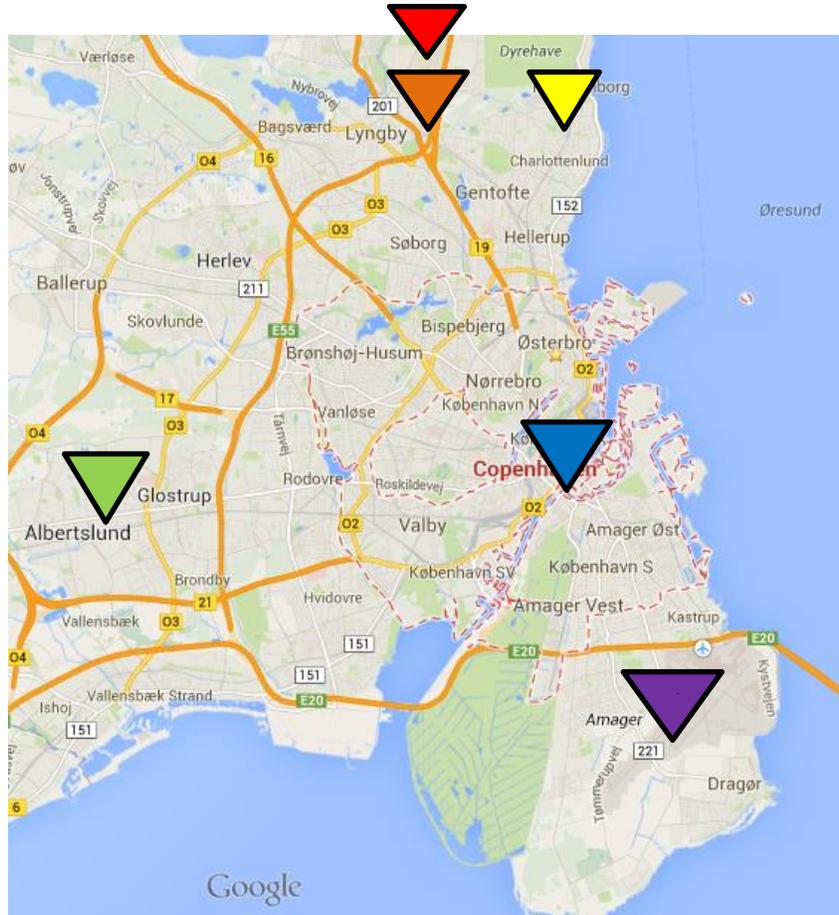


Figure 3.7 – Interview Map

Interview Locations

Tesla Motors	Viktor Gudmundsson
BMW	Martin Storm
Renault	Peder Klink
Clever	Lise Kirkegard
Copenhagen Electric	Kare Albrechtsen
Danish Eco Council	Jeppe Juul
Danish Electric Vehicle Alliance	Magnus Gottlieb
Danish Standardization Organization	Regnar Shultz
Electric Vehicle Drivers of Denmark (FDEL)	Steen Frederiksen
Federation of Danish Motorists	Torben Lund Kudsk
Norwegian Consumer Council	Gro Mette Moen

*Interviews held at the Danish Consumer Council= 

3.2.3 Consumer Taenk Survey

The Danish Consumer Council releases a quarterly magazine called Tænk. Tænk provides consumers with information regarding current council activity as well as offering advice on purchasing services and goods. In this quarterly magazine that was released in April, Tænk requested that its subscribers answer an online survey to better understand the current consumer interests. Our sponsor, Martin Salamon, allotted us space for five questions in this Taenk survey which was sent out to 2710 subscribers. We obtained responses from 1092 individuals which is a response rate of 40%. This allowed us to analyze the quantitative answers of over 1000 individuals with varying age, gender, and location. A copy of the final Taenk survey can be found in Appendix D while the specific questions and reasoning can be found in section 3.3.3.

We submitted a copy of our five question Taenk survey to our sponsor for review the first day upon arrival to the Danish Consumer Council. We met with Martin on the following day to discuss the initial questions provided. We decided to replace the question on tax exemption for electric vehicles with one about what type of car (gas, diesel, electric, and hybrid) people are interested in purchasing. This would allow the opportunity to gain a better understanding of the type of cars consumers are currently seeking. The next item addressed in the meeting was the reasoning for providing each answer on the Taenk survey. These explanations are provided in sections 3.3.2 and 3.3.3, depending on the correlated objectives. The only change made to the provided answers was adjusting the cost intervals in question two. Instead of finding the actual price of vehicles in Denmark, we converted American prices to Kroner. The numbers originally provided did not align with the actual values of vehicles in Denmark and as a result, needed to be changed.

3.3 Method Techniques

The study required the group to speak with a variety of individuals with expertise in different fields. The following section outlines the main methods the group used for specific tasks. This section outlines the main research protocol along with the specific questions the group asked throughout the project duration.

3.3.1 Research

Understanding the functions of the Danish Consumer Council was an ongoing process where each day we became more accustomed to how the DCC functions and how they best utilize their time and resources. In order for this project to be of use to them, the recommendations our team makes must fit in the target scope of the Danish Consumer Council.

We achieved this objective by using two main methods, research and assimilation. The project group performed the majority of the research through online searching of the Danish Consumer Council and how they function. Our sponsor provided the team with very useful material including the company's strategic plan, mission, and vision via a multi-slide PowerPoint presentation. The team gained a much stronger basic knowledge of the purpose and functionalities of the DCC after reading through the PowerPoint. We were given an in-depth analysis of their strategy, history, and statues via online sources (Taenk, 2014). After conducting a thorough investigation of these sources, the team designed the project to coincide with the Danish Consumer Council's vision. Much of the basic information is included in the background (see section 2.1) but this only serves as a foundation. Our understanding was built upon the foundation as the assimilation process took effect. In order to expedite this process, the team spoke to over ten employees to understand the inner workings of the DCC. We asked questions such as: What is your position? What projects are you working on? How do you better protect consumers? What are your main methods for completing tasks? By observing the other employees, the group determined the applicability of the project's scope, and better tailored our recommendations on how the Danish Consumer Council could best utilize its resources to improve the electric vehicle industry.

3.3.2 Semi-Structured Interviews

The study required asking different questions to each individual because of their experience and expertise. The full list of organization specific questions can be found in Appendix E. The following section outlines the most important questions asked to the individuals. Included in each question is an explanation of why it was asked.

Clever(A)

A1 Are there any specific safety precautions concerning electric vehicles today compared to gas, diesel, and hybrid vehicles?

A2 How important are the aesthetics of vehicles to Danish car owners?

A3 Are there any specific findings on certain demographics that are more likely to be electric car owners?

A6 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Question A1 and A2: These questions establish if either safety or aesthetics were barriers preventing consumers from buying electric vehicles. (Objective 2)

Question A3: This question determines the market for EVs in Denmark. Certain demographic information would be crucial for creating recommendations. (Objective 2)

Question A6: The reason for asking this question is to contrast differing opinions on future changes for a more established EV industry in Denmark. These opinions were beneficial for providing future recommendations to the DCC.

Copenhagen Electric (B)

B1 Are there any specific safety precautions concerning electric vehicles on the market today compared to gas, diesel, and hybrid vehicles?

B2 How important are the aesthetics of vehicles to Danish car owners? With most electric vehicles on the market today having a distinguished look, do you think this affects the total sales?

B4 Are the electric vehicles being used as primary cars?

B6 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Questions B1 and B2: Refer to question A1 above for explanation. (Objective 2)

Question B4: The goal of asking this question was to determine the electric vehicle market in Denmark. This information was crucial for future recommendations by understanding the current needs of the consumer. (Objectives 2 and 3)

Question B6: Refer to question A6 above for explanation.

Danish Eco-Council (C)

C2 Have you thought about more possible incentives to push EV sales?

C5 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Question C2: This gains a better understanding on current and future government actions.

Posing this question provided the study with knowledge on governmental actions for future recommendations. (Objective 3)

Question C5: Refer to question A6 above for explanation.

Danish Electric Vehicle Alliance (D)

D1 Do you believe that car dealerships selling both electric and non-electric vehicles increase the price of their electric models to compete with gas models after the vehicle registration tax?

D2 Are there any specific safety precautions concerning electric vehicles on the market today compared to gas, diesel, and hybrid vehicles?

D3 How important are the aesthetics of vehicles to Danish car owners? With most electric vehicles on the market having a distinguished appearance, do you think this affects the total sales?

D5 Are the electric vehicles being used as primary cars?

D6 How standardized is the electric vehicle infrastructure in terms of interoperability in Denmark? (Ex. Charging stations, parking, etc)

D8 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Question D1: This question provides a better understanding towards a possible barrier preventing the uptake of EVs in Denmark. The question posed provided opinions on the possibility of car dealerships raising EV prices to profit from the vehicle registration tax. This would essentially negate the removal of the vehicle registration tax to the consumer. (Objective 2)

Questions D2 and D3: Refer to questions A1 and A2 above for explanation. (Objectives 2 and 3)

Question D5: Refer to question B4 above for explanation. (Objectives 2 and 3)

Question D6: The team asked this question to gain a better understanding towards a possible barrier preventing the uptake of EVs in Denmark. The electric vehicle industry not being standardized was identified as a potential barrier preventing the development of the industry. (Objective 2)

Question D8: Refer to question A6 above for explanation.

Danish Standardization Organization (E)

E1 What needs to become consistent between all models of electric vehicles in order for the EV industry to see growth? (NOTE: bring up parts of electric vehicles that may need to be standardized if they are not mentioned ex. Charge time, range, price, charging methods, parking,)

E2 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Question E1: The group asked this question to show the possible barriers in the sense of standardization. It may also turn out that standardization is not involved with any of the barriers preventing the development of the electric vehicle industry. (Objective 2)

Question E2: Refer to question A6 above for explanation.

Federation of Danish Electric Vehicle Drivers (F)

F1 Do you believe that Car Dealerships selling both electric and non-electric vehicles increase the price of their electric models to compete with gas models after the vehicle registration tax?

F2 Is there any specific safety precautions concerning electric vehicles on the market today compared to Gas, diesel, and hybrid vehicles?

F3 How important are the aesthetics of vehicles to Danish car owners? With most electric vehicles on the market having a distinguished appearance, do you think this affects the total sales?

F5 Are the electric vehicles being used as primary cars?

F6 How standardized is the electric vehicle infrastructure in terms of interoperability in Denmark? (Ex. Charging stations, parking, etc)

F8 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Question F1: Refer to question D1 above for explanation. (Objective 2)

Question F2 and F3: Refer to questions A1 and A2 above for explanations. (Objectives 2 and 3)

Question F5: Refer to question D4 above for explanation. (Objectives 2 and 3)

Question F6: Refer to question D6 above for explanation. (Objective 2)

Question F8: Refer to question A6 above for explanation.

Federation of Danish Motorists (G)

G1 How standardized is the electric vehicle infrastructure in terms of interoperability in Denmark? (Ex. Charging stations, parking, etc)

G3 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Question G1: Refer to question D6 above for explanation. (Objective 2)

Question G3: Refer to question A6 above for explanation.

Norwegian Consumer Council Elbilforeningen (H)

H1 What changes over the past few years have led to a successful EV industry?

H2 Is there any specific safety precautions concerning electric vehicles on the market today compared to Gas, diesel, and hybrid vehicles?

H3 How important are the Aesthetics of vehicles to Norwegian car owners? With most electric vehicles on the market having a distinguished look, do you think this affects the total sales?

H5 Are the electric vehicles that have been sold being used as primary cars?

H6 How standardized is the electric vehicle infrastructure in terms of interoperability in Norway? (Ex. Charging stations, parking, etc.) Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?

H7 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Question H1: The project team asked this question to understand why Norway is the most successful EV nation in the world. Because Norway and Denmark are so similar, finding out what changes have been made in Norway to enable a successful electric vehicle industry would benefit the study immensely (Objective 2).

Question H2 and H3: Refer to questions A1 and A2 for explanations. (Objectives 2 and 3)

Question H5: This question provides a better understanding towards a possible barrier preventing the uptake of EVs in Denmark, especially if Norway is using these cars as secondary/commuting cars. (Objectives 2 and 3)

Question H6: This shows the possible barriers in the sense of standardization and how Norway is overcoming them. (Objective 2)

Question H7: Refer to question A6 above for explanation.

BMW (I)

I1. We have read that the BMW I3 is going to revolutionize electric vehicles on the market, how does it stand out from other electric vehicles available? Is the I3's performance comparable to the BMW gas and diesel models?

I2. Has there been any pre-sales offered to consumers for the BMW I3? How much interest from Danish consumers has it drawn so far?

I3. Are you aware of the former company Better Place, and their idea of battery swapping technology? Do you think it is still a plausible idea that could reduce charge time significantly? What is BMW working on in terms of reducing charging time?

Question I1: The question aims to identify the key aspects that consumers are interested in because the i3 is one of the most highly rated EV models on the market. (Objective 2)

Question I2: The project team asked this question to gain a better understanding of current consumer interest in EVs. (Objective 2)

Question I3: This question serves multiple purposes. First, it is aimed to discuss the failure of Better Place and its relevance to the consumer. Second, it sparked conversation on the issue of charge time. Finally, it is posed to bring up the issue of range and what BMW is doing to resolve this issue moving forward. (Objectives 2 and 3)

Renault (J)

J1. Even though Renault's attempt at reducing charging time with Better Place fell through, what is Renault working on moving forward in terms of enhancing electric vehicles?

J3. How much interest has the Renault Twizy drawn? The Kangoo Z.E.? The Kangoo Z.E. Maxi? Why would a potential buyer choose these models over the other models you offer?

Question J1: This question is important because Renault was the only car company to sign a contract with Better Place. Their input on Better Place would be very knowledgeable because of their recent experience with the company. It is important to see what Renault's plans to do in terms of addressing the concern of range. (Objective 3)

Question J3: This question is posed to understand what current buyers are looking for in an EV. (Objective 2)

Tesla (K)

K1. The Model S seems to have really taken off as a leader in the electric vehicle industry, how does it compare to other electric, gasoline, diesel, and hybrid vehicles on the

market today? In what ways does it out-perform the competition? In what ways does it under-perform compared to the competition?

K2. Has there been any pre-sales offered to consumers for the Model X? How much interest from Danish consumers has it drawn so far?

K3. Even though the Model S is superior compared to other electric vehicles available to consumers, it is one of the pricier models. Is Tesla going to remain solely a luxury vehicle company, or are there intentions to make a more affordable model for the average Danish Consumer?

K5. Are you aware of the former company Better Place, and their idea of battery swapping technology? Do you think it is still a plausible idea that could reduce charge time significantly? What is Tesla working on in terms of reducing charging time?

Question K1: Since the Model S is often looked at as the premier electric vehicle on the market, the Tesla representative's opinion how it compares to other vehicles would be valuable information. (Objectives 2 and 3)

Question K2: The difference between the Model X and Model S is that the Model X is a larger car. The project team asked this question to further understand what consumers are looking for in electric vehicles, specifically size of the car. (Objective 3)

Question K3: The group asked this to see if the company is attempting to broaden their target market by offering a cheaper model. This is aimed to help the team understand whether price or range is the main issue for consumers. (Objective 3)

Question K5: This question outlines what consumers are looking for when purchasing an EV. The question was asked to bring up a conversation about Better Place and figure out what Tesla is doing to combat the long charge time issue. (Objective 3)

3.3.3 Taenk Survey

The study's five question Taenk survey was distributed to 2710 individuals across the entire country of Denmark. The main goal of the Taenk survey was to study consumers' attitudes about electric vehicles. The project team asked each question to achieve either object

2 or 3. Along with asking these five questions, the Taenk survey obtained basic demographic information about responding individuals. The five questions are listed below along with explanations for asking each individual question.

- 1) What type of car would you consider buying for your next car?
 - a) Gas
 - b) Diesel
 - c) Electric
 - d) Hybrid
 - e) Others

By asking this question, we began to understand what current consumers are looking for in their new car purchases. We decided to list the top four selling types of cars as answers along with a category for others. The spread of answers determines the status of the current vehicle market in Denmark. This question determines whether or not consumers are even considering buying an electric or hybrid vehicle.

- 2) What is the price range you would be willing to spend on a new vehicle?
 - a) Under 100,000 DKK
 - b) 100,000 – 200,000 DKK
 - c) 200,000 – 300,000 DKK
 - d) 300,000 - 450,000 DKK
 - e) Over 450,000 DKK

This question provides information on whether or not consumers are willing to pay for electric vehicles to make an environmental impact. These values are based on price values comparing different electric vehicles. The cheapest electric cars are about 100,000DKK. The average car price ranges from 100,000DKK to 200,000DKK. The higher end electric cars are between 200,000DKK and 300,000DKK. The Tesla models are all above 500,000 DKK.

3. What improvements concerning electric vehicles would substantially impact your decision to purchase one? (Please select all that apply)
 - a) Longer range per single charge
 - b) Reduced charging time
 - c) Increased availability of charging stations
 - d) Cheaper MSRP (manufacturer's suggested retail price)
 - e) Aesthetics
 - f) Other

This question determines the most important factors to the Danish consumer and ranks them by priority. The answers provided come from the list of hypothesis, located in section 3.4, the project team created for the slow EV uptake in Denmark.

4. What would you consider to be the longest acceptable time to fully recharge the battery of an electric vehicle?
 - a) Over 8 hours
 - b) 5-8 hours
 - c) 2-5 hours
 - d) Less than 2 hours

This provides current consumer opinion of EV recharge time. Based on a side by side comparison of all electric vehicles, the range of charging time is between 2.5 hours and 12 hours at 240 volts (fueleconomy.gov). The majority of EVs fall within choices b and c. Answer a is based on an average night sleep. Only 1 model can fully charge in less than 2 hours..

5. What is the range that an electric vehicle would need before you would consider buying or leasing it?
 - a) Under 80km
 - b) 80-160km
 - c) 160-320km
 - d) 320-450km
 - e) Over 450km

This question provides data on the general population's thoughts on the limitation of electric vehicle range. Based on a side by side comparison of electric vehicles, the range varies from 80 km to 450 km. Answer a only includes 3 models. Answer e is unrealistic because zero models travel more than 450km. The majority of electric vehicles range from 80 to 160 km, which is answer b. Only the expensive Tesla models cover the distance required for answer d. Answer c is the difference between the Tesla models and the remainder of the electric cars (Clean Technica, 2013).

3.4 Qualitative Analysis Process

After studying the electric vehicle industry for seven weeks during the seven-week project preparation phase, the group formed some rough hypotheses on why the industry has not succeeded yet in Denmark. The team's initial thoughts were that the lack of standardization

and interoperability, in terms of charging stations, was a major factor. Another hypothesis was that although Norway is similar to Denmark, they sell more EVs because they have a higher per capita GDP. This coupled with their ability to produce cheap electricity through hydropower makes them a world leader in EV sales. Demographically, the group hypothesized that EVs were only being bought as second cars because of their lack of range. Danish cars are already very expensive and EV prices are too high for a country with low car sales. Some secondary factors the team considered were that the charge time is too slow, EVs are not aesthetically pleasing, and most car companies are not pushing their sales. Overall the group considered that it may not be plausible to have fully electric vehicles and that hybrids are a more viable option for present day. Generating these hypotheses propelled thought into selecting categories for a deductive open coding analysis procedure.

To convert raw audio files into useable data, the group first transcribed the recording, conducted a process called deductive open coding. Open coding is a tactic where the analyzer goes through a transcription and highlights with different colors based on the topic at that point in the interview. In this case, the project group used deductive coding which means that one creates the color scheme or categories before going through the transcription. Inductive coding is the opposite where one creates categories based on the topics the interviewees discussed. We choose deductive coding because it was easier to analyze across multiple interviews if the categories were the same and the group already had a good idea of which topics would be discussed based on the questions posed. Table 3.4 shows the categories the team created with their respective colors. Section 3.4.1 is a step-by-step process of the analysis process.

Table 3.4 – Open Coding Categories

Purpose, Goals, Methods, Organizations Relations with Electric Vehicles-	YELLOW
Price-----	TURQUOISE
Aesthetics-----	PINK
Norway-----	GREEN
Range-----	RED
Demographics-----	VIOLET
Consumer Interests-----	GRAY 50%
Standardization/Infrastructure-----	GRAY 25%
Incentives, Taxes-----	DARK YELLOW
Moving Forward-----	DARK RED
EV Owner-----	BLUE

3.4.1 Open Coding Process

1. Set Up and Conduct Interview with Representative

See section 3.2.2 for our contact and interview protocol.

2. Transcribe the Interview

The project team recorded each interview after receiving permission from our interviewees. One individual then transcribed these recordings verbatim into word documents, seen in Appendix G.

3. Open Coding Highlighting

Magnus: So, actually the thing in Denmark right now, so what we call a microcar, that are certainly small cars that have three doors or sometimes 5, they are really cheap. And the reason is that they are so fuel efficient nowadays so they can also be exempt from the taxes from this fuel efficiency scheme and also that they are just really really small. People buy them. Those are, the ten most sold cars in Denmark for the last 2-3 years have been microcars. Microcars are not particularly safe but theyre cheap. So everyone just buys them. That would imply that people are not as concerned with safety as they are with money.

Jackie: So what about aesthetics, you know the looks of the cars, some electric vehicle models are distinctly different than the average gas powered vehicle. Do you think that affects the way consumers look at EVS?

Magnus: That's a good question, I mean recently electric cars have started to become even more similiarized to gas powered cars. I mean recently in the 90s and even 80s there were these electric cars that were not as big as other ones, didn't go as far or as fast, we have a story about a Danish produced car. It had a glass cockpit all around you that opened up like this. And until recently the electric car in Denmark has just been equal to that. Its something that you drive but isn't really a car. But then in the last couple of years cars have come with ordinary tires and ordinary body and stuff like that. SO I don't think today that people think of EVs as ugly or strange I think that some of the biased is that the electric car looks different. I would say most people probably don't think of it. I don't think anyone thinks that electric cars are ugly. That's not my general...

Figure 3.8 – Highlighted Transcription

Figure 3.8 is an example of the highlighting process, with the turquoise representing price and the pink representing aesthetics. When a block of text fell under multiple categories, we highlighted it with the applicable colors and then came back later to separate each sentence in to the categories that made the most sense.

4. Organize Highlighted Sections in Excel

The project group decided to use Excel for organizing the large quantity of data collected through interviews. Each interview group had its own Excel file and each interview had its own Excel sheet inside the corresponding group file (see figure 3.9). The team went through the highlighted transcriptions and copied the highlighted text into the respective categories.



Figure 3.9 – Excel Interview Tabs

5. Clear and Concise

After organizing the text, the next step was to reduce the text while making it more concise and easier to read. When copying transcriptions verbatim much of text is not relevant and just takes up space, so this was an important step for ease of analysis. Figure 3.10 gives an example of this step in the total open coding process.

Interviewee	Organization	Purpose/EV Relation	Price	Aesthetics	Norway	Range
Lisa Kirkegaard	Clever	<ul style="list-style-type: none"> The purpose of clever is to be an electric mobility operator and our purpose is too charge electric vehicles, and help secure the 	<ul style="list-style-type: none"> The main one for the private consumer is the price for the car. Above all, this is the main obstacle because of the taxation system... 	<ul style="list-style-type: none"> I think that the first movers, and it is first movers that purchase, they want the car to be distinguished. The car functionally has been 	<ul style="list-style-type: none"> They have a technical taxation where the cars are taxed after how much they pollute and emit, and furthermore they don't have any 	<ul style="list-style-type: none"> 1600 families have participated and they lend a car 3 months for free and drive it around and we can see they don't use the full range of
		<ul style="list-style-type: none"> We don't give goals on the home charging solutions, those goal we keep to ourselves. However we have announced 50 				

Figure 3.10 – Interview Organization by Category

6. Intra-Group Comparisons

Once all the text was coded and placed into the categories the next step in the process was to compare the interviews within their own groupings. To make this simpler we created sheets for each group called “Compare” where each interview’s data related to a certain topic was placed next to the other interview’s topics. Figure 3.11 is an example of this step illustrating comparing the car manufacturers’ purposes and EV relations.

Tesla Purpose/EV Relation	Renault Purpose/EV Relation	BMW Purpose/EV Relation
<ul style="list-style-type: none"> IM actually called a Product Specialist, so my role within the company is to do marketing and direct consumer relationships. either plan a strategy on how to penetrate the Danish Market, how to put electric vehicles on the road, and how to form a direct relationship with the consumers, basically sales as well. Although in my 	<ul style="list-style-type: none"> I am the steady guy in here. I worked at the Renault store before. I am not the head of sales here at Renault, but I am the one you come to if you have a question. I take the electric vehicles under my wing. I am just a salesperson, but it is my responsibility to pick up the news and distribute it to my colleagues. Some weeks we do not hear from anyone, but sometimes we hear from about 4-5 per week. People have to get 	<ul style="list-style-type: none"> I have been at BMW for 10 years. I originally worked with selling traditional cars, now I have the responsibility for the BMW I in Denmark we got some cars here in November for what we call a soft launch, so the customers can test drive and see what it was all about. If the customer wanted to have one of the first i3's in Denmark, they could put down a deposit of 20,000 kroner, and would be put into a pool of buyers that will be released in may june and july this year, we have a goal of about 100 cars this

Figure 3.11 – Intra Group Comparison

7. Summarize Intra-Group Comparisons

To make writing the analysis easier we decided to take the process a step farther and summarize each interview by category. This section is colored in yellow. The analysis method then called for writing all the similarities within the category as well as all the differences. The green section highlights the similarities while the red shows the differences. This process can be seen in figure 3.12.

Tesla Standardization	Renault Standardization	BMW Standardization	Tesla Incentives	Renault Incentives	BMW Incentives
<ul style="list-style-type: none"> You need more electric vehicles to build the charging stations. Which comes first, do you start with the charging stations or do you start with the electric vehicle. That's a dilemma, the chicken or the egg. So that's when the government should step 	<ul style="list-style-type: none"> I think if they made the same sockets that you put in the car. If they standardize these things, then it would be easier for electric vehicle owners to go to any charging point and put in my car there. I think it is the job of the European Union The EU just put in a law that says 	<ul style="list-style-type: none"> the infrastructure in Denmark is one of the best, but people just don't know about it. Consumers can also purchase a wall box to charge at their homes, it also provides a faster charge. The main partner is clever, you get the BMW charge card with a premium 	<ul style="list-style-type: none"> Lets start with the government. The governments top priority would need to be to have some sort of subsidies, to help out the EV industry at the beginning. Personally I believe that when you have such a new technology, such a disruptive technology, 	<ul style="list-style-type: none"> No price is not an issues because luckily for EV's Denmark has some of the highest tax on cars so when we buy a petrol or diesel car in Denmark there is a 180 percent tax on the car. There is no tax for the electric cars 	<ul style="list-style-type: none"> It is, actually it has its own place, 180% tax 25% VAT, but this car is slightly stout in between these positions. And that is why we have been able to have this huge reduction in tax.: with the exemption of the vehicle registration tax, it says that it is expiring is that a concern for consumers Martin: they are extending
<p>Government needs to step up and build more infrastructure otherwise it's a chicken and the egg scenario with selling cars / charging stations.</p>	<p>governments responsibility to standardize and develop infrastructure.</p>	<p>Charging infrastructure in Denmark is very good, its just not advertised</p>	<p>incentives are there but to really establish an EV industry in Denmark, the government should abolish the VAT on electric vehicles.</p>	<p>Feels as though the tax exemption on EV's is good and working.</p>	<p>BMW with range extender doesn't get the exemption but will have huge tax deductions based on the small amount of CO2 emissions.</p>
<p>Tesla and Renault say the government needs to get involved more</p>			<p>No real agreement among companies</p>		
<p>BMW says the infrastructure in denmark is actually pretty good already.</p>			<p>enough. Renault says it is, and BMW is now concerned with new tax deductions base</p>		

Figure 3.12 – Intra Group Compare and Contrast

8. Draw Conclusions

The final step in the process is to take the summarized text and begin to draw conclusions about what it means. First the project team wrote about each interview and compared and contrasted within each grouping. Then, the group compared across the three types of interviews as a cross group analysis to determine the broad range of views based on each topic.

3.5 Quantitative Analysis

The project team chose to complete the quantitative analysis after the qualitative analysis because the Taenk survey results came back during week 5 and due to time constraints, having one section of the analysis completed at that point was paramount. Once the DCC released the Taenk survey, there was approximately a five week delay before the results came back. The results came back in Excel files with the five electric vehicle questions as well three demographic questions on age, gender, and housing region. Figure 3.13 is an example this raw demographic data the Danish Consumer Council provided the group. Our goal was to look for any correlations or patterns based on the demographics and the electric vehicle questions posed. For example one of our original hypotheses (see section 3.4) was that less populated regions of Denmark would have a lower interest in EVs. The Taenk survey results allowed the group to check the validity of the hypotheses and look for any unforeseen barriers to EV uptake.

1. What is your gender?							
						Respondents	Percent
	a. Male					421	38.6%
	b. Female					671	61.4%
						1092	100.0%
2. How old are you?							
						Respondents	Percent
	a. Under 25 years of age					58	5.3%
	b. 25-35 years of age					181	16.6%
	c. 36-49 years of age					203	18.6%
	d. 50-60 years of age					269	24.6%
	e. Over 60 years of age					381	34.9%
						1092	100.0%
3. In what part of the country/region do you live?							
						Respondents	Percent
	a. Hovedstaden					360	33.0%
	b. Sjælland					165	15.1%
	c. Syddanmark					204	18.7%
	d. Midtjylland					256	23.4%
	e. Nordjylland					95	8.7%
	f. Bornholm					12	1.1%
						1092	100.0%

Figure 3.13 – Taenk Survey Analysis Spreadsheet

The initial step in analyzing the data was to convert the answers from Danish into English. This was especially important for the questions that had an option of write-in answers (see question 3 in 3.3.3). Once the results were in English the group created an outline of the results based on the electric vehicle question posed and then combined with the demographics to see if anything was of interest. To display these correlations effectively we utilized Excel to create different graphs including bar charts, stacked bar charts, pie charts, and column charts. When finished with our initial results we then consulted with a member of the Danish Consumer Council to compare. This process allowed us to develop our own thoughts and create a strong learning experience. The meeting’s main discussion topics included graph standardization and demographic based results. We have displayed the improved results and analysis in Chapter 4: Data and Analysis.

3.6 Methodology Overview

Table 3.5 is a Gantt chart that visualizes the time spent on each phase of the investigation.

Table 3.5 – Methodology Tasks

Methodology Tasks	Weeks							
	Prep	1	2	3	4	5*	6	7
Create and Submit Taenk Survey Questions	■	■						
Prepare for Interviews	■	■	■					
Understand DCC Strategy	■	■	■	■	■	■		
Conduct Interviews**			■	■	■			
Organize and Evaluate Data				■	■		■	
Preliminary Recommendation Discussion							■	
Finalize Findings for DCC Report					■	■	■	■

* Work will be slowed in the end of week 5 and beginning of week 6 due to the extended Easter break

** The dates of scheduled interviews were 3/25, 3/31, 4/1, 4/2, 4/2, 4/3, 4/4, 4/8, 4/9, 4/10, 4/10, 4/10.

This project gathered data and information on schedule through the methods provided. The group analyzed Taenk survey data later than expected due to the return date of the information. The details of the Gantt chart allowed the group to keep on task and meet deadlines. Doing so allotted enough time for the team to thoroughly analyze all the collected data. The data with analysis is located and summarized in the following section.

4 Data and Analysis

Chapter 4 consists of our internal research within the Danish Consumer Council, interview analysis, and survey analysis. Our internal research directly meets objective 1 which is to better understand the functions of the Danish Consumer Council so we can align our work with their vision and strategy. The interview analysis met both objectives 2 and 3. More specifically, interviews conducted with various organizations and car dealerships met objective 2, which is to identify the barriers preventing consumers from adopting electric vehicles. Interviews conducted with electric vehicle owners and non-owners meet objective 3, which is to understand the consumer interests towards electric vehicles. Lastly the survey analysis of the Taenk survey also meets objective 3 by providing input from consumers throughout Denmark.

4.1 Internal Research

Over the course of this project, our team conducted our work to fit the Danish Consumer Council's mold. Coming into the project, our team had a general understanding on how a consumer council functioned, but it was difficult to judge exactly what they did. By speaking to employees from different areas of the council, it became clear that everyone strives towards their main goal of protecting and empowering consumers. Some employees we spoke to include Senior Economist Troels Holmberg, Senior Advisor Sine Jensen, Senior Economist Morten Pedersen, Senior Jurist Mads Braüner, Student Employee Ilyas Dogru, Senior Advisor Claus Jørgensen, and Chief Economist Martin Salamon. The employees use a variety of methods to achieve the organizations goals and in doing so, increases strategic effectiveness. Lobbying is a tactic used by the council to get government policies changed for the benefit of the consumer. They use their strength in the Danish media as an incentive for the government to respond to needs in a timely fashion. It is the council's job to aid the consumers in making informed decisions on their purchases when companies and manufacturers try to take advantage of them. Funded by their large membership, the council returns value to its members by providing product testing, political results, and reviews of companies to publicly encourage ethical behaviour.

The Danish Consumer Council has a set of objectives outlined in their strategy on their website (Taenk, 2014). This includes their strategic plan, mission, vision, and statutes. The mission of the DCC is to strengthen consumer empowerment, while their vision is a Denmark where all consumers can make a safe choice. These two statements encapsulate the Danish consumer mindset and give us a direction to head in when making our final recommendations. In order to reach their mission, the Consumer Council's three strategic objectives are: to be relevant and meaningful – at all stages of life; to make it easy for individuals to make a good choice; and to promote balanced consumption. The Council focuses on political results through lobbying in the European Union and more specifically through the Danish Government. Due to the fact that consumerism is such a broad topic, they do not focus on all aspects and specifically leave out income taxes, distribution of wealth, and defence.

Relaying information to the consumer is extremely important to the Danish Consumer Council. Their main method of communication is the release of two magazines Forbrugerrådet Taenk (Think), and Forbrugeråddet Taenk Penge (Think Money). The DCC distributes Taenk monthly to all members and is the most popular consumer magazine in Denmark with 85,000 subscribers. Council members must pay a surcharge fee to receive Taenk Penge, a supplementary magazine. The main difference between the magazines is that Taenk Penge writes about specific financial industries while Taenk focuses on general consumer products. Looking through several issues of these two magazines, the project team saw how the Council communicates with consumers and in turn learned how to properly present our findings. For instance, a product testing example can be found in figure 4.14 on the current GPS's on the market. A similar page made for electric vehicles may be beneficial in promoting and communicating the EV industry to consumers.



Figure 4.14 - DCC Review of GPS'

4.2 Interview Analysis

In order to get an understanding of the electric vehicle uptake in Denmark, the project team interviewed Garmin specific professionals in the field including electric vehicle organizations, potential EV owners, and car dealerships. Such information helped us learn about general consumer opinion, barriers to uptake, the charging infrastructure system, and overall opinions on moving forward. Section 4.2.1 summarizes each car manufacturer interview individually and then compares all three to each other. Next in section 4.2.2, all interviews in the electric vehicle and sustainability group are summarized individually before analyzing them as a group. The third section, 4.2.3, is an analysis of our feedback regarding EV owners and non-owners. Finally, section 4.2.4 brings it all together to form a cross group analysis.

4.2.1 Car Manufactures

4.2.1.1 Tesla

The project team met with a representative from Tesla, Product Specialist Viktor Gudmundsson. As a Product Specialist, his role revolves around marketing and developing consumer relationships. He plans strategies on how to penetrate the Danish market and forms direct relationships with the consumers. Commercial advertising is not included in Tesla's strategy; instead Tesla relies on a word-of-mouth marketing strategy. Gudmundsson likened Tesla's marketing strategy to the invasion of Normandy. The goal is to penetrate a little bit of

the early majority from one point or one beach, and then spread into the entire majority or entire continent. Between sign-ups and walk-ins, they conduct 20 to 30 test drives per day. They know that these test drivers will share their positive Tesla experience with others.

Gudmundsson mentioned that Tesla is not concerned about the price difference between the Model S and other EVs because other EVs are not the Model S' primary competition. Consumers who display interest in purchasing the Model S generally compare it to higher-class vehicles from companies such as Audi, Mercedes Benz, and BMW. The base Model S can accelerate from 0-100 km in 4.4 seconds and has a 425 km range battery. Unlike most EVs, the Model S is firmly in the primary vehicle slot in households because of these specs.

In terms of charging infrastructure in Denmark, Mr. Gudmundsson said it is a chicken and egg problem. Do you sell the cars first and then the infrastructure comes, or do you build the infrastructure first and the cars will follow? Gudmundsson believes that the government needs to be more assertive in developing charging infrastructure, and claimed the upper level of Tesla is lobbying to see more charging infrastructure from the government. He feels the current incentives for electric vehicles are doing well, but the government needs to go one step further and abolish the Value Added Tax (VAT) in order to assist the development of the electric vehicle industry. Norway provides similar incentives for their EV owners, but EVs are also exempt from the VAT. He also mentioned that the overall wealth of Norway is higher than Denmark enabling more citizens to afford EVs.

Moving forward, Tesla plans on developing a cheaper model by 2017 targeted the average consumer rather than the upper class. Gudmundsson thinks that by then, the Tesla brand will be even stronger in the eyes of the consumer.

4.2.1.2 BMW

We spoke with Martin Storm, BMW representative, who has worked there for 10 years, and is now the head of BMW's i sector in Denmark. This past November, BMW had a soft launch of the BMW i3 where the public was able to sign-up for test drives and could put down a 20,000 kroner deposit to preorder an i3. The i3 models are projected to come out in May, June,

and July in Denmark. Mr. Storm explained there was an original goal of selling 100 i3s in Denmark this year, but the goal was increased to 200 after they rapidly sold 80.

With the exception of the Tesla Model S, the i3 is a more expensive EV option when compared to others on the market. Like the Model S, the i3 is competing with more expensive brands like Audi and Mercedes Benz. However, the i3 is the cheapest BMW model available in Denmark due to the current tax exemptions for EVs. The i3 has a futuristic look compared to the other BMW models offered. Our interviewee implied that this was done with the purpose of “flashing the idea and attractiveness of the future and healthier environment.” The i3 has a range of 160 km when driven in the city, but only a 100km highway range. Recently, BMW designed a range extender for the i3 that uses petrol to charge the battery when the battery is low. The range extender increases the range of the i3 to 300 km and with this extender, the vehicle registration tax is not exempt. However, the Danish government deducts taxes based on the amount of CO₂ emissions released into the atmosphere and the overall tax deduction is actually similar to the exemption of the vehicle registration tax on fully electric vehicles.

According to Mr. Storm, the i3 is generally being bought as a secondary car, and about 25% of the 80 sold i3's were bought by individuals in the first mover category. He also believed that the current charging infrastructure is more developed than most Danes think. Negative media coverage along with Better Place's failure has affected consumer opinion towards EVs. Storm alleged that there is already sufficient infrastructure in Denmark to drive an EV without worrying about finding a charging station nearby. That being said, the more that are built the safer consumers will feel in their EV purchase.

Storm believes the lack of action from the government attributes to the struggle of the EV industry in Denmark. He claimed that even though the incentives are similar in Denmark as in Norway, Norway is seeing a stronger EV industry because the government is more active when it comes to pushing for a healthier environment. The Danish government has been difficult to deal with and he urges that the government do more advocating for the industry. Storm expressed that BMW expects to see half of the models in their showrooms to be EVs by

2020. Storm told us about a 5 billion dollar investment BMW made for their i sector and in his opinion, it will not fail.

4.2.1.3 Renault

The team spoke with salesman Peder Klink from Renault who admitted on average he sees only 0-5 consumers looking for an EV each week. Unlike the BMW i3 and the Tesla Model S, the Renault Zoe is much cheaper and comparable to the rest of the EVs on the market. Interestingly, the Renault Zoe does not include the price of the battery in the total cost, but instead the consumer pays a monthly battery rental fee that varies based on the distance the car travels. Along with making the vehicles cheaper, renting the battery relieves some consumer concerns about battery technology such as possible failures and technological advancements. This battery renting technique can be beneficial to the consumer but it also requires them to pay each month instead of upfront.

In terms of the incentives the government provides for EVs, Klink feels the exemption of the vehicle registration tax is helping the industry. He explained that because the Model S has a great range and is competing with other higher-class vehicles, it can be significantly cheaper than its competitors due to this exemption. In terms of the barriers preventing consumers from purchasing EV's, Klink believes it is a combination of mainly range and the charging infrastructure. Studies have shown that the average range of EV's is sustainable for 85% of drivers. The problem arises when a consumer is concerned about long distance travel.

Klink felt that Better Place drew negative media attention to Renault, even though the battery swapping technology had potential. He mentioned that the negative media coverage reached all electric vehicles with Better Place's failure, leading the average consumer to believe that EVs themselves were the problem. Instead, it was actually the lack of financial stability with the program that caused the downfall. Klink also talked about Norway's successful EV industry and linked it to the additional exemption of the VAT. He believes that in the future, the Danish Government and the EU need to standardize and develop more EV infrastructure so that consumers concerns will be alleviated.

4.2.1.4 Car Company Comparison

The representatives from Tesla, BMW, and Renault, have similarities and differences in their viewpoint of the EV industry in Denmark. In terms of the price of the products they offer to consumers, BMW and Tesla are competing against higher-class vehicles while the Renault Zoe competes with cheaper vehicles and uses their battery renting strategy as a means of making the initial price cheaper than most competitors.

All three company representatives agree that one of the major barriers preventing consumers from purchasing an EV is range. The Tesla Model S does not raise concerns about range because of the 544 kg battery which enables it to travel 425 km, but they agree range is very important to consumers. In comparison, the BMW i3's range varies from 100-160 km depending on whether it is being used for city driving or highway travel. However, the consumer has the option to buy the range extender that will extend its range to 300 km. This range extender is a very popular option and clearly demonstrates that the consumer wants more range. Lastly, the Renault Zoe has a range of up to 210 km which proves to be more efficient in an urban setting, like the i3. The interviewee's believe range is important but also said that consumers tend to have range anxiety that is not supported.

Another barrier preventing consumers from buying EVs are the negative generalizations that the media releases to the public. Tesla, BMW, and Renault collectively offer test drives to consumers in order to give a full experience as a marketing strategy. They are doing more hands on vehicle showings to educate the consumers about their products. They also agreed that the Danish government must become more involved with aiding the development of charging infrastructure in Denmark. It is necessary to alleviate consumer hesitation due to lack of infrastructure.

The interviewees disagreed on the current incentives for buying electric vehicles. Tesla says that the government needs to abolish the Value Added Tax, whereas Renault feels like the exemption of the Vehicle Registration Tax is sufficient. On the other hand, BMW claims the new exemptions based on the amount of CO₂ released into the atmosphere are the correct form of taxation. Overall the representatives had some areas they agreed were important to

consumers such as range and infrastructure, but they had differing opinions regarding taxes and incentives.

4.2.2 Electric Vehicle and Sustainability Organizations

4.2.2.1 Clever

Clever is an electric mobility operator which pushes to “secure the mobility of electric vehicles by offering charging stations at home or company addresses,” according to Lise Kirkegard, Clever’s Senior Vice President for Communications and Marketing . She feels that price is the main barrier to uptake for the private consumer and the taxation system in place makes smaller cars much cheaper than the EV, creating a large issue for the industry.

Clever is conducting an ongoing study of 1600 families participating in a car sharing scheme. Thus far they have noticed that the range wasn’t an issue for the families, and most could have driven further than they did. Additionally, Kirkegard discovered that the same numbers of families were looking for an EV for the first car as those looking for a second. She does not believe that the aesthetics of EVs are a barrier to uptake because the newer models, such as the BMW and Tesla options, “are looking smarter.” However, she believes the first movers to the technology are those who would like to stand out anyway. “It is important that the electric vehicle looks different, yet smart at the same time.” In her opinion, safety is not a barrier either. Some believe that the quietness of an EV draws a danger for the handicapped community, but another study by Clever showed that this isn’t true and electric vehicle drivers actually use more caution due to the silence of the car.

According to Lise, consumers may have negative views on EVs because of the fallout of Better Place and individuals in Denmark see all EVs to be synonymous with Better Place. Furthermore, some consumers refuse to purchase an electric vehicle until there are more charging stations. “People might in this early phase overestimate the need and the value of infrastructure. We think we need to go out and charge just like we do gas. However this is not true because the primary charging happens at the private address.”

There is overall a large information gap for the consumers. If information can be disseminated to the public there is a large potential for EV’s in upcoming years. A taxation

reform could be what is needed for the industry so electric vehicles could compete with microcars. She feels that it is necessary to prolong the tax incentives, because there are already orders placed for cars in 2016 and the industry does not yet know what the price will be because the taxing may change. In order for the industry to succeed consumers need to have confidence that the prices, taxes, and incentives will be stable for the near future.

4.2.2.2 Copenhagen Electric

Copenhagen Electric works towards creating a greener society in Copenhagen and aims for it to be one of the leading electric vehicle regions in the world. We interviewed Kare Albrechtsen, the head of the EV secretariat under Copenhagen Electric. The main purpose of his position is to take on EV projects that attract the most investments and to find potential buyers among fleets and private consumers. In Kare's opinion there are two types of markets for private owners, one-car households and two-car households. For a one car household, the current range for the majority of EVs are not enough because you will have difficulty making long trips, while if a household has two cars there is no reason that one cannot be an electric vehicle. The second car is used mainly for commuting, but due to high EV prices and a flawed tax system people aren't really considering buying them. Microcars are gaining market share due to their low price in Denmark, but in Norway this isn't the case because EVs and microcars are similarly priced.

The group asked Kare what he believes needs to happen moving forward. He responded saying that physiologically people need to be convinced that the range is sufficient. He also mentioned that the price of microcars needs to increase. A microcar is a classification of automobile that is generally less than 3.5 meters long and includes models such as the Volkswagen UP or Smart Car. These microcars are taking the majority of the market that electric vehicles would be aiming for in Denmark. Instead of progressing into the early majority, Denmark has yet to leave the first mover stage. In Norway, it has been proven that everyday people consider EVs and have passed the psychological line. In Kare's opinion, the public psyche that charging is a problem is wrong. He thinks it is actually an advantage because people are able to charge in their own homes. As the new generation of EVs is introduced, the range will

be much larger and less of an issue. If microcars and EVs are more equally priced, then there will be potential for an increase in EV uptake.

4.2.2.3 Danish Eco-Council

The first interview the group conducted was with Jeppe Juul, a Policy Officer with Energy and Transport at the Danish Ecological Council. The Danish Eco Council works on all levels of the transportation sector in Denmark but he has a focus area on electric vehicles. They focus mainly on changing the tax system for EVs but also do other activities such as holding conferences to promote EVs. Their overall purpose is to promote electric vehicles in all aspects except the actual selling of the cars or the promotion of specific brands.

Juul believes that there is large consumer interest in EVs because of their environmental positives as well as their road handling ability. However, the framework of the tax system and overall price leads consumers to shy away. He indicated that cars in general are expensive in Denmark, but microcars are very cheap and accounted for almost 60% of all car sales in the country this past year. Another common thought is that range is a major barrier to EV uptake, but in Juul's opinion this is strictly psychological and he references that the Danish Energy Agency made a report that said 95% of all trips in Copenhagen could be made with an EV. Danes rarely drive long distances so EVs could meet their needs for an ample portion of the time. Another factor, infrastructure, is also a lower priority in his mind because people rarely use up their entire range. It is more of a physiological safety measure.

Overall, Juul believed that in order for Denmark to reach its environmental goals, the transportation sector needs to be revamped. Cars are a major factor towards carbonization but it is much more difficult to get consumers to change their purchasing habits as opposed to putting up more wind turbines or solar panels. "If we want more renewable energy we can just do it. We have the plans that we can just double the windmills, solar panels, biomethane etc. If we want to, we can, just like pushing a button. The problem is transportation." In his opinion, hybrids could be a crossover solution to full EVs and they end up being quick fixes for car manufactures to comply with stricter CO2 emission standards.

4.2.2.4 Danish Electric Vehicle Alliance

The Danish Electric Vehicle Alliance (DEVA) is a privately owned political interest group for those interested in investing in an EV. They have three employees and consider themselves lobbyists for potential EV buyers. We spoke with one employee, Magnus Gottlieb, who said “Our purpose is not to sell electric cars, but to make electric cars easier to sell.” They help to provide a media outlet when anyone in particular is looking to investigate EVs. They aim to correct misconceptions regarding electric vehicles and give objective information to those interested.

When asked about the demographics of most EV owners, the DEA felt that EV owners are made up by two categories: private individuals and fleet owners. They said that the individual owners do not necessarily represent a certain demographic, however it is mostly those interested in protecting the environment or enthusiasts of technology such as engineers. For each of these two categories, according to Gottlieb, the price of an electric vehicle is an impactful barrier to uptake. Electric vehicles typically cost twice as much as other cars upfront, but the long term service charges are few compared to other cars. However, people don’t usually think about this when buying a car, according to Gottlieb. He believes range anxiety is also a viable barrier to uptake due to the fact that switching from a gas vehicle to electric brings an emotional hurdle for consumers in this regard.

Public opinion of electric vehicles is affected by the media, and that often leads to misconceptions about EVs. The main concern is that people think that EVs “just don’t go far enough.” On the other hand, the media creates a positive view for those who simply think that EVs are cool, innovative, and nice to drive. These viewpoints are directed towards the general population that has a specific interest in cars.

Gottlieb believes that taxes should be technically based and not value based like they are presently. He spoke of the BMW model with a range extender as an interesting exception. This model has an option of adding in a range extender, which accesses gasoline when the car’s battery is low. This makes the car ineligible for the electric vehicle registration tax exemption. However, there is an incentive in place for car manufacturers that lowers the tax on the car

based on the distance it can travel per liter of gasoline. This ratio is very high for the BMW range extender model because it can now go 166km on the first liter of gas.

The Danish Electric Vehicle Alliance heavily prioritizes tax reformation. The current tax system makes microcars too cheap. He believes that they should cost more, which could come with a change in the tax system. Gottlieb expressed that fleet owners should be the main target for uptake right now. Multiple vehicles are purchased at once and have large parking lots which makes the charging very feasible. He mentioned there is a problem with car dealerships because they haven't been pushing the sale of their EVs. Only in places like Tesla and BMW are the EVs in prominent display locations. Lastly, Gottlieb explained that the government should put forth efforts to inform the general public about electric vehicles. The public is not well informed and that is where misconceptions arise.

4.2.2.5 Danish Standardization Organization

Another interview was conducted with Regnar Schultz, Senior Consultant for Dansk Standards. The organization was appointed by the Danish government to work with standards that comply with Danish law as well as European directives. They inform companies of these standards to make it easier to comply with the directives.

Schultz believes that the main barriers to uptake for EVs are that they are too expensive and that range anxiety is preventing people from buying EVs as a first car. This is the overall perception of the average consumer. They believe the car will not go far enough to fulfill their needs. Even for those who are looking to purchase a second car, price is still a hindering factor. He believes that battery swapping was a brilliant idea and this would negate the problem of range. This also would be using green electricity because the batteries at swapping stations could be charged by wind power. Battery swapping is no longer being pursued though, and Regnar feels that the charging structure in place needs to be more standardized. In addition, he thinks that the VAT should be removed. This would be a major step towards the consumer uptake of electric vehicles in Denmark. A standardized charging infrastructure, the development of better batteries, and more range will make the industry and the uptake much more successful.

4.2.2.6 Forenede Danske Elbilister

The original goal of the United Electric Vehicle Drivers of Denmark was to protect those who bought the Renault Fluence through the efforts of Better Place. We spoke with the chairman of the organization, Steen Fredericksen, in order to learn from his point of view. The organization wanted to keep battery swapping alive, and now works as sort of a consumer council for EV owners that works to support the electric vehicle rollout in Denmark.

Fredericksen expressed that range is still the first main barrier for consumers, with price closely following. However, he discussed that the largest issue is ignorance and the lack of knowledge for the consumer. There arises a perception that the batteries do not last long enough and that “in essence, they are indifferent because they simply haven’t tried it.” Fredericksen explained to us that in his opinion electric vehicles are usually bought by families that are looking for a second vehicle. The most represented demographics of buyers are both these families and also enthusiasts of the technology and innovation. He does not see the aesthetics to be an issue as they have been in the past. The cars are progressing towards a better overall look.

In the future, there should be some changes with the taxation to help the electric vehicle industry grow. As far as charging infrastructure, he agrees that it needs to be more standardized and there should be a roaming system in place in which customers can use different charging systems. In the future, he feels that the industry needs to understand the market better, and come up with a better business model.

4.2.2.7 Federation of Danish Motorists

The team conducted an interview Federation of Danish Motorists’ (FDM) Tom Lund Kudsk, head of public affairs. FDM has viewpoints differing from the other organizations. FDM is a consumer interest group that provides legal service to its 240,000⁺ members and conducts political lobbying. Kudsk believes that over time, cost of ownership between an EV and a comparable ICE vehicle is about the same. “One cannot perform all of the same tasks with an EV so there isn’t a point in purchasing one.” He says that 90% of one’s daily driving can easily be done with an EV, but that last 10% is also very important. Kudsk focused heavily on the small

size of the Danish market. He insisted that car manufacturers don't care what the Danish politicians do because it is only a small part of the car industry's income. This statement was very surprising because even though Denmark's car market is relatively small, it is not insignificant.

"We have 2.3 million cars in Denmark. We have 1500 EV's. They are not the green revolution in Denmark.....Politicians see EV's as the solution but we see EV's as a part of the solution not THE solution. In the long run, the solution will be fuel cell cars" stated Kudsk.

This gave some new insight considering other interviewees had opposing feelings. In summary, FDM believes that the range and price are still the prominent barriers to uptake.

4.2.2.8 Norwegian Consumer Council

The Danish Consumer Council has a counterpart in Norway called Forbrukerrådet and we conducted a phone interview with Gro Mette Moen. The Norwegian Consumer Council has a similar purpose to the Danish Consumer Council. Moen is an advisor within transportation and represents the Consumer Council in any transportation related affairs.

Moen was able to provide valuable insight into why Norway is the leading EV country in the world and how Denmark could improve its industry. She stated that first of all Norway is set up to succeed, because they have very cheap hydro-electric power which is perfect to maximize electric vehicle sustainability. They also have a strong political majority which made electric vehicles a priority and developed many incentives and financial advantages. This coupled with a very strong economy has allowed people to overlook some of the short comings when it comes to range. 50% of car travel in Norway is less than 5km but the overall driving distance is a lot more than in Denmark. They also have only 4% of people who commute by bike compared to almost four times that in Denmark. Charging Infrastructure is also more concrete and simple in Norway. The system is more standardized and has been in place for longer. They are working towards customers not having to have a relationship with a specific provider. Moen notes that it should be as easy as gasoline "When the consumer gets there, he doesn't know if he needs to call somebody, or ring a doorbell or send an SMS. This provides insecurity." Denmark currently has two main charging providers but in order to use the other provider you must call their

customer service and speak to a representative which is just another added step. Denmark can learn from their Scandinavian neighbor, but perhaps the most important lesson is looking at Norway's form of taxation which is based on emissions not on the value of the car. This coupled with the wide array of incentives (free tolls, bus lane travel, free parking, etc.) have led to 12% of all cars sold in Norway being fully electric (Coffey, 2014).

4.2.2.9 Organization Comparison

By conducting these eight interviews across a range of different organizations, our team observed the electric vehicle industry from a number of viewpoints. Overall there were more similarities than differences in opinions, but some of the differences caused us to rethink some of the hypotheses (See Section 3.4). Price is a major barrier to consumer uptake in Denmark and almost every interviewee mentioned that the taxation system needs to be reorganized in order for EVs to thrive. More specifically, they note that the exemption of the vehicle registration tax alone is inadequate and the 25% Value Added Tax needs to be removed. The Eco Council, EV Alliance, Federation of Danish Motorists, and Clever all mentioned that microcars were taking a large share of the EV market due to their extremely low prices. In fact, some microcar models currently on the market are 50% cheaper than the cheapest cars for sale in the 1980s (Copenhagen Post, 2014). Microcars are extremely detrimental to electric vehicles because of their cheap prices which make it almost impossible for EVs to compete in the market.



Figure 4.15 – BMW i3

Differing opinions on several issues came from a variety of the interviewed groups. For instance, the Danish Eco Council believed that car manufactures refuse to push the sales of their electric vehicle models. They stated that this is due to higher profit on future service of ICE cars compared to EVs when the car dealerships can make up to 80% of their profit on these car maintenance services. Another interesting fact was that the EV alliance looks at consumer uptake in two different markets: private and fleet ownership. They believed that private sales would follow if fleet ownership was at a higher level.

Range was another major barrier, according to the majority of our interviewees. 90% of all trips in Denmark can be made with an EV, but there is a mental factor which consumers can not overlook when making their decision on which car to purchase. This range anxiety may not be justified, but at this point consumers are not well aware of their actual range needs. In this case there is a clear lack of information flow between EV manufactures and consumers. Copenhagen Electric suggested that with the ability to charge at home, one can cut out trips to the gas station, which makes an EV even more convenient than a gasoline car. The Norwegian Consumer Council representative believed that people can make 90% of their trips with an EV, but it is impossible to overlook the other 10% of trips. Others argue that the 5-10% of the time you need a longer range could be compensated with other forms of transportation, finding charging stations along the way, or by owning an EV as just a secondary vehicle. Overall, the organizations believed that an EV is not ideal for long trips but can certainly service consumers' needs most of the time.

The team hypothesized that aesthetics of electric vehicles could potentially be one of the barriers to uptake. In the past, electric vehicles had a very distinct look that many consumers might not want as some models look exceptionally different from their gas-powered counterparts. There were some common aspects among the organizations opinions on this topic and it was mentioned in almost every interview session that the aesthetics of electric vehicles have come a long way compared to the past. EVs used to have a very distinguished look and whether or not potential buyers liked this, the current models look very similar to gas powered cars. Many interviewees mentioned that the Tesla Model S and the BMW i3 look like they belong with other luxury vehicles on the market. They are aesthetically pleasing and draw

an immense interest from the consumer population. Another popular thought was that EV owners enjoy having a distinguished car because it can be seen as a status symbol and promote the owner's values. The combination of these opinions has negated our original hypothesis about aesthetics being a barrier to uptake.

Next the team inquired further about the country of Norway in our interviews, as it is the world leader in electric vehicle uptake. When talking to the professionals in electric vehicle organizations, we learned much about Norway's success. First and foremost, all agree that Norway is simply a wealthier nation. Their inhabitants have a higher per capita income on average. This makes electric vehicles more feasible to purchase for their population. The team was also informed by the Norwegian Consumer Council that cars are a much more prominent means of transportation in Norway when compared to Denmark. Proportionally, more Norwegian dealerships are selling EVs simply because more cars are being sold. Lastly, all mentioned that Norway offers more incentives for electric vehicle buyers. The main difference is that in Denmark, electric vehicle purchase is exempt from the vehicle registration tax but not the Value Added Tax. In Norway they pay neither.

There were very few differing opinions on the subject of Norwegian electric vehicle uptake. However, some believed that the wealth in Norway was the driving factor for uptake, whereas others believe that the government is more supportive of the industry and has been this way for a long time.

It was helpful to investigate whether or not electric vehicle owners represent a certain social class or demographic. Often the interviewee would mention that consumers are buying electric vehicles as a second family car. They believed that it is tough to determine a particular demographic because the sample size is too small at this point in time. Overall it was expressed that there are only two types of groups looking to buy EVs: families looking for a second vehicle and enthusiasts of the technology and innovations involved with the industry.

The driving goal for the project is to inquire about the consumer interests regarding electric vehicles in Denmark. We asked all of the organizations to articulate their beliefs on this subject. The dominant response was that in Denmark, electric vehicles are too expensive and

the industry is too early in development for consumers to dive in. Additionally, there is a range anxiety among the consumer body. Many of the interviewees expressed that a lack of knowledge is hindering the population from accepting electric vehicles into their daily lives. According to a few of these organizations, the media brings about misconceptions among the Danish population. There were some strong differing opinions in this category. The Federation of Danish Motorists believes that the electric vehicle is unreasonable for the consumers' lifestyles. Alternatively, the Eco-Council and Copenhagen Electric feel that consumers would fall in love with EVs if only they could be more informed, and ultimately try one for themselves.

Standardization was an interesting topic of discussion and the feedback was different than our original assumptions. We hypothesized that infrastructure would be a major concern for consumers, but according to our interviewees, this was a secondary priority that would develop along with the consumers need. The major concern is not the amount of charging stations but rather the interoperability between the top companies, Clever and E.On. The Clever representative had a strong view that interoperability was great. She told us that a member of Clever could simply drive to an E.On station and make one phone call to get their charge. Other organizations such as the EV Alliance believed that it was much too difficult to switch between stations and that it should be as easy as filling up a tank of gasoline. The Norwegian Consumer Council added that having to make a phone call and wait for a representative makes it inconvenient to the consumer and limits their desire to purchase an EV. Better Place's idea of battery swapping was considered obsolete by all of the interviewees besides the Danish Eco Council who thought swapping was easier and more efficient. In summary, the standardization of charging infrastructure is important but it is not the top barrier for the development of the EV industry in Denmark.

Incentives and taxes have been a significant topic brought up in every interview. It is evident that the current incentives being offered in Denmark are limited compared to those in Norway. In order for the incentives to have an impact, there needs to be more of them. Overall, the consumers should be educated on how the incentive system works. Norway has had a lot of success with its free bus lane travel, free charging, free parking, and free tolls but Denmark has

only implemented free EV parking. The Danish government has publicly stated that there will be incentives put in place but they have not followed up and as a result the EV industry is suffering. As previously mentioned, there needs to be a revamp of the tax system and currently the vehicle registration exemption is insufficient. One suggestion made by the EV Alliance was to follow Norway's example and create a tax system for automobiles based not on price but on the level of carbon emissions. This would make the markets for EVs and microcars more competitive. The Norwegian Consumer Council explained that Norway is so far ahead that people are already considering phasing out the incentives because the industry is no longer in need of a boost. Denmark is the most expensive country in the world to buy a car due to its high taxes, so bringing in a new car technology is not an easy task.

The interviewees were asked how the uptake should move forward. Each organization mentioned various solutions. A common thought was that the tax system needs to be reworked, and microcars need to be priced higher for the EV to have any chance in Denmark. Individually, the Eco Council believed that hybrids were a crossover solution to fully electric vehicles and their implementation could be a great stepping-stone. The EV Alliance thought the best way to reach the early majority would be to target fleet owners and not private consumers because they purchase large numbers of vehicles and then hope for private owners to follow suit. The Federation of Danish Motorists representative had a much different opinion and said that EV's were not the solution to the transportation emission problem. Their representative believed that the government needed to conduct more research into other types of energies to power automobiles and was angry that politicians were only focusing on EVs. The Danish Standardization Organization had an interesting point which was in Denmark there needed to be large advancements in battery technology in order for EV to progress. The current technology simply could not meet the requirements of the average consumer. This coincides with one of our original hypotheses that if companies could further develop the batteries any current concerns could be addressed.

4.2.3 Electric Vehicle Owners and Non Owners

The project team also asked ten of the interviewees questions regarding their personal car choices. The purpose of these questions was to identify, from a consumer perspective, the

main reasons for owning or not owning an electric vehicle. The project team asked ten people in total of which two owned an EV, two didn't own a car, and the remainder owned a gasoline or diesel automobile. It was surprising that only two out of 10 owned EVs because the interviewees were directly related to the EV industry with the exception of one.

The main demographic information needed was the type of car the individual owned. The questions that followed revolved around identifying the major setbacks to owning an electric car. Our final questions asked the consumer what they thought should be changed to propel the electric vehicle market in Denmark. The main arguments made by interviewees can be seen in Appendix F. For comparison purposes, we grouped the individuals into categories depending on the type of car they currently own. Through these personal interviews, we were able to investigate the perspective of non-car owners, electric vehicle owners, and petrol car owners.

The three main reasons why non-car owners would not buy an electric vehicle were: the expensive price, the lack of range, and that many Danes simply do not need a motor vehicle. As Albrechtsen mentioned above in Section 4.2.2, the issue lies in the similarity between the microcars and electric vehicles in terms of meeting consumers' desires. The key difference is that the microcars do not have the range restrictions that electric vehicles have. Viktor Gumundsson from Tesla and Kåre Albrechtsen from Copenhagen Electric both agreed that the price was too high for them to purchase an electric vehicle. On the contrary, Gro Mette Moen mentioned that she would buy a hybrid over an electric vehicle because of the range limitations. The non-car owners articulated that the high price and limited range is what mainly influences a first time buyer's opinion of electric vehicles.

Electric vehicle drivers in Denmark seem excited and satisfied with their purchase. We spoke to owners of the Nissan Leaf and the BMW i3. Every electric vehicle owner to whom we spoke to had nothing but good things to say about them. Martin Storm mentioned that it "drives so nice and for the price, it is pretty fast". The general opinion of electric car owners is that the shorter range is not an issue, especially if it is used as a commuting car. As Fredericksen mentioned above in 4.2.2, the biggest market lies in families with two cars. It is very realistic to

have one car for long distance travel and have an electric vehicle as the second car for daily commuting purposes. This is what Lise Kirkegaard does with her Nissan Leaf and describes her driving as “stress free” and “a pleasure”. The electric vehicle owners provided insight to the true benefits of owning and using an electric car.

Petrol powered vehicle owners were precise in stating the reasons they did not choose an electric vehicle when buying a car. The majority chose the petrol models purely for range purposes. Every petrol car owner mentioned that the range of an electric vehicle would not satisfy their transportation needs. Nana Winkler and Peter Klink both mentioned that they only have a petrol powered car for long distance travels. No petrol owner mentioned the price to be an issue. Many people understood that they could satisfy their daily commuting needs with an electric car, but were turned away because they would not be able to travel long distances with one. The general result from speaking to car owners is that Danish individuals are looking to purchase a car for the enhanced range.

4.2.4 Cross Group Analysis

Several key ideas stand out when comparing and contrasting our interview groupings: organizations, vehicle dealerships, and vehicle owners. The key issues identified throughout the groups were related to the price and range of electric vehicles on the market today. Range is consistently brought up to us as a psychological issue rather than an actual issue. According to numerous organizations and vehicle companies, EVs are suitable to meet the Danish Consumers everyday needs. The problem lies in the consumer’s minds where they perceive EVs cannot meet their needs. Many consumers who purchased petrol cars said they didn’t choose an EV because of the range difference.

Along with limited range, the price of EVs in Denmark is a major barrier to EV uptake. A common theme is that the majority of EVs on the market are more expensive than the microcars because of the VAT tax. Norway has managed to lower the prices of EVs by exempting EVs from their VAT tax which in turn has propelled Norway to the world leader in the electric vehicle industry.

We also noticed some smaller notions across the groupings. An interesting demographic fact according to our interviewees is that EVs in Denmark are generally bought as secondary vehicles. Consumers who are buying EVs as their primary vehicle are purchasing the higher class Tesla Model S. Unlike in our original hypotheses, the charge time and aesthetics of the EVs on the market don't seem to be a major concern for consumers. Many feel that the futuristic look of EVs on the market today is a sign of a green future. Charge time is only brought up as a sub-issue to the short range of the majority of EVs on the market.

The team noticed that many Danes want the government to make key changes to advance the industry. Currently, they are exempting EVs from the vehicle registration tax, but our interviewees imply that more needs to be done. These changes could involve removing the VAT on EVs, revamping the tax system to be based on the CO₂ emissions, or aiding in the development of infrastructure to help alleviate concerns about range. The government needs to act on their environmental goals and it starts with more legislation for EVs.

4.3 Survey Analysis

4.3.1 Demographics

Three questions on the Taenk Survey regarding demographics were relevant to our project. These included gender, age, and the region of Denmark in which the respondent lived. The results of these demographic questions can be seen below in Figures 4.16, 4.17, and 4.18 respectively.

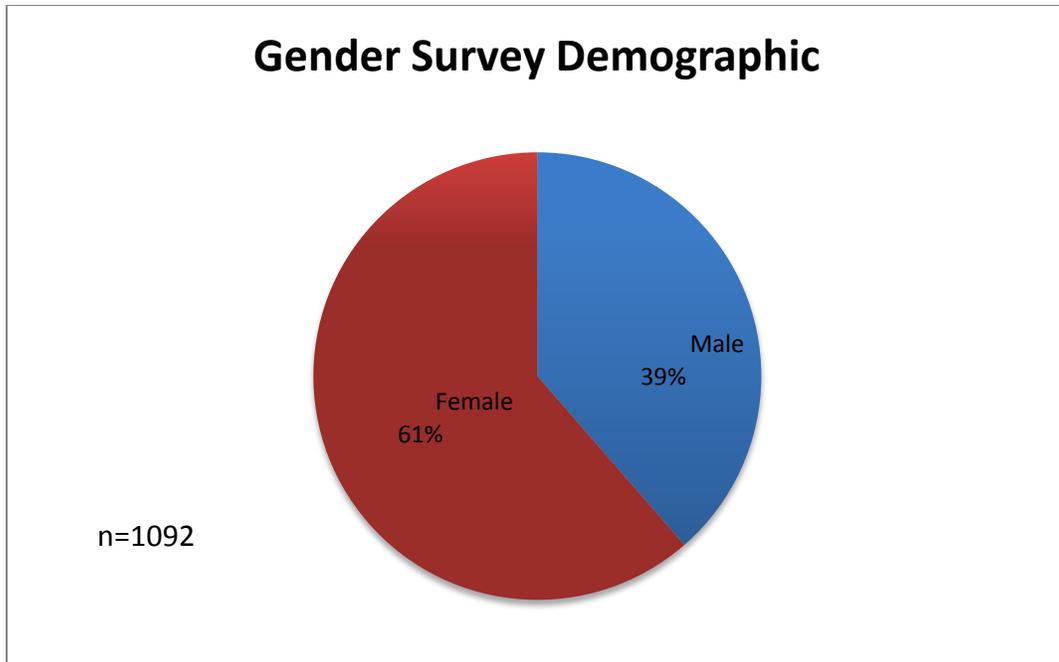


Figure 4.16 – Gender Survey Demographic

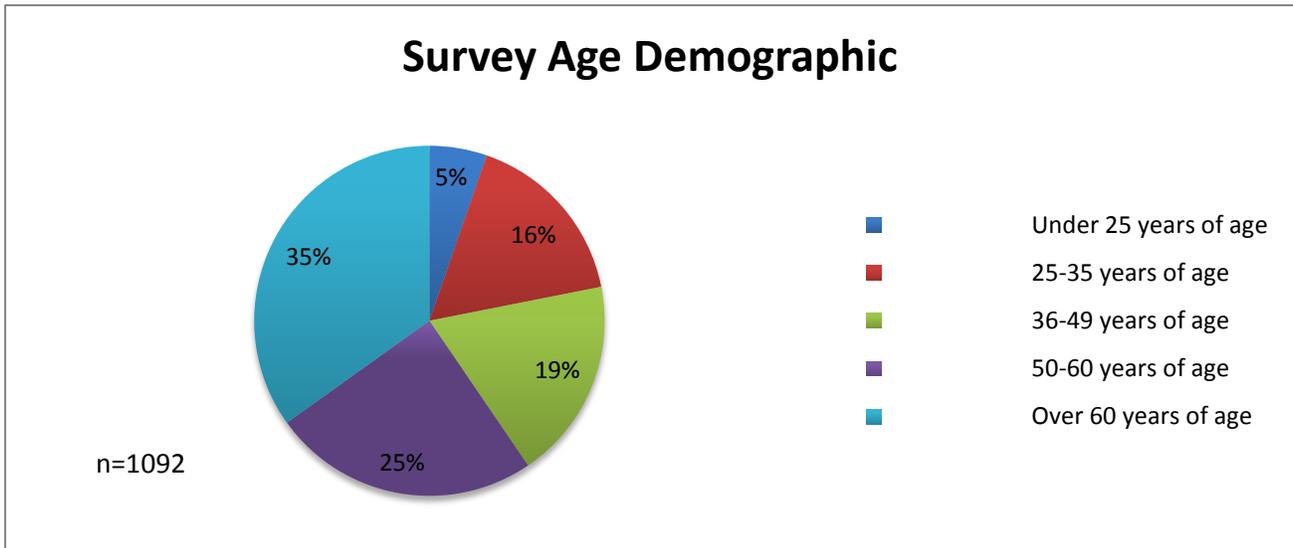


Figure 4.17 – Survey Age Demographic

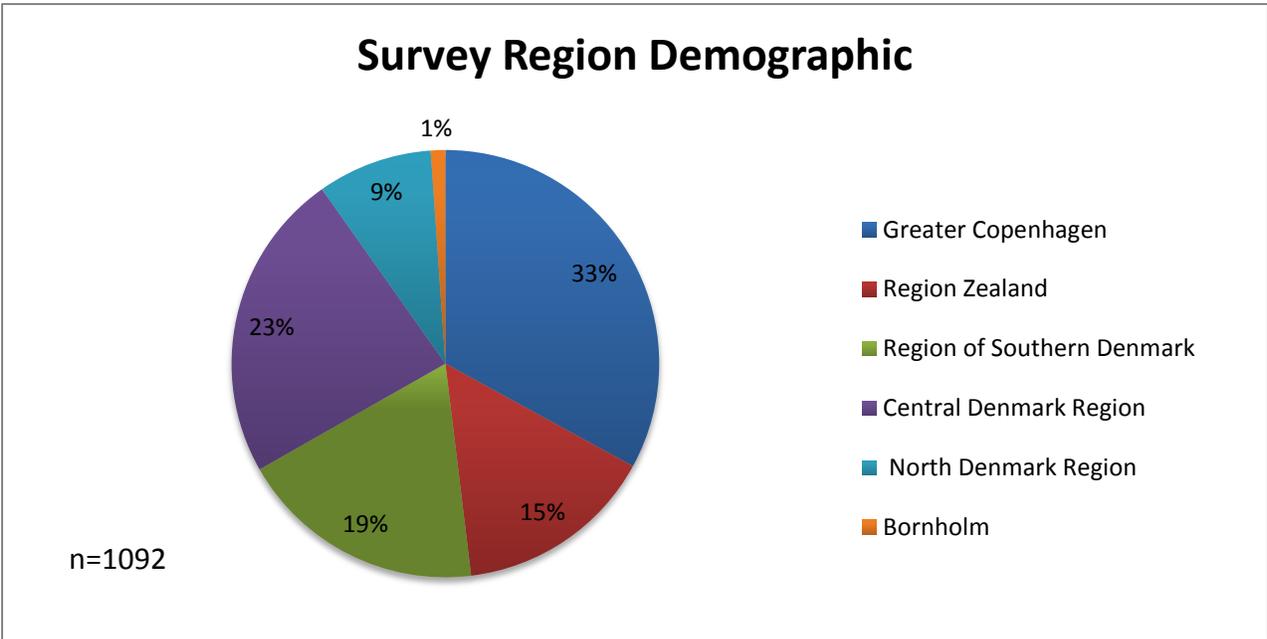


Figure 4.18 – Survey Region Demographic

The majority of respondents were female at 61%. 79% of the respondents are over the age of 35, and 60% were over age of 50. In terms of regions in which the respondents live, the majority come from Greater Copenhagen and Central Denmark. Only 10% of respondents lived in the Bornholm and North Denmark regions combined.

4.3.2 Next Vehicle Purchase

The first question we asked the respondents was “what type of car would you consider buying for your next car?” The results to this question can be found below in Figure 4.19. Overall, more than half of the respondents said they would purchase a gas car as their next car with 57.8%. The next most common choice was diesel with 32.3%, followed by hybrid, others, and electric, with 20.2%, 14.0%, and 12.5% respectively.

Furthermore, we broke down these results based on the demographics of the respondents. These correlations can be found below in Figures 4.20, 4.21, and 4.22.

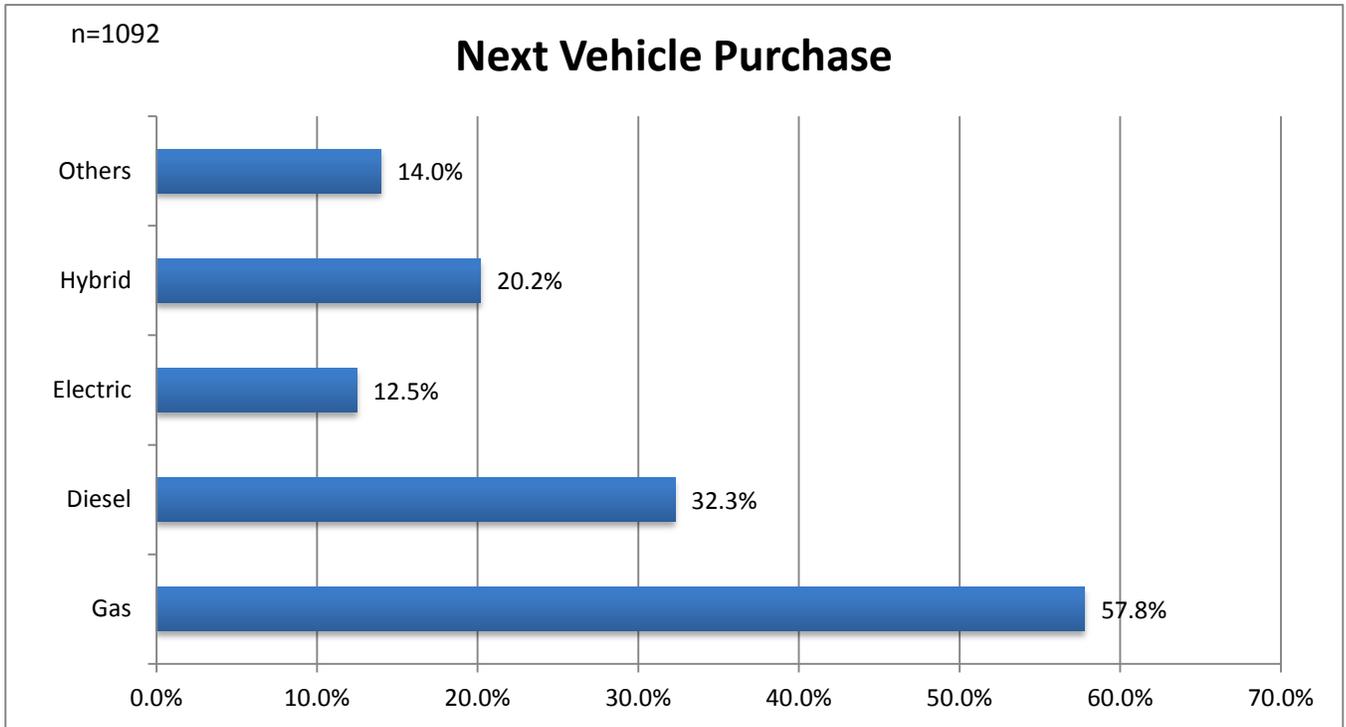


Figure 4.19 – Next Vehicle Purchase

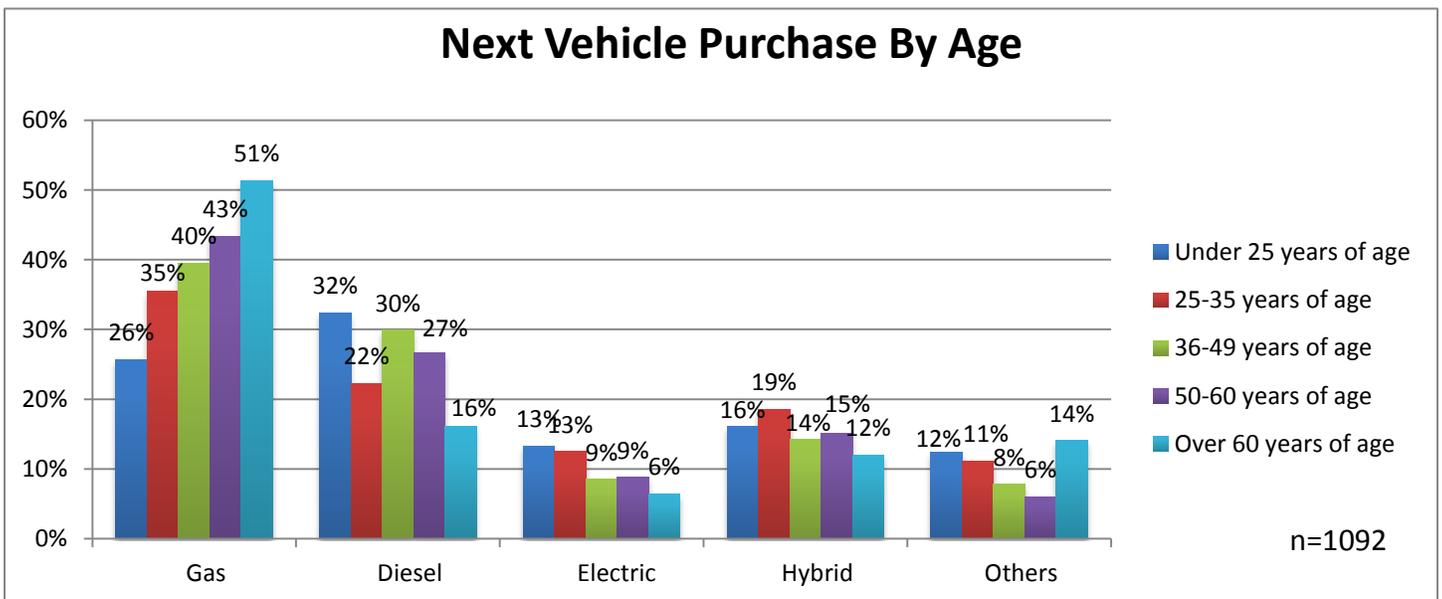


Figure 4.20 – Next Vehicle Purchase By Age

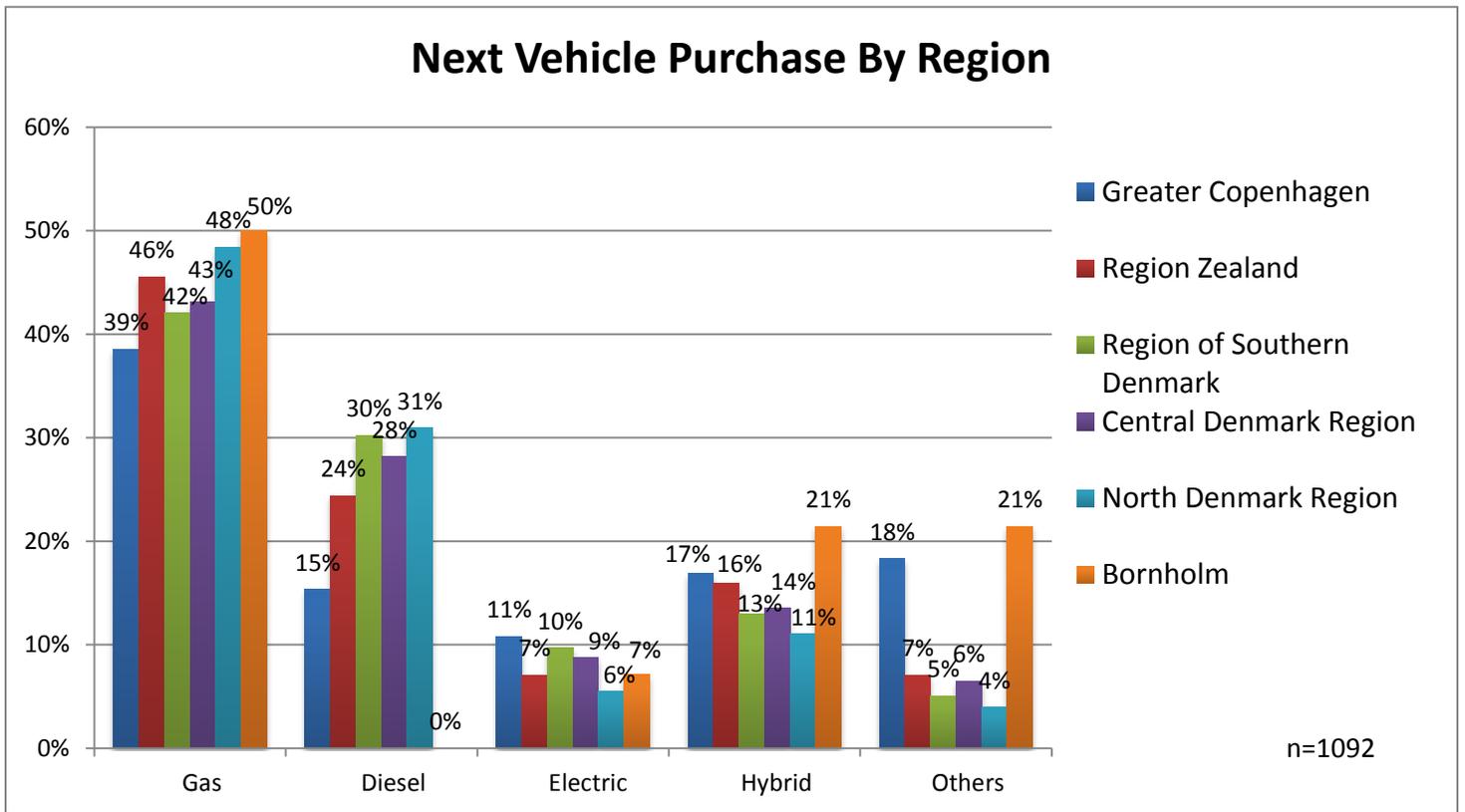


Figure 4.21 – Next Vehicle Purchase By Region

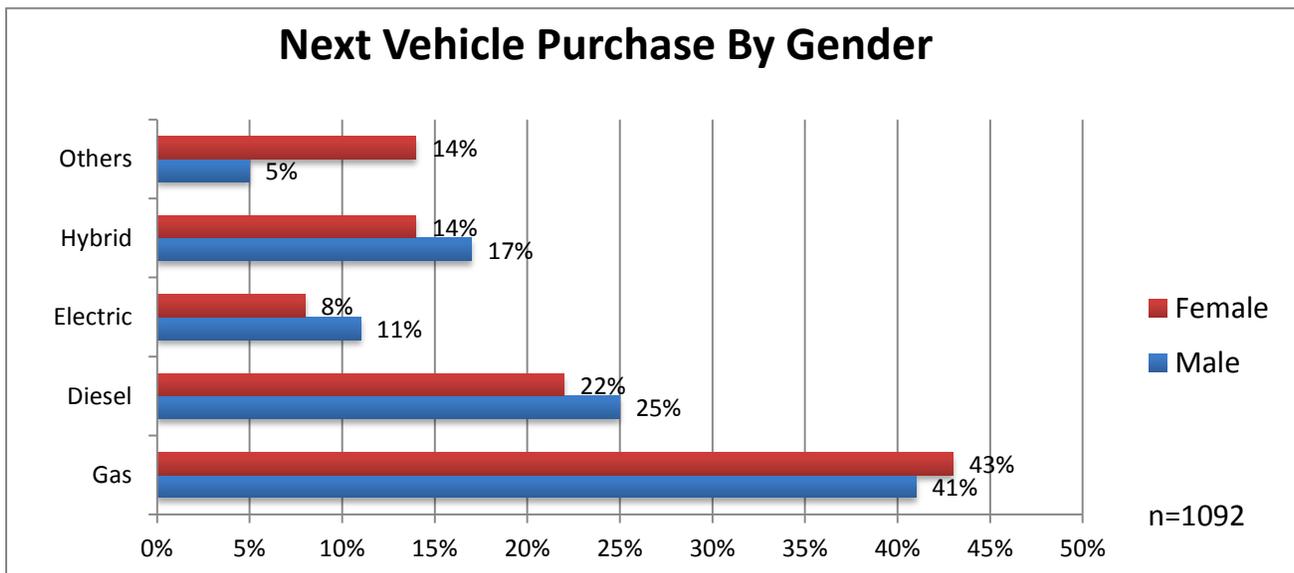


Figure 4.22 – Next Vehicle Purchase By Gender

An interesting point to be made is that as age increases the percentage of responses for gasoline increases. In addition as age decreases the desire for an electric vehicle increases. This linear observation is apparent in figure 4.20. Other observations from that figure are that the “under 25 years old” age group is the most evenly distributed among the answers whereas the “over 60 years old” age group has the most unevenly distributed answer choices in favor of gas.

In regards to the region demographic we did not find that a particular area was more in favor of EVs than another. This is interesting because we hypothesized that the Copenhagen area would have more EV interest than in the countryside.

With respect to gender, females are more in favor of gas cars as their next purchase compared to males. Also 14% of female respondents chose “others” as their next car, compared to only 5% of males.

4.3.3 Price Range for New Vehicle

The second question we asked the respondents was “what is the price range you would be willing to spend on a new vehicle?” The results from this survey question can be found below in Figure 4.23. The most popular price range among the respondents was the 100,000-200,000DKK with 37.8%. Next came the 200,000-300,000DKK and under 100,000DKK with 18.3% and 16.4% respectively. An interesting result from this question was that 11.1% of all respondents said they would under no circumstances purchase a car. Also 9.0% of all respondents said they didn’t know within which price range they would spend on a new vehicle.

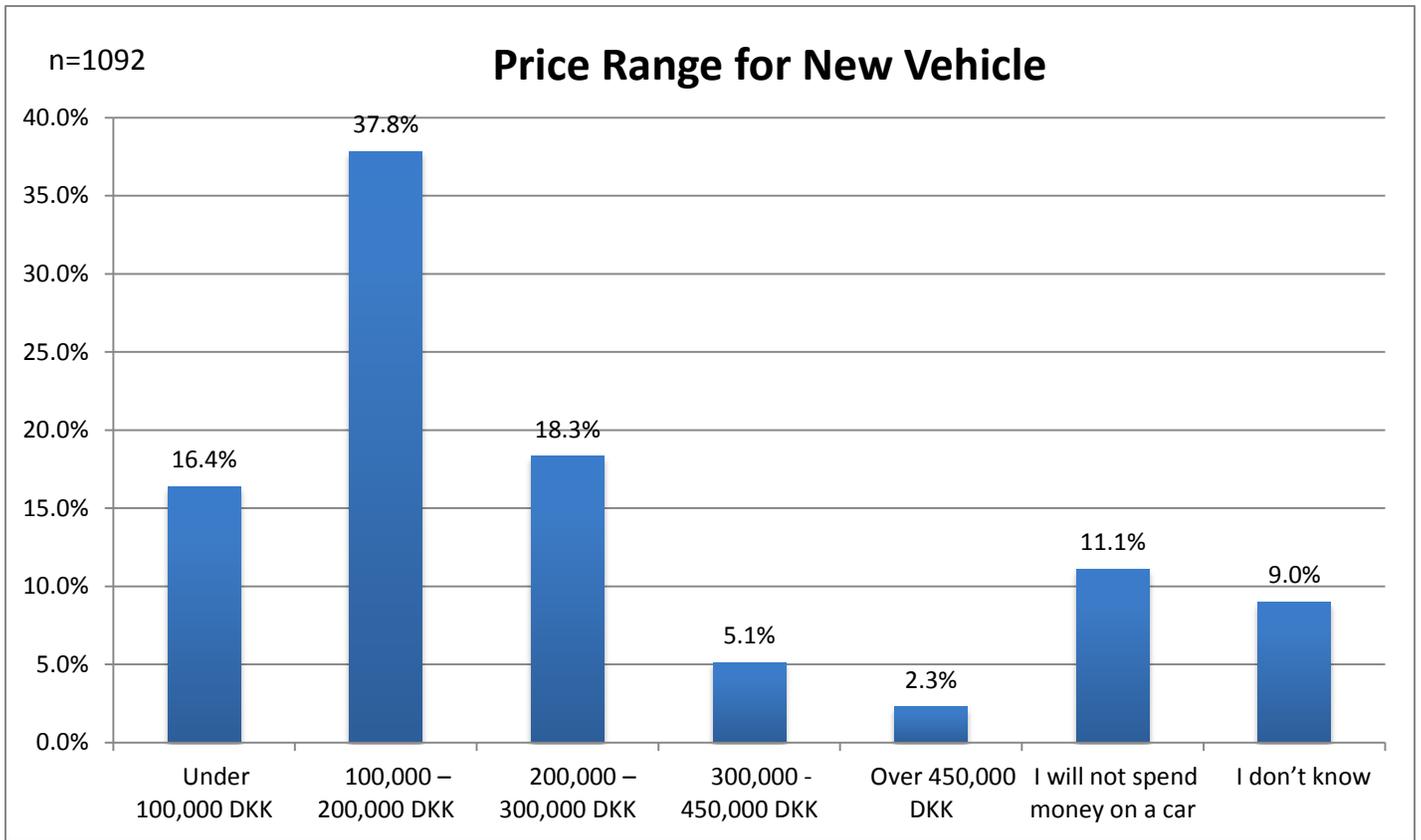


Figure 4.23 – Price Range for New Vehicle

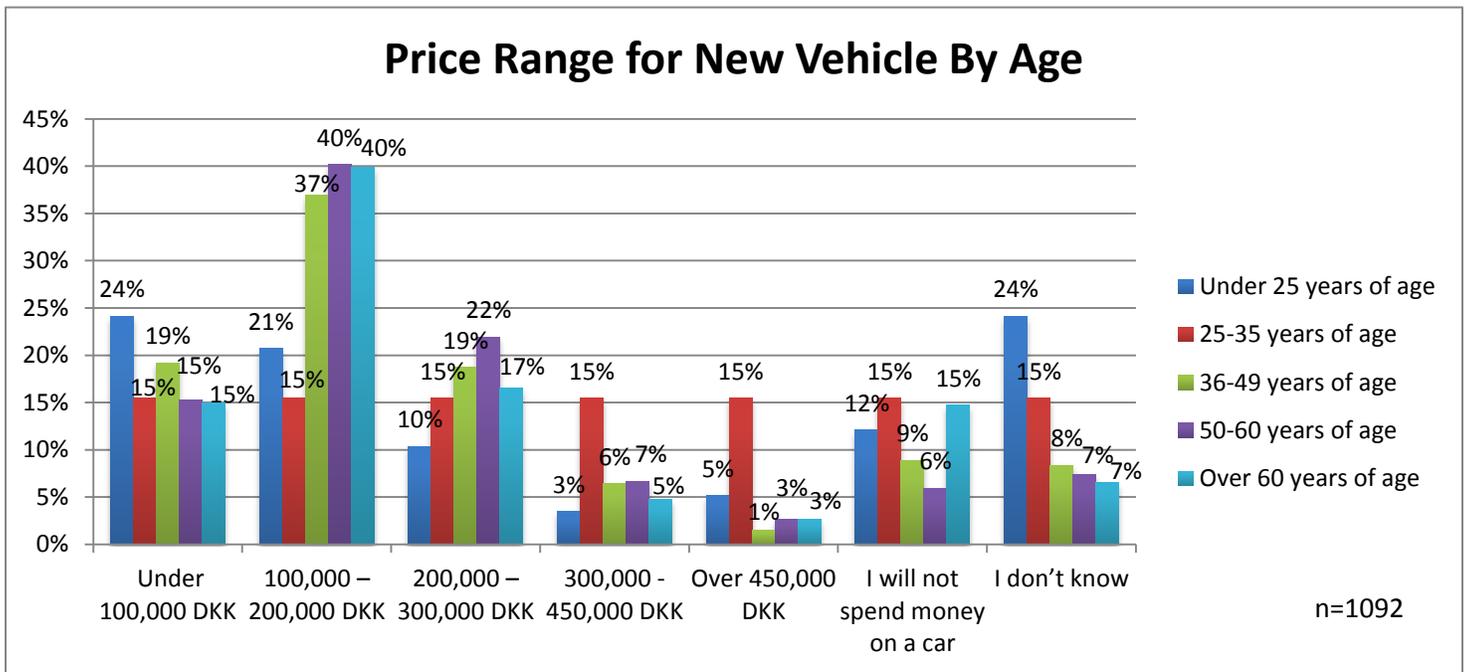


Figure 4.24 – Price Range for New Vehicle By Age

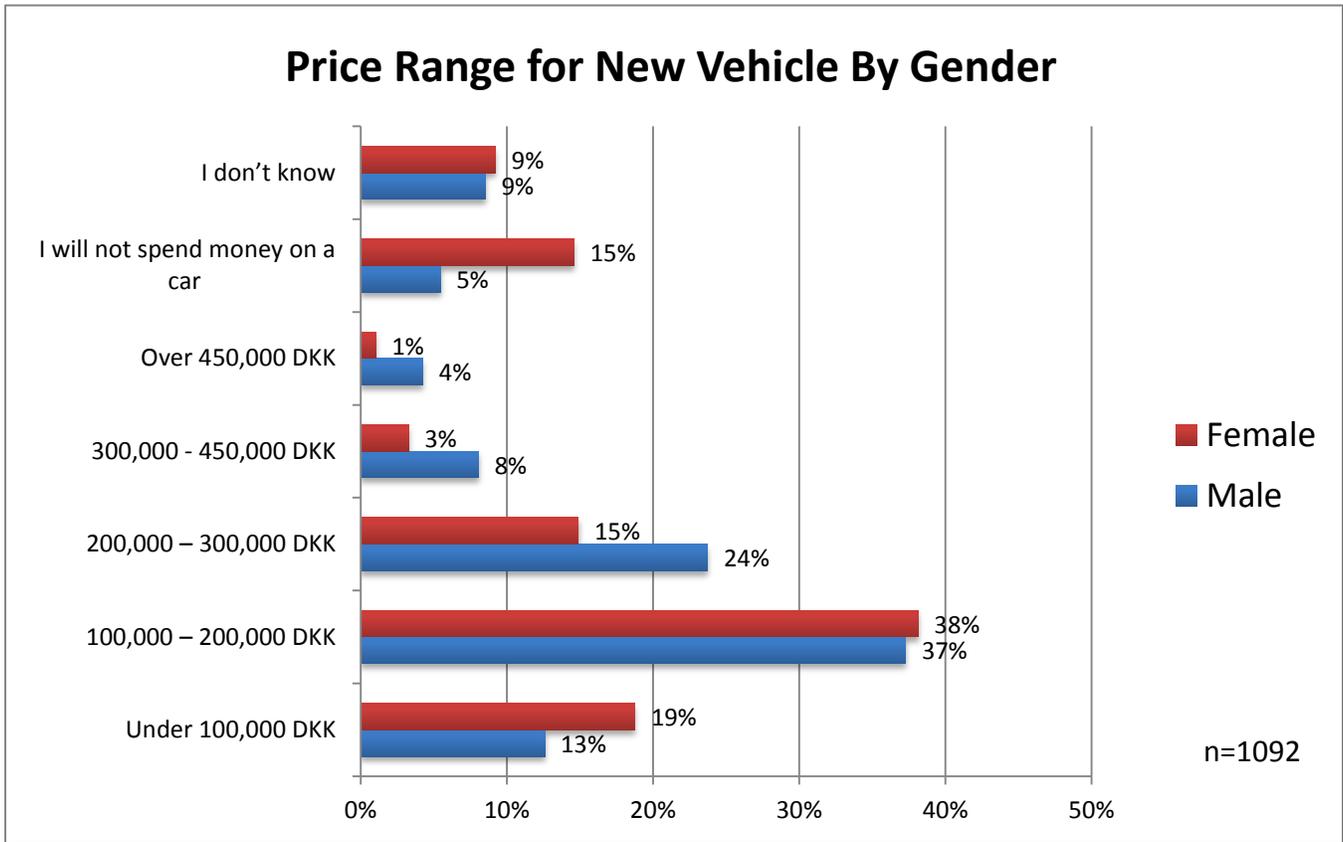


Figure 4.25 – Price Range for New Vehicle By Gender

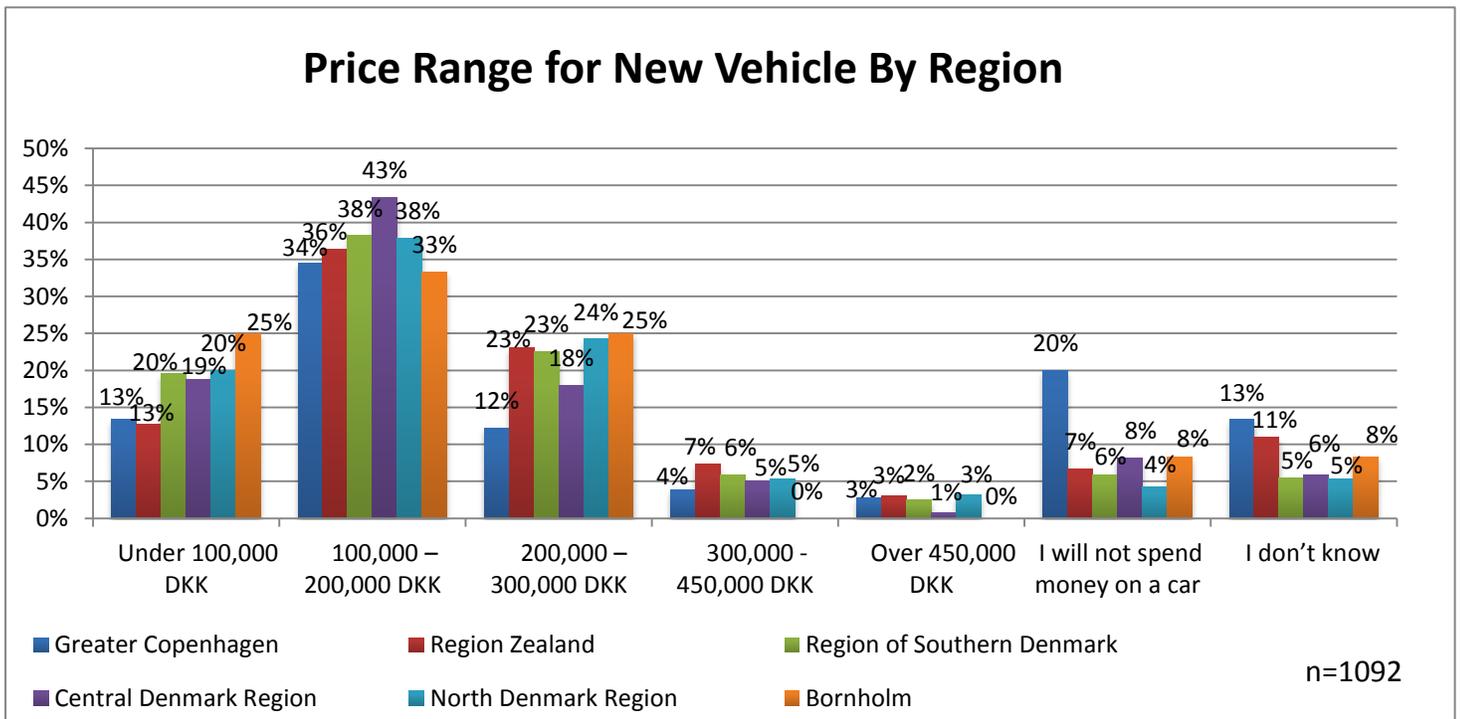


Figure 4.26 – Price Range for New Vehicle By Region

The “under 25 years old” age group was the only age group to have the highest amount of responses say they would spend under 100,000DKK, or that they didn’t know how much they would spend on a new vehicle. Every other age group said they would spend between 100,000-200,000DKK on a new vehicle. The “over 60 years old” and the “25-35 years old” age groups had the highest percentages saying they would under no circumstances spend money on a car.

All of the regions said they would spend between 100,000-200,000DKK on a new vehicle. 20% of respondents from Greater Copenhagen said they would under no circumstances spend money on a car, the next highest percentage answering this way was only 8% from both Central Denmark and Bornholm. This is most likely because of the large amount of people who commute by bike or public transportation in the Copenhagen area.

Females are more likely to spend an amount in the lower price ranges on a new vehicle, as well as not purchase a new vehicle at all. Males were more likely to spend between 200,000-300,000DKK on a new vehicle than females.

4.3.4 Desired Electric Vehicle Improvements

The third question we asked was “What improvements concerning electric vehicles would substantially impact your decision to purchase one?” The results of this survey can be found in Figure 4.27 below. Overall the improvements that the respondents would like to see for electric vehicles are longer range per single charge, increased availability of charging stations, and a cheaper MSRP, with 53.4%, 43.1%, and 38.6% respectively. Reduced charging time, and “I will not under any circumstances buy an electric vehicle next time” fall closely behind with 29% and 18.7% respectively. “I don’t know” received 14.4% of the total amount of responses as well. The other category had an option for write in answers which was also analyzed. The most common write ins were people were not interested in buying a car in general, had no driver’s license, were worried about range, or they said the cost of electric vehicles were too high.

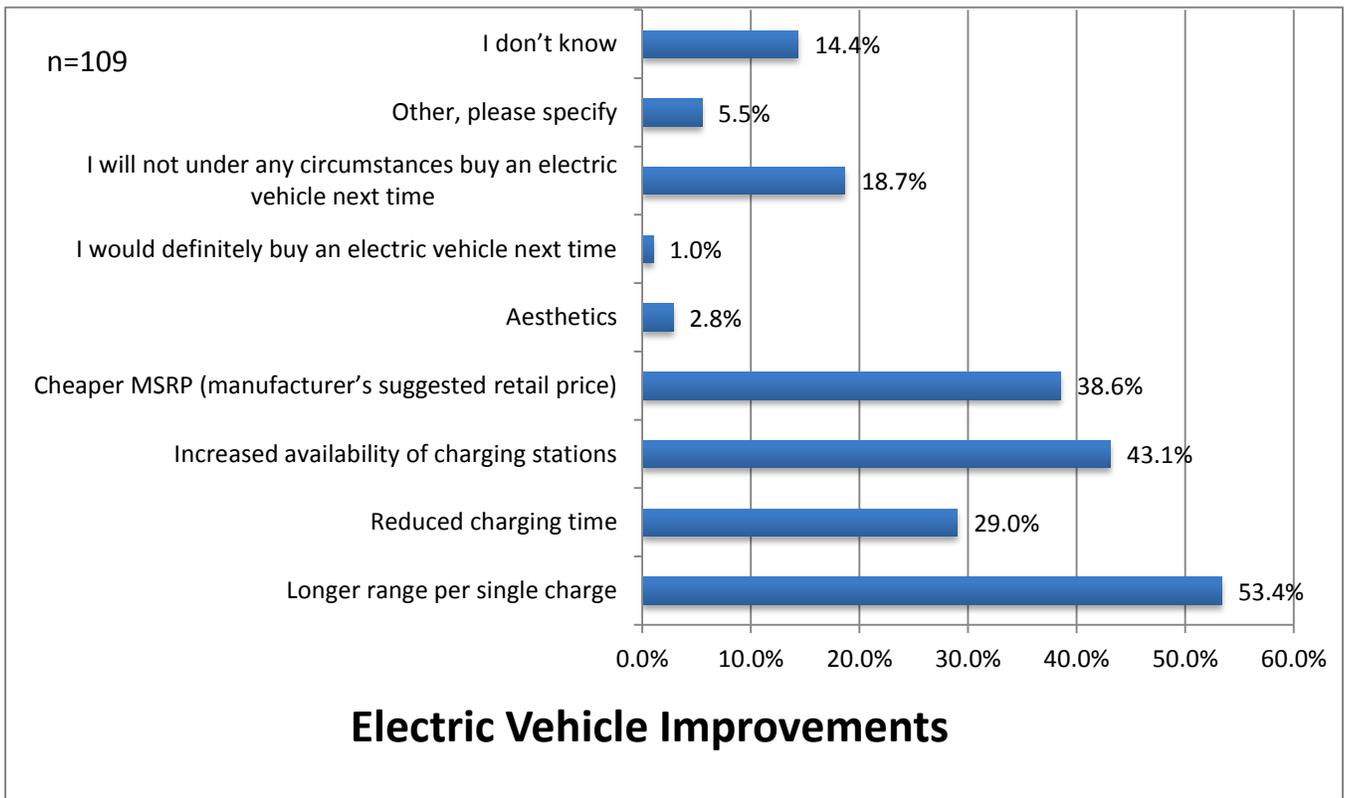


Figure 4.27 – Electric Vehicle Improvements

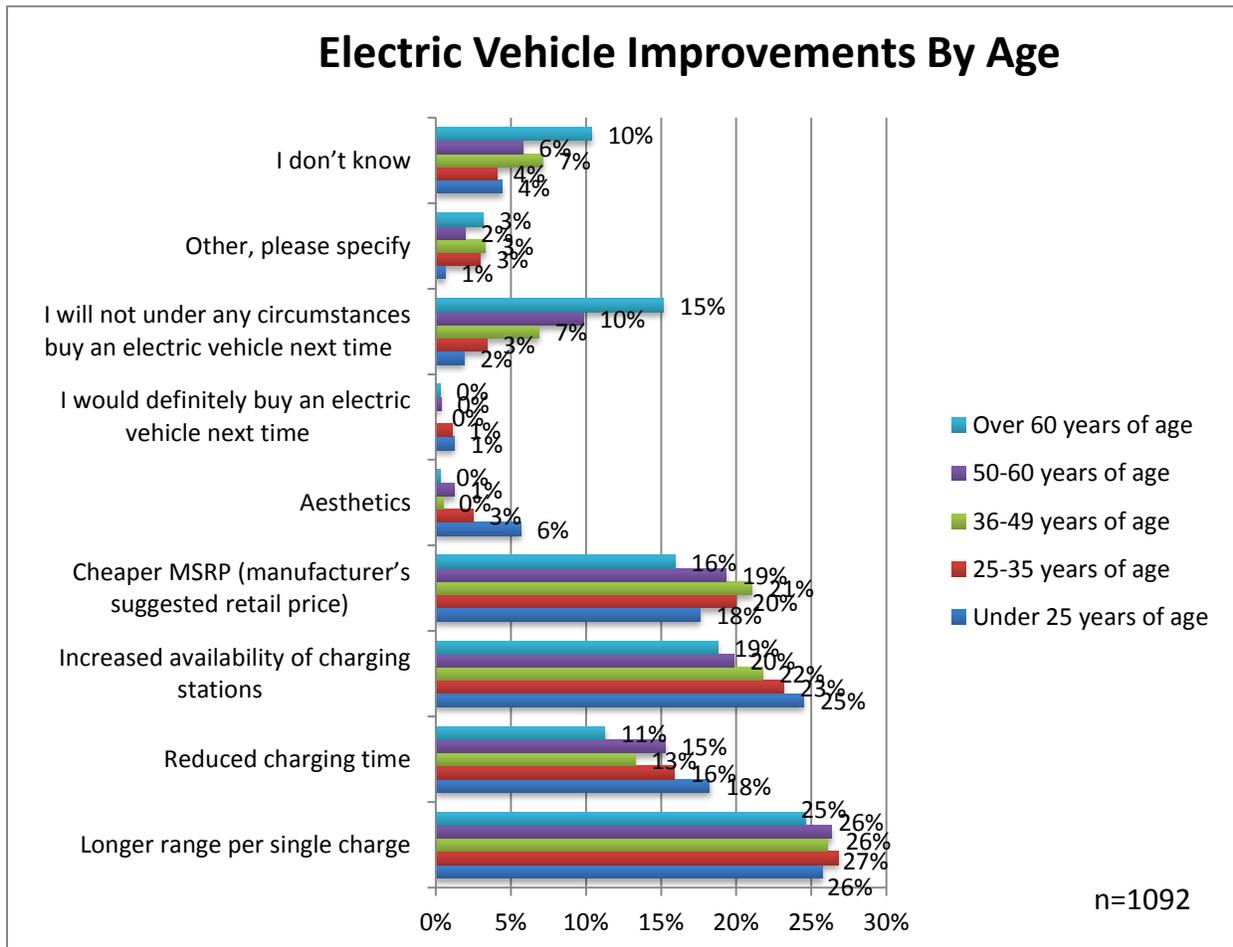


Figure 4.28 – Electric Vehicle Improvements by Age

Electric Vehicle Improvements By Region

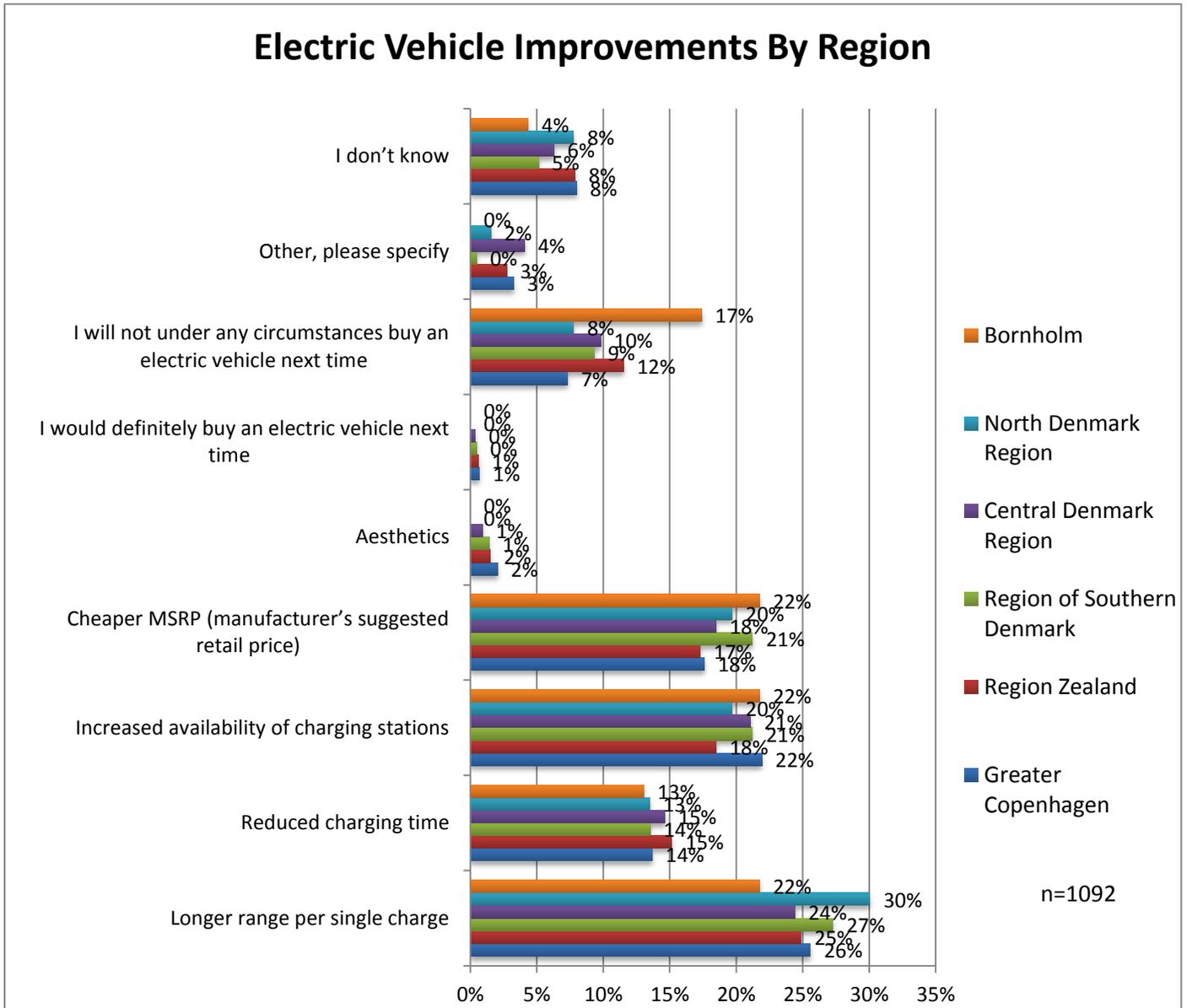


Figure 4.29 – Electric Vehicle Improvements By Region

Electric Vehicle Improvements By Gender

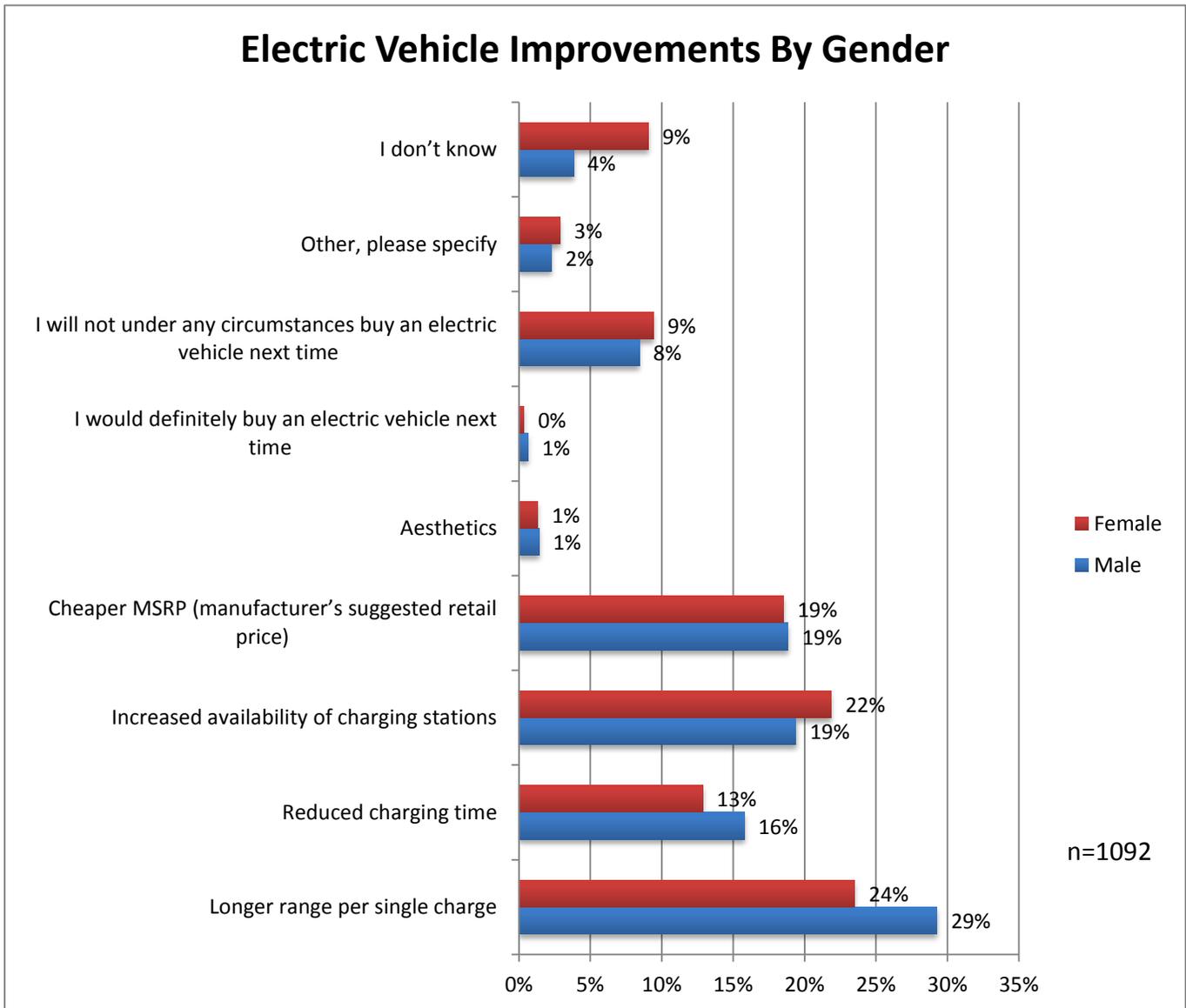


Figure 4.30 – Electric Vehicle Improvements By Gender

As the age of the respondents increases the answer “I will not under any circumstances buy an electric vehicle also increases. The “I don’t know” answer choice takes a significant percentage of responses from every region. Range is the improvement that respondents in every region want to see most. Both females and males want to see a longer range as the biggest necessary improvement. Females chose “I don’t know” almost twice as many times as men.

4.3.5 Acceptable Recharge Time

The fourth question was “what would you consider to be the longest acceptable time to fully recharge the battery of an electric vehicle?” The results to question 4 can be seen below in Figure 4.31. The majority of respondents chose “under 2 hours,” “I don’t know,” and “2-4 hours” as the longest acceptable charging time with 37.9%, 27.0%, and 25.7% respectively.

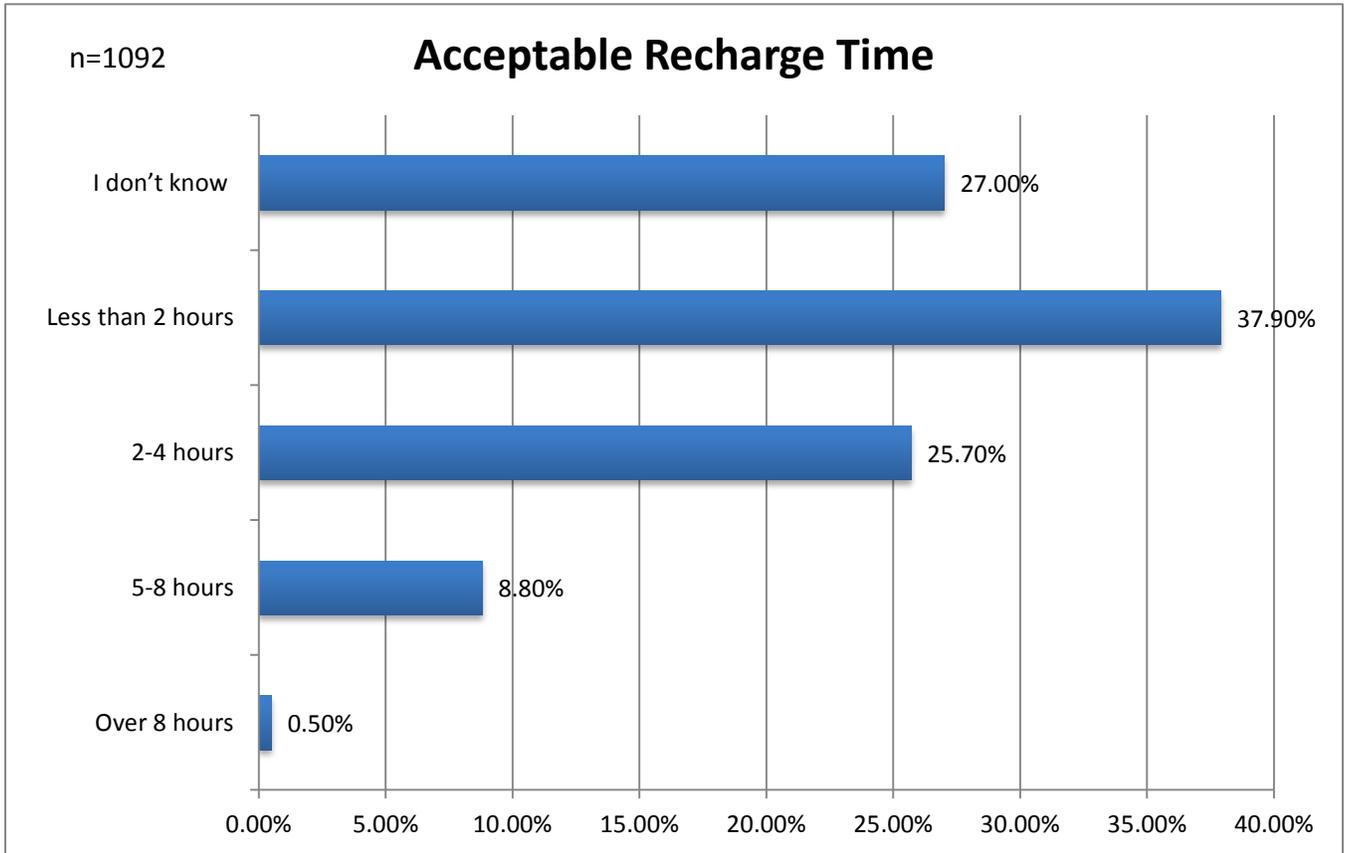


Figure 4.31 – Acceptable Recharge Time

Acceptable Recharge Time By Age

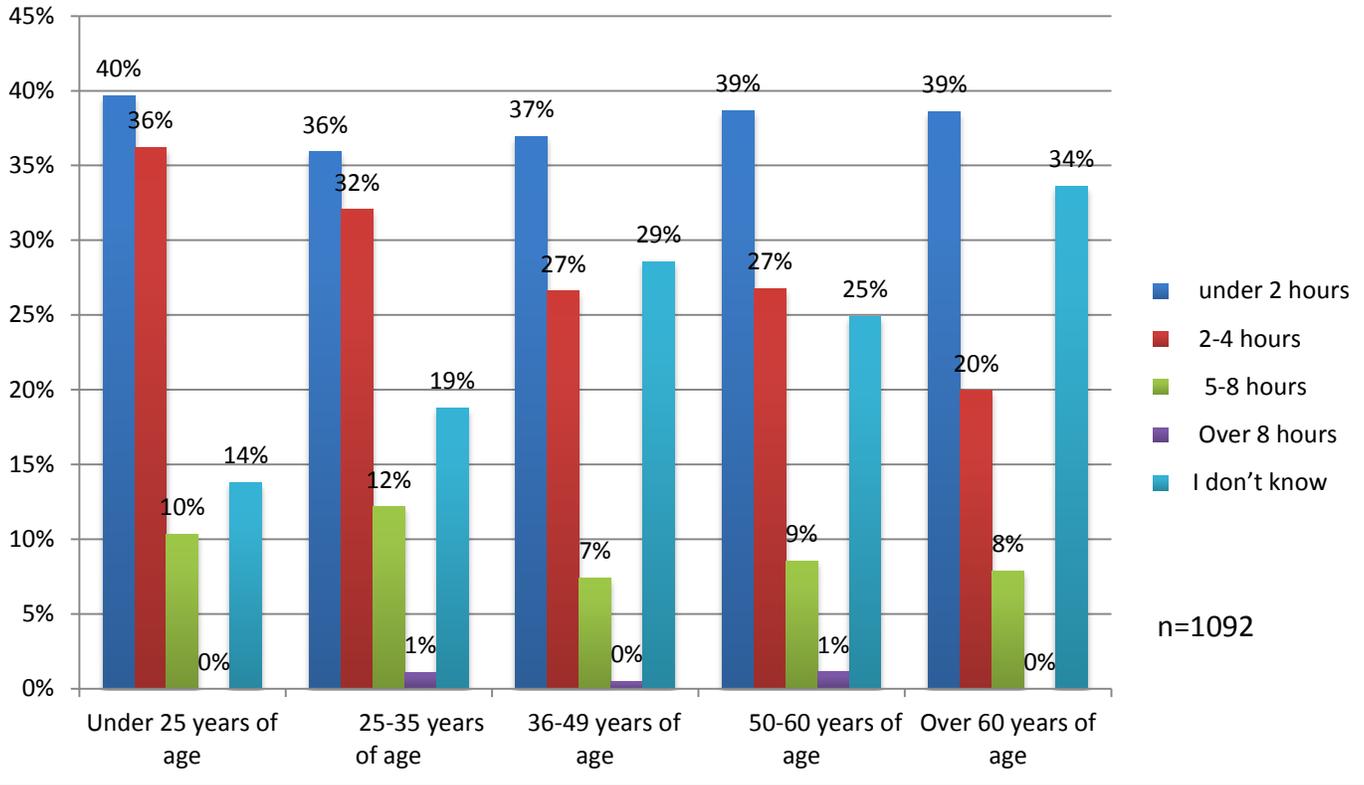


Figure 4.32 – Acceptable Recharge Time By Age

Acceptable Recharge Time By Gender

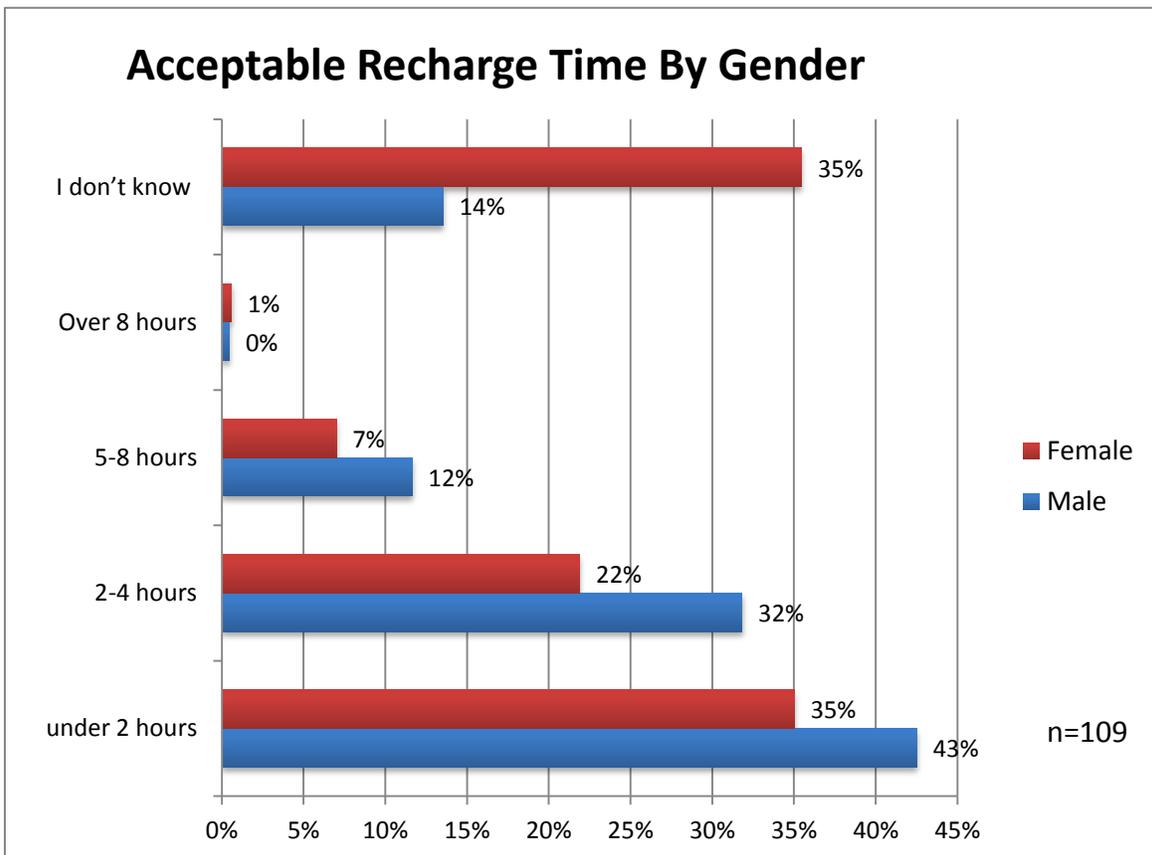


Figure 4.33 – Acceptable Recharge Time By Gender

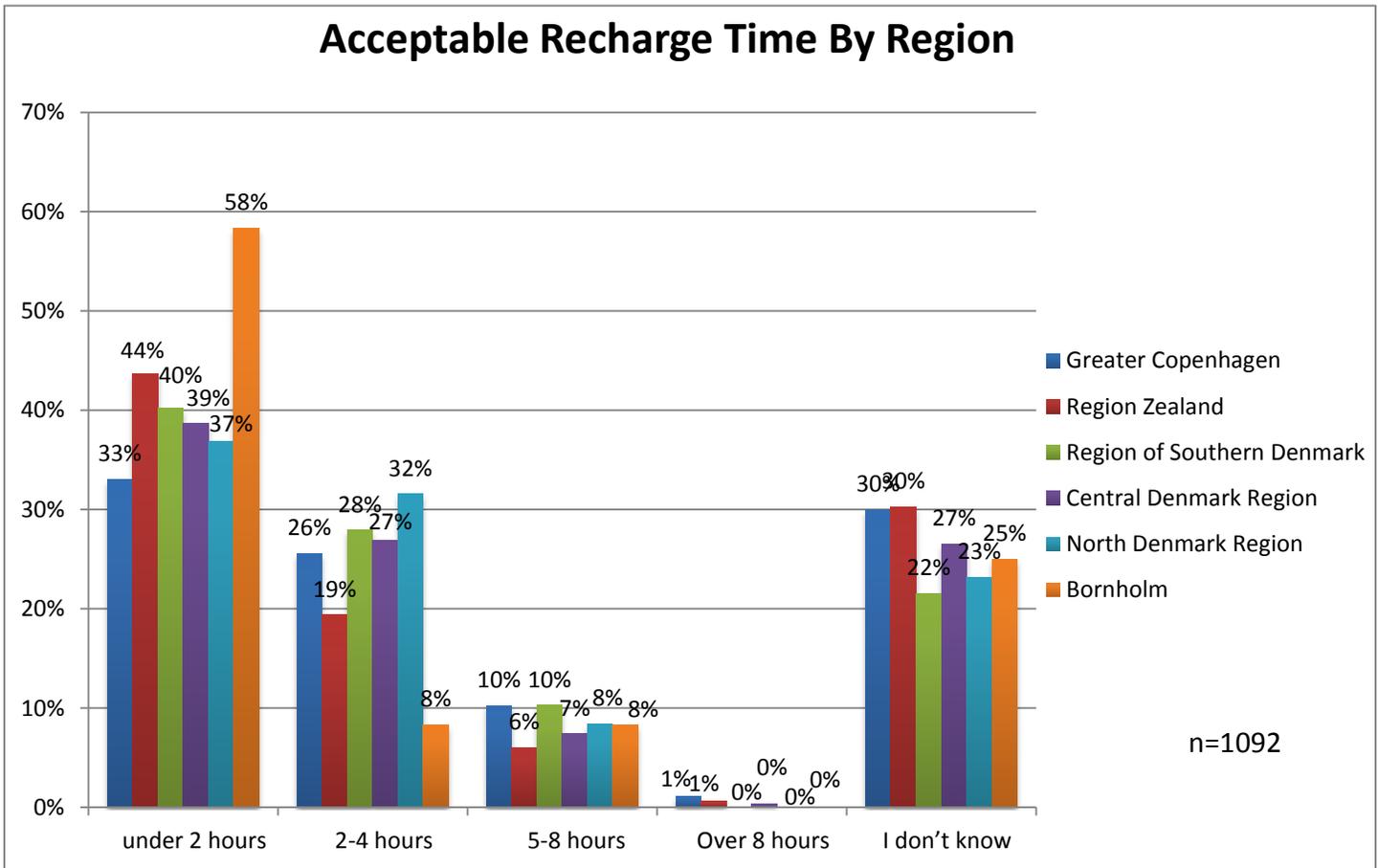


Figure 4.34 – Acceptable Recharge Time By Region

There are no noticeable trends by age or by region for acceptable charge time. In terms of gender the “I don’t know” answer choice was chosen by 35% of females compared to only 14% of males which indicates that females have less overall knowledge of the EV industry.

4.3.6 Acceptable Range

The final question we asked the respondents was “What is the range that an electric vehicle would need before you would consider buying or leasing it?” The results from question 5 can be seen below in Figure 4.35. The majority of individuals selected the lowest acceptable range for an EV to be above 160 km (65.8%). “I don’t know” was the most common answer closely followed by “161-320km,” “321-450km,” and “over 450km” with 27.1%, 25.7%, 23.0%, and 17.1% respectively. The “81-160km” answer was the least chosen with only 6.2% of all responses. “Under 80km” did not get 1% of the overall responses.

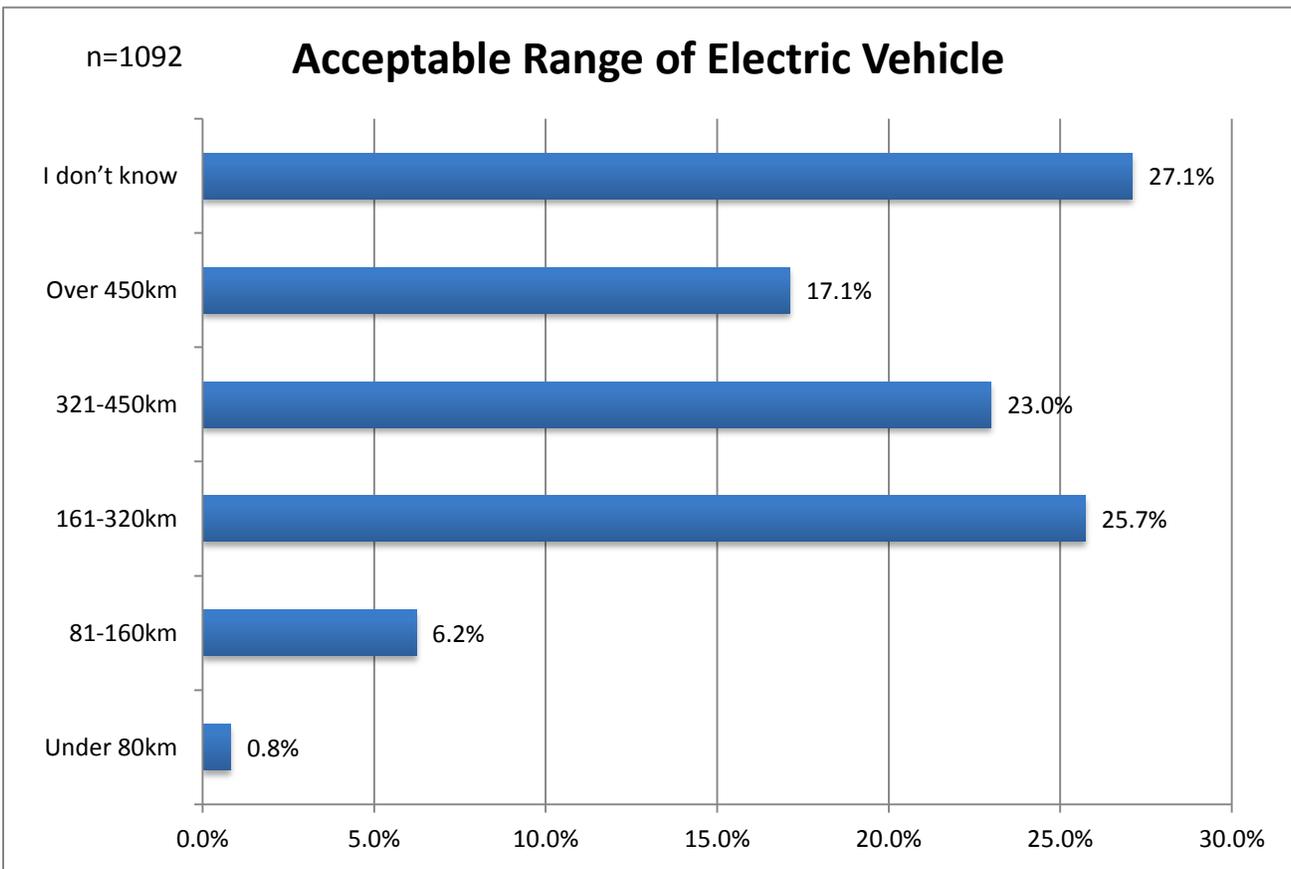


Figure 4.35 – Acceptable Range of an EV

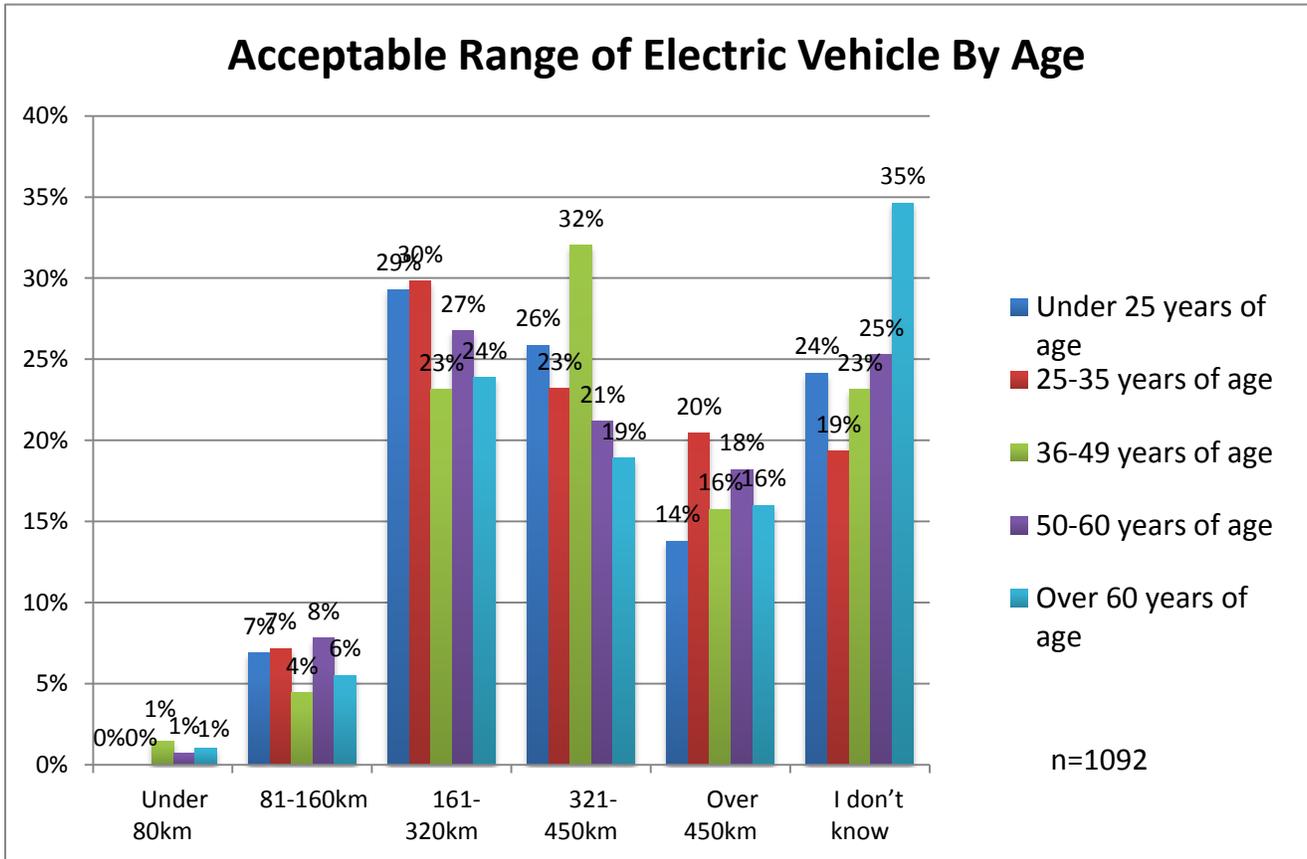


Figure 4.36 – Acceptable Range of EV by Age

Acceptable Range of Electric Vehicle By Region

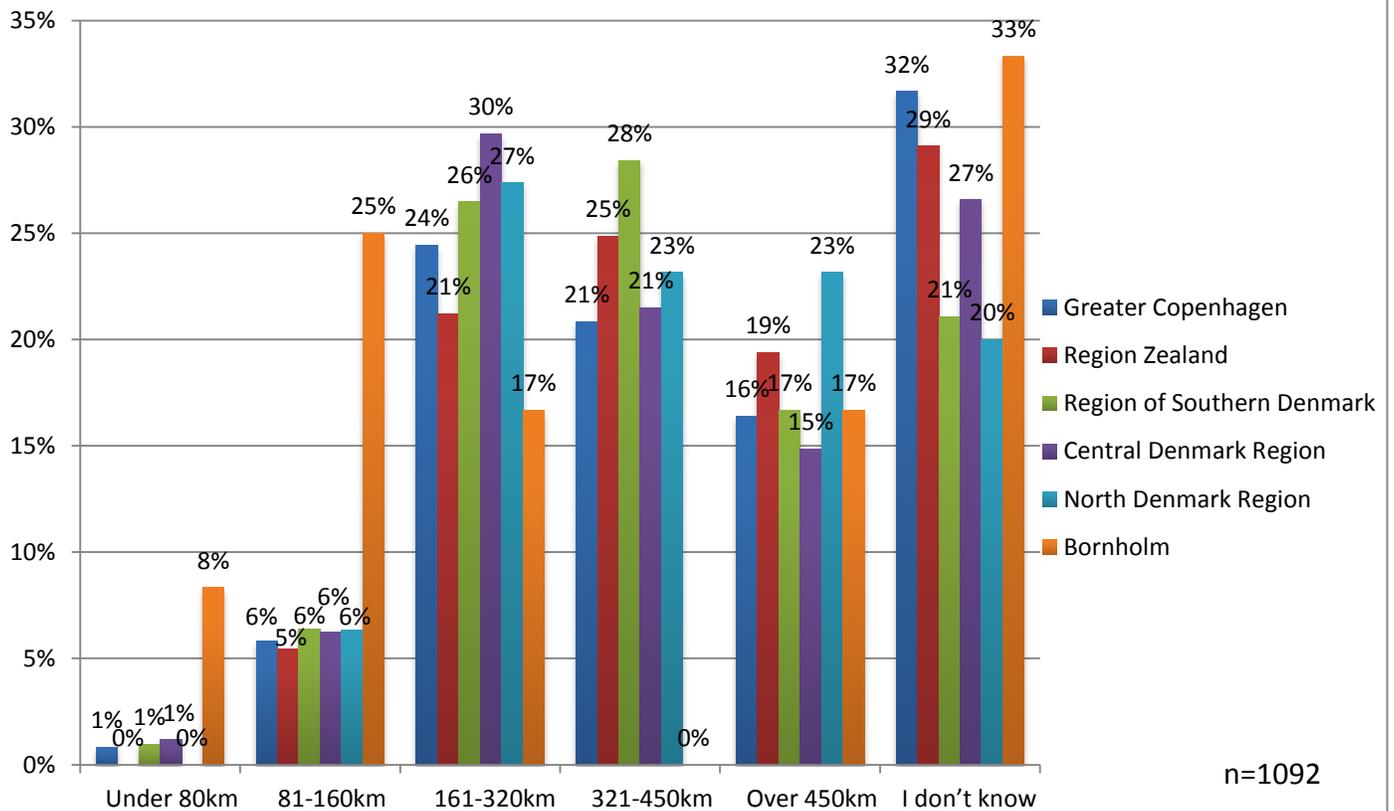


Figure 4.37 – Acceptable Range of an EV by Region

Acceptable Range of Electric Vehicle By Gender

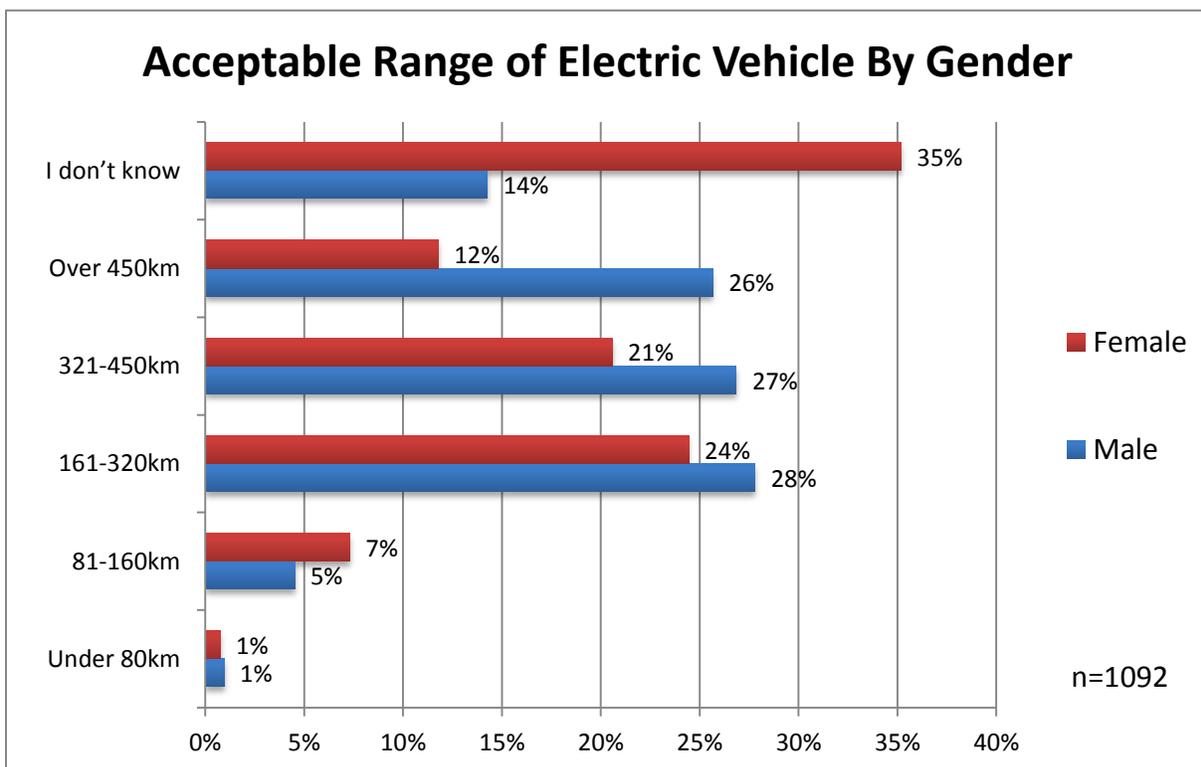


Figure 4.38 – Acceptable Range of an EV by Gender

In terms of age, all groups directly reflect the results of question 5. The “161-320km” response is acceptable to a strong percentage of all age groups.

Despite the response “I don’t know” being the most common answer, it is not the case for region besides Greater Copenhagen and Zealand. This answer is chosen significantly more in Greater Copenhagen, and only surpasses the other choices by a small margin in Zealand. The “161-320km” and “321-450km” choices are the leaders in all other regions. Again, 35% of females responded “I don’t know” compared to only 14% of males. Males are responding with “161-320km,” “321-450km,” and “over 450km” pretty evenly, whereas they decrease respectively with females.

4.3.7 Overall Survey Results

Overall, the results from the survey are consistent across the different questions. The electric vehicle was the least popular answer for which type of car would be purchased next. In addition many respondents had no interest in purchasing a car because they do not need one. They most likely use public transportation and bicycles instead. This can also be seen in question 2 involving the price range respondents would be willing to spend on a new car. If the respondents were going to purchase a car, they would want to spend between 100,000-200,000DKK. The under 25 range said that they would not purchase a car for over 100,000 DKK but there are no EVs available for under 100,000 which negates the interest young consumers have because they cannot afford one. A few EV models are available between 100,000-200DKK, but the options are very limited. The most popular EV models including the Nissan Leaf, Tesla, Smart Car, and BMW i3 are all priced above 200,000DKK (Electric Car Market, 2014). This indicates that the current models are priced too high for most consumers.

Range is the biggest issue that the respondents had with electric vehicles. The majority of respondents expect the range of an electric vehicle to be at least 161-320km, which few EVs can offer at this point in time. In order for consumers to consider EVs to be viable options they need to be convinced that there is acceptable range.

Another common theme from our survey was that a large percentage of respondents lacked education on electric vehicles. This is important because these respondents are not considering EVs because they simply do not know enough on the subject. Females made up the majority of these responses saying “I don’t know,” to questions concerning improvements, charge time, and range for electric vehicles.

5. Conclusion

The project team interviewed twelve experts in the electric vehicle field, released a survey to Danish consumers with 1,092 respondents, and conducted 14 weeks of research. The goal was to determine what the contributing factors are to the lack of electric vehicle uptake in Denmark, and how the Danish Consumer Council can help combat the problem. We found there are four top barriers in Denmark for the EV industry uptake (ranked highest to lowest): range, price, consumer knowledge, and infrastructure.

53.4% of our survey respondents said that range was an improvement that needed to be made in order for them to consider purchasing an electric vehicle. This result was depicted in the graph in figure 4.27. This places range at the top of the list for consumer concerns and identifies it as a major barrier to electric vehicle uptake. Through our qualitative analysis, we also determined that range is a major obstruction. However, the ability to have more in-depth research with qualitative compared to quantitative allowed the group to realize that it is not just range but range anxiety. Danish consumers do not realize that electric vehicles can meet up to 90% of all their everyday travel needs. The average consumer believes they need a longer range than they actually use. This was expressed by both Tom Lund Kudsk of FDM and Viktor Gudmundson of Tesla, among many others (Appendices E.2G&E.3K respectively). That being said, there is an understandable argument that consumers are still unwilling to have a car that does not meet 100% of their needs. The problems arise when consumers need to make long trips. For these special trips an EV would not meet the consumers' needs. Our research suggests that electric vehicles would best serve as a second car. 15% of Danish households own 2 or more cars, 44.5% own 1 car, and 40.5% do not own a car (Dalbro, 2013). Due to the fact that only 15% own 2 or more cars the marketability of EVs is limited further.

Based on the combination of the team's quantitative and qualitative analysis, price is the second largest obstruction to the development of the EV industry in Denmark. Current prices for the average EV are still higher than the average internal combustion engine, even with the exemption of the 180% vehicle registration tax. Micro cars are taking a high percentage of the EV market because they fit the same needs, yet are priced significantly lower (many under 80,000 DKK). 38.6% of our survey respondents indicated that price was a concern

in their consideration to purchase an EV (Figure 4.27). Our interviews suggest that higher end luxury EVs, such as the Tesla and BMW models, are able to compete because their competitors are also priced highly. Average EVs aimed for the general population are not selling because they are not providing enough range to justify value for their price. In order for EVs to penetrate the early majority market in Denmark they need to be more affordable.

When the team inquired about these top two barriers (range and price) another significant barrier was identified, lack of consumer knowledge. Although this is not the number one barrier to uptake, consumer knowledge could potentially be the best target area for the DCC to focus its efforts. The Taenk survey participants expressed that range was the largest obstruction to uptake, but the team realized that consumers were not aware which EVs could fit their needs. When inquiring about price, the project group learned that consumers disregard EVs typically due to their initial cost. Most consumers are unaware of cost over time, cost per mile, or return servicing costs of an EV vs. other car types, which could potentially affect their decision.

The lack of communication is evident in the Taenk survey where respondents answered “I don’t know” in large numbers for questions posed. 14.4% chose “I don’t know” when asked what improvements could be made for electric vehicles (Figure 4.27) and 27% chose “I don’t know” for both acceptable range and acceptable charging time (Figure and 4.31 and 4.35). In addition, it may be difficult for the consumer to know where the closest charging stations are located along their driving route. This leads us to our last barrier.

According to Survey Question #3, 43.1% of Danish consumers believe the availability of charging stations is limiting their interest in electric vehicles (Figure 4.28). The fear of running out of charge while on the road is a very real factor in potential buyers’ minds. This is how the fourth barrier, charging infrastructure, was realized. Even though many EV owners will have their own charging station available in their house, those who live in apartments may not. Additionally, there is a need for more standardization of charging stations. Currently, there are two main charging providers in Denmark, Clever and E.On, and crossing over from one to

another is not as convenient as refueling at a gas station. Here arises another issue for consumers.

A constant goal throughout this project has been identifying how the electric vehicle industry can move forward in its product life cycle and penetrate the early majority of the Danish automobile market. To do this, we have outlined the major obstructions including price, range, infrastructure, and consumer knowledge which is where the Danish Consumer Council's resources come into play. In order for Denmark to be carbon neutral by 2050, the transportation sector needs to be addressed sooner rather than later and the team's input as to how the DCC can do so is outlined in the following chapter's recommendations.

6. Recommendations

In the previous chapter, four barriers to EV uptake in Denmark were listed: Range, Price, Consumer Knowledge, and Infrastructure. Identifying these barriers is very useful in determining how the Danish Consumer Council could most effectively use their resources. To take it a step further, we have provided specific recommendations that fall within the Council's operations to push the EV industry. This is in accordance with objective one; understand the functions of the Danish Consumer Council.

The DCC could further benefit consumers by overcoming the barriers mentioned and approaching three main parties listed by priority: Consumers, Danish government, and car dealerships. These groups represent different constituents in the development of the electric vehicle industry.

Consumers:

To increase the information flow to consumers, the DCC could create a product or industry review in the Taenk Magazine. These product reviews are commonplace in the magazine and would provide consumers with more information on the electric vehicle industry, for example, how an EV compares to an internal combustion engine or a hybrid. It would be useful to include things such as charge time, cost of ownership, environmental benefits, and the price of an E-Gallon which is the price it would cost you in electricity to drive the same distance an internal combustion engine vehicle would get on one gallon of gas.

A major help to consumers would be the development of a mobile application and website that provides the location of all EV charging stations in Denmark and neighboring countries. Currently, there are no such apps made specifically for Denmark which contributes to the consumers' lack of knowledge and range/infrastructure anxiety. Mobile apps such as Plugshare and EV Charging Station Locator have been very successful in the United States (Fehrenbacher, 2011). Clever has released a mobile app for Denmark that has the same function, but it only displays Clever charging stations.

Government:

Government recommendations for the Danish Consumer Council utilize one of their main tactics, political lobbying. The DCC rarely deals with taxation as it is a complicated, highly political, and a difficult area to change. However, in the case of electric vehicles the removal of the VAT has been shown to have extremely positive results when looking at Norway's success. In addition, ease of interoperability is a consumer right and without which, the EV industry will remain greatly hampered. This would best be approached from a government level to enforce standardization of charging stations and plugs. Additionally, the expansion of current EV incentives such as free tolls and access to bus lanes will aid in the advertisement of the benefits of purchasing an EV.

Car Dealerships:

It is in the best interests of the consumers for the DCC to conduct further studies to determine why dealerships are reluctant to promote their EVs, and more specifically, determining the EV pricing in comparison to ICEs. In addition, there should be research on whether the consumers are receiving full benefits from the tax exemptions or if dealerships are just receiving larger profits.

Table 6.6 below illustrates and summarizes the major problems found and recommendations that could be possible solutions.

Table 6.6– Problems and Recommendations By Target Group

Target Group	Problems	Recommendations
Consumers	<ul style="list-style-type: none"> • Lack of knowledge • Range anxiety • Current negative opinion of EVs because of Better Place 	<ul style="list-style-type: none"> • Industry review in Taenk • Smartphone application locating all charging stations
Government	<ul style="list-style-type: none"> • Exemption of Vehicle Registration tax is not effective enough • Microcar tax breaks are too extreme • Interoperability of charging stations and plugs • Limited EV incentives and advertisement 	<ul style="list-style-type: none"> • Lobby for removal of value added tax (successful in Norway) • Propose standardization between charging stations and plugs (use of Clever and E.ON) • Expanded incentives and advertisement <ul style="list-style-type: none"> ○ Ex. Free tolls, access to bus lanes
Car Dealerships	<ul style="list-style-type: none"> • Reluctance to push EVs • Battery technology • EV Prices after tax exemption 	<ul style="list-style-type: none"> • Study why Dealerships are not pushing EVs • Research EV vs. ICE model pricing

Going Forward:

Moving forward, we suggest that the first phase of action for the Danish Consumer Council is to provide an industry review of electric vehicles in an upcoming version of their Taenk magazine. This effort could eliminate many concerns stemming from the failure of Better Place while educating the general population. In addition, we recommend that the Consumer Council research deeper into car dealership’s pricing of EVs to understand who is benefiting from the removal of the vehicle registration tax. Finally, the creation of a smartphone application that identifies every charging station in the country could ease consumer range concerns. The Danish Consumer Council has the resources to help this industry and if they marshal them effectively, they will be accomplishing their goal of protecting and empowering consumers.

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Appendix A: Confidentiality Boilerplate

Before all interviews this statement will be read or paraphrased to the interviewee.

To begin, we would like to ask for permission to use and quote your statements in this meeting.

We are a group of 4 college students from Worcester Polytechnic Institute performing a research project for the Danish Consumer Council. Our project entails understanding consumer opinion of electric vehicles and why there has not been an uptake of them. This information will allow the Consumer Council to create a plan of action to better protect consumers. Our data and findings will be submitted to the Danish Consumer Council for future actions and published through Worcester Polytechnic Institute.

There are no known risks associated with this interview.

If you so choose, the recordings and statements will be kept anonymous and in no way relate to you or your organization.

Please feel free to say as much or as little as you would like and can refrain from answering questions at any time. You can also decide to stop the interview at any time.

If you are willing, we would like to record the interview for future analysis and writing purposes.

Thank you for your cooperation.

Appendix B: Introductory Email

Dear (Contact),

My name is (Person Sending the Email) and I am an American University Student conducting a group project with Forbrugerrådet, the Danish Consumer Council. The purpose of this project is to identify the major consumer interests and concerns regarding electric vehicles, as well as recognize any potential barriers to the advancement of the industry in Denmark. We will provide a list of recommendations on how to allocate the Consumer Council's resources based on our research. We believe you would be an excellent source for our project due to (insert relations to electric vehicles here). Are you available to meet in the next week here at the Consumer Council or at (insert location of interviewees business) for a 30 minute interview? We would appreciate any information you could provide us with.

Thank you,

Brodie Green, Lawrence McGillicuddy, Jacqueline Lynch, Vincent Samuel

+45 77 41 77 87

Ecardk14@wpi.edu



Appendix C: Introductory Phone Call

Hi, my name is _____ and I'm calling from the Danish Consumer Council. May I ask to whom I am speaking?

I am part of a group of American University students conducting a study regarding electric vehicles in order to provide recommendations to the Danish Consumer Council. We are interested in setting up an interview with_____. Are you available to meet in the next week here at the Consumer Council or at (insert location of interviewees business) for a 30 minute interview? We would appreciate any information you could provide us with.

Appendix D: Consumer Survey

- 1) What type of car would you consider buying for your next car?
 - a) Gas
 - b) Diesel
 - c) Electric
 - d) Hybrid
 - e) Others
- 2) What is the price range you would be willing to spend on a new vehicle?
 - a) Under 100,000 DKK
 - b) 100,000 – 200,000 DKK
 - c) 200,000 – 300,000 DKK
 - d) 300,000 - 450,000 DKK
 - e) Over 450,000 DKK
- 3) What improvements concerning electric vehicles would substantially impact your decision to purchase one? (Please select all that apply)
 - a) Longer range per single charge
 - b) Reduced charging time
 - c) Increased availability of charging stations
 - d) Cheaper MSRP (manufacturer's suggested retail price)
 - e) Aesthetics
 - f) Other
- 4) What would you consider to be the longest acceptable time to fully recharge the battery of an electric vehicle?
 - a) Over 8 hours
 - b) 5-8 hours
 - c) 2-5 hours
 - d) Less than 2 hours
- 5) What is the range that an electric vehicle would need before you would consider buying or leasing it?
 - a) Under 80km
 - b) 80-160km
 - c) 160-320km
 - d) 320-450km
 - e) Over 450km

Appendix E: Interview Organizations and Questions

E.1 5 Standard Introductory Questions:

1. Please state your name and title at your organization.
2. What is your organization's purpose? What methods do you use to achieve your goals?
3. Does your organization have any relations to electric vehicles?
4. What are the barriers preventing the Danish electric vehicle industry from developing?
5. In general, what is the opinion of the Danish population concerning electric vehicles?

E.2 Electric Vehicle Organizations:

A. Clever

- A1 Is there any specific safety precautions concerning electric vehicles today compared to gas, diesel, and hybrid vehicles?
- A2 How important are the aesthetics of vehicles to Danish car owners?
- A3 Are there any specific findings on certain demographics that are more likely to be electric car owners?
- A4 Are there issues as far as standardization and interoperability regarding infrastructure, etc.?
- A5 What can you tell us about Better Place and do you think it affected the public's opinion?
- A6 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?
- A7 With Norway being world leader in the uptake, what would you say is the major difference between Norway's success and Denmark's lack thereof?

B. Copenhagen Electric

- B1 Are there any specific safety precautions concerning electric vehicles on the market today compared to gas, diesel, and hybrid vehicles?
- B2 How important are the aesthetics of vehicles to Danish car owners? With most electric vehicles on the market today having a distinguished look, do you think this affects the total sales?
- B3 On average what is the average age of electric vehicle consumers in Denmark?
- B4 Are the electric vehicles being used as primary cars?
- B5 Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?
- B6 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

C. Danish Eco-Council

- C1 How important are electric vehicles to the country's carbon neutral plan?
- C2 Have you thought about more possible incentives to push EV sales?

- C3 Do you think the general population is on board with the country's carbon neutral plans?
- C4 Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?
- C5 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

D. Danish Electric Vehicle Alliance

- D1 Do you believe that car dealerships selling both electric and non-electric vehicles increase the price of their electric models to compete with gas models after the vehicle registration tax?
- D2 Is there any specific safety precautions concerning electric vehicles on the market today compared to Gas, diesel, and hybrid vehicles?
- D3 How important are the aesthetics of vehicles to Danish car owners? With most electric vehicles on the market having a distinguished appearance, do you think this affects the total sales?
- D4 On average what is the average age of electric vehicle consumers in Denmark?
- D5 Are the electric vehicles being used as primary cars?
- D6 How standardized is the electric vehicle infrastructure in terms of interoperability in Denmark? (Ex. Charging stations, parking, etc)
- D7 Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?
- D8 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

E. Danish Standardization Organization

- E1 What needs to become consistent between all models of electric vehicles in order for the EV industry to see growth? (NOTE: bring up parts of electric vehicles that may need to be standardized if they are not mentioned ex. Charge time, range, price, charging methods, parking,)
- E2 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?
- E3 Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?

F. Federation of Danish Electric Vehicle Drivers (Forende Dansk Elbilster)

- F1 Do you believe that Car Dealerships selling both electric and non-electric vehicles increase the price of their electric models to compete with gas models after the vehicle registration tax?
- F2 Is there any specific safety precautions concerning electric vehicles on the market today compared to gas, diesel, and hybrid vehicles?
- F3 How important are the aesthetics of vehicles to Danish car owners? With most electric vehicles on the market having a distinguished appearance, do you think this affects the total sales?
- F4 On average what is the average age of electric vehicle consumers in Denmark?

- F5 Are the electric vehicles being used as primary cars?
- F6 How standardized is the electric vehicle infrastructure in terms of interoperability in Denmark? (Ex. Charging stations, parking, etc)
- F7 Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?
- F8 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

G. Federation of Danish Motorists

- G1 How standardized is the electric vehicle infrastructure in terms of interoperability in Denmark? (Ex. Charging stations, parking, etc)
- G2 Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?
- G3 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

H. Norwegian Consumer Council Elbilforeningen

- H1 What changes over the past few years have led to a successful EV industry?
- H2 Is there any specific safety precautions concerning electric vehicles on the market today compared to Gas, diesel, and hybrid vehicles?
- H3 How important are the Aesthetics of vehicles to Norwegian car owners? With most electric vehicles on the market having a distinguished look, do you think this affects the total sales?
- H4 On average what is the average age of electric vehicle consumers in Denmark?
- H5 Are the electric vehicles that have been sold being used as primary cars?
- H6 How standardized is the electric vehicle infrastructure in terms of interoperability in Norway? (Ex. Charging stations, parking, etc)Do you happen to have contact information of electric vehicle owners that may be willing to be interviewed?
- H7 In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

E.3 Electric Vehicle Dealerships

Standard List of Dealership Questions:

1. Why do you think there are more EV sales in Norway than Denmark?
2. On average, how many people per day contact you dealership looking for an electric vehicle? Gas vehicle?
3. What is your electric vehicle strategy for the future? Are there any new strategies being put into place to help push the sales of electric vehicles?
4. What have you found the major concern to be for potential EV buyers?
5. Would you purchase one of your own models?
6. What are some of the main barriers holding the Danish consumers back from purchasing electric vehicles?

7. If Denmark is to see a developed electric vehicle industry within the next few years, what needs to be the industry's top priority?
8. Have consumers of your electric models typically purchasing these cars as their primary vehicle? Or are they being purchased as a secondary vehicle?
9. Is (name of company) working with Denmark to see a larger infrastructure for electric vehicles throughout the country?

I. BMW Denmark A/S

- I1 We have read that the BMW I3 is going to revolutionize electric vehicles on the market, how does it stand out from other electric vehicles available? Is the I3's performance comparable to the BMW gas and diesel models
- I2 Has there been any pre-sales offered to consumers for the BMW I3? How much interest from Danish consumers has it drawn so far?
- I3 Are you aware of the former company Better Place, and their idea of battery swapping technology? Do you think it is still a plausible idea that could reduce charge time significantly? What is BMW working on in terms of reducing charging time?

J. Renault

- J1 Even though Renault's attempt at reducing charging time with Better Place fell through, what is Renault working on moving forward in terms of enhancing electric vehicles?
- J2 Why do you think Better Place's technology fell through?
- J3 How much interest has the Renault Twizy drawn? The Kangoo Z.E.? The Kangoo Z.E. Maxi? Why would a potential buyer choose these models over the other models you offer?

K. Tesla Motors Copenhagen

- K1 The Model S seems to have really taken off as a leader in the electric vehicle industry, how does it compare to other electric, gasoline, diesel, and hybrid vehicles on the market today? In what ways does it out-perform the competition? In what ways does it under-perform compared to the competition?
- K2 Has there been any pre-sales offered to consumers for the Model X? How much interest from Danish consumers has it drawn so far?
- K3 In terms of range, the Model S is elite compared to other electric vehicles, how is Tesla planning to improve this even further?
- K4 Even though the Model S is superior compared to other electric vehicles available to consumers, it is one of the pricier models. Is Tesla going to remain

solely a luxury vehicle company, or are there intentions to make a more affordable model for the average Danish Consumer?

- K5 Are you aware of the former company Better Place, and their idea of battery swapping technology? Do you think it is still a plausible idea that could reduce charge time significantly? What is Tesla working on in terms of reducing charging time?

E.4 Potential Electric Vehicle Owners

1. Do you own a car?
2. If so, what kind of car? (gas, diesel, electric, hybrid, etc.)
3. Would you consider purchasing an electric car? Please explain either why or why not.
4. What needs to be changed in order for you to further consider purchasing an electric car?
5. What aspect (range, charge time, price, aesthetics, etc.) is most important to you when purchasing a new vehicle?
6. Do you think electric cars will make an impact in the future towards Denmark's carbon neutral goals?
7. How would you describe the general public's opinion on electric cars?
8. Any other comments would be greatly appreciated.

Appendix F: Potential EV Owner Analysis Chart

Interviewee	EV Owner	Summary	Similarities	Differences
Magnus	No, I do not have a license	No license=no car	Majority say that range is the issue preventing purchasing of EV's. Second most common issue is price.	Owners have not complained about range being an issue. Very few bad comments from owners about their cars. The main reason for not owning an EV is range, especially from gas/diesel owners
Viktor Gudmundsson	not yet I graduated in august but im working on it.	Not enough money for EV (probably Tesla)		
Gro Mette Moen	I don't have a car. I'm a part of a care sharing scheme. I'm not considering buying a car, I would buy a hybrid.	Car sharing program. Would want a hybrid because of range		
Kare Albrechtsen	here at Copenhagen electric, I am driving a Renault zoe it works very fine and we use them as my main car.	Loves company EV. Privately will purchase one, too expensive now		
Nana Winkler	has a desiel	Has diesel car. Purely for range.		
Peter Klink	no I do not my parents live 350km away from here and I have a family in Finland which is 1850 km	Owns a gas/diesel for range purposes		
Regnar Shultz	No I don't actually, we were planning on having one for the company	Has diesel car currently because of caravan. Would try to get EV. Would like to see more range.		
	I have a diesel, Im considering buying an electric car			
Martin Storm	yes I own the i3.	Owns a i3 because BMW makes them. Loves it		
Lise Kirkegaard	Yes I do actually	Owns Nissan Leaf. Financial reasons. Has 2 cars. Loves driving EV		

Appendix G: Transcribed Interviews

G.1 Electric Vehicle Organizations

A. Clever

Brodie: Please state your name and title at your organization.

Lise: My name is Lisa Kirkegaard. My title is senior Vice President for Communications and Marketing.

Brodie: What is your organizations purpose? What methods do you use to achieve your goals?

Lise: The purpose of clever is to be an electric mobility operator and our purpose is too charge electric vehicles, and help secure the mobility of electric vehicles by offering charging solutions at home or at the company addresses and also other charging solutions for the public such as places where people go often along the highway. We offer charging at home and on the fly.

Brodie: Do you have any specific goals?

Lise: We don't give goals on the home charging solutions, those goal we keep to ourselves. However we have announced 50 quick charge stations each offering 50kw charging and also 22 kw AC charging. Furthermore, beside these 50 quick chargers we are putting up 150 AC charging stations with 22 kw.

Brodie: What are the barriers preventing the Danish Electric Vehicle Industry from Developing?

Lise: In Denmark, we have put out a lot of surveys regarding the barriers. The main one for the private consumer is the price for the car. Above all, this is the main obstacle because of the taxation system... the small cars are very cheap in Denmark. These micro-cars... they only cost around 70,000 kr where the electric vehicle, even though there are no taxes, starts at 160,000 kr. So, this gap is too big for the consumer. They are used to looking at the start price of the car rather than what we call total cost of ownership. So it's quite difficult to see economically.

There are two other barriers: range of the car - they think the range at the moment is too low, and the last one is that they would like more public infrastructure to be put up before they will invest. This last point, we have results that show this might more be a mental barrier than a real one because we can see the state of charge.

1600 families have participated and they lend a car 3 months for free and drive it around and we can see they don't use the full range of the car, they charge at home half full and at the public station. Actually they could've driven further than they actually do. People might in this early phase overestimate the value and need of the infrastructure. With the gas mindset we think we have to drive out go to the tank and fill gas. But this is not the case with EVs because the primary infrastructure is at the private address. It's the big information gap we have to deliver because the consumers don't know that when you talk electric cars they're going to have it at their own address. There's a big potential if we can get this information out.

Lise: Yes, the project is still going on. It's a 2 year project and the results are published in Danish on the webpage. I can send you a link.

Brodie: Is there any specific safety precautions concerning electric vehicles today compared to gas, diesel, and hybrid vehicles?

Lise: No I don't think so actually. The cars, all of them have been crash tested. For example when looking at the Leaf, only the Volvo 60 was more secure when tested for crashing. They're very safe cars and then you have two others of course, I think especially if you have a wallbox you are secure. Some cars require what you would call a specific, safetybut they also seem to have solved the problem by putting extra safety precautions. Also, the cars don't make any sounds and that has been an issue from the handicap organizations. However we haven't seen it as a problem in Europe and we tested it in the project and there has been no problem coming from the lack of sound. The drivers become more aware because they know below 25 km/hr. When they go over there is a sound. Actually the drivers have become more cautious because they have more responsibility. We enjoy the silence and become more cautious. It's a bit of a problem that doesn't exist in real life. It's more theoretical.

Brodie: How Important are the aesthetics of vehicles to Danish car owners?

Lise: I think that the first movers, and it is first movers that purchase, they want the car to be distinguished. The car functionally has been approved; it can do all the jobs. A car also means identity and freedom wishes so I think that it is important that the car is distinguished yet it should still look smart. I think they're getting there now. Look at the Tesla Model S and the new BMW. They are very smart looking. People don't want that car because its electric, a lot of them want it because it's a gorgeous, really smart looking car. It's important that it is different, yet smart. It doesn't need to look like a moon rocket on the inside. That is important. You pay a price and people want to stand out and receive attention on it.

Brodie: Are there any specific findings on certain demographics that are more likely to be electric car owners?

Lise: No, we don't have numbers on who has it yet. However we have some in Clever because we do some market surveys and we have demos on interest. The interest is just as high among families with one car as much as families with 2 cars. We found this interesting. On the short term basis they have a higher interest among those groups. They would also change their car often. So that might explain something. We don't have any other info regarding age. Women are more positively thinking about the EV, they don't seem to have as much knowledge as the men but they're actually more positive regarding the car.

Brodie: Are there issues as far as standardization and interoperability regarding infrastructure, etc. ?

Lise: It's really good actually. You can say that we have kind of formed a clever side saying that the consumers shouldn't worry about the standards. This is because we will have stations that have all options. Likewise, we will have all types of charging and supply so I think that there's good interoperability regarding standards. Also there is open access to the two main networks: Ours and E.Ons network. There's no roaming because it is not needed at this stage and anyone can access the two networks. To access ours, you need a charging card and you pay what you

use. E. On: you can access there charger and phone their customer service, pay an amount, and then charge.

Brodie: Are there any other major players?

Lise: There are no other major players. It's a heavy investment to go into the infrastructure business; it's not something we are earning money on. There will be a much larger volume before we earn money. It's not some private suppliers are doing this and that normally only shows that we believe there will be a market in the future, but it's a long term investment.

Brodie: What can you tell us about Better Place and do you think it affected the public's opinion?

Lise: I think one should remember better place was only operating in Denmark and Israel; they were not present in Norway or the U.S. so they were not going global. They kind of, in Denmark, had a large affect because in many eyes they were synonymous with the Electric Vehicle in Denmark. They had a technical focus on battery shifting, and we and the other actors in the business focus on charging with a mounted battery. The bankruptcy was a technological clearance that came out because it ended all the talk of battery swapping stations. It kind of died with Better Place. Now we know which type of technology won and this is kind of a relief. All that talk of which should it be, that kind of diffused some of these consumer. So it was good to have the technological clarification.

No doubt it had an effect on the consumer because Better Place spent so much money on marketing and had a high awareness and knowledge and we hadn't had money to spend. Among the state authorities, they know Clever, but the private consumer didn't have the same knowledge. So, Better Place spent too much on marketing. We were happy to know that there were competitors. That's always good. They spent a lot of money on marketing which was premature. It was a bit.... Well it might have harmed the industry because people were like where are the cars? It was a bit too early. It wasn't until half a year ago that we saw the variety of new electric cars. Before, there was only the Leaf and Fluence and the three micro-cars. Those were the only ones on the market, so there wasn't much to choose among. Now we are

looking to the BMW i3 and others so it's not until now that there's been this variety to choose from where we have micro, medium, and regular to choose from. So, Better Place might have harmed more than it could help.

Brodie: In order to see a developed electric vehicle industry in the near future, what course of action should be taken?

Lise: There's no doubt that in Denmark, there's only one major thing that could be game changing, and that is if we look at the taxation. We cannot compete with micro-cars. We need to look at taxation systems, so as the EV can be able to compete with these micro-cars. That's the main thing there and furthermore, we need to make sure there is more regulation that prolongs for a longer period. Actually the electric vehicles are free of taxation but that is only until 2015 and this is a very short term when you talk business and manufacturing. They already have placed orders on their cars for 2016. We need a longer regulation so we know what the boundaries are so the investors know what future they are looking into.

Brodie: With Norway being world leader in the uptake, what would you say is the major difference between Norway's success and Denmark's lack thereof?

Lise: They have a technical taxation where the cars are taxed after how much they pollute and emit, and furthermore they don't have any VAT. You have to pay VAT in Denmark, they don't have that in Norway and they have a technical taxation. In Denmark the tax is based on the value, not how much they pollute. Further, they have a long list of incentives. They have all this water power and so on. They have this payment system around Oslo where you have to pay to get into and out again yet electric vehicles don't have to pay this. We have had some surveys from Norway and 72%... why are they buying? More than 72% of all buyers' reasons were financial like the taxation, the VAT, the free parking, going through these tolls etc. So 72% of all the main drivers were financial. So it is because it's a good business economically in Norway.

Brodie: Well we have no further questions, but on a personal level do you own an Electric Vehicle yourself?

Lise: Yes I do actually. What made me purchase were a few things. One was actually that I work at clever, so I kind of like the idea of electric vehicles. However, it was mainly financial and it was something about safety actually because I drive 60 km each day and for me it made economic sense. I can go very cheap. I have a Peugeot 107 and a Nissan leaf. It cost me all the same amount. It's so cheap to drive. I have a bigger fancy car with equipment and also a safer car so that was one of the things. So, it's more for driving pleasure and very stress free to go driving. It is stress free and smooth driving.

Brodie: Well thank you for your time we really appreciate it. This will be helpful for our project.

B. Copenhagen Electric

Vin: So to start off we wanted to know what your title and position in Copenhagen Electric is?

Kare Albrechtsen: My title is head of the EV secretariat head of Copenhagen electric which is the unit under the capitol region of Denmark to make EV project here in the region

Larry: So you focus specifically on EV's?

Kare: yes, focus on EV's but we also look into other electric transportation and other related to transportation but mainly focus on EV's

Vin: So what are the main goals of Copenhagen Electric and what methods do you use to obtain these goals?

Kare: the main objective is to make EV projects that can attract most investments and projects to Copenhagen and of course get some cars out and running by finding potentials both among the municipalities among the companies and among the private consumers. So we have projects in this respect towards them. Which I can describe

Vin: So then to start about the actual industry, what would you say the major barriers preventing consumers from really digging deep into the EV industry?

Kare: Well I think that's a very big and interesting question, we have to separate different boxes so to say to understand it in my mind and of course you can see for example Norway where I was yesterday they sell EV's like crazy they told me. Now 20% new car sales are EV's. It's a lot. There are various reasons for this but we can come back to that. For start with the Danish case if we look at the split in different groups we have the municipalities and public entities, we have the companies and we have private consumers. Private consumers I often tend to split in my mind into households with one car and households with 2 cars. IF we look at the municipalities first and also the regions itself I would say this is where the Danish itself rules and regulations and framework setup is the place where we have a lot of focus because it is where we are the closest to have a breakthrough because the current economic framework in Denmark is so that an EV if you compare to a similar car and you compare over a total cost of ownership the period where you have it then it could more or less balance the economy depending on how much you drive, it can be even a plus in some cases and in some cases could be a minus, but that depends of course you would have to consider the limits of the distance. There's no limit the way that you can charge and with a gasoline car you have to charge but of course it takes a longer time and the availability is a bit different so in practice what happens is those that buy the car nowadays are those that don't drive very far and I take tesla out of the equation, I put that in later, because it is a complete different case. So for example the municipalities will very rarely buy a tesla, maybe one for the mayor or something like that, but otherwise no. so it is the smaller cars that we are talking about and in that case they would find actually a good case both for business and environment they have some challenges finding out where, which ones to change at time and what is the right model because they are not used to that many around but they are quite satisfied with those that are they have a lot of cars that are not going far anyways so charging issue is not a problem it is more of an advantage because you are charge at home and you do not have to agree on who has to charge or fill the gasoline tank so we have a lot of focus on that we have a travel team going around visiting the municipalities in the regions here (29 municipalities in the region) looking into the fleets making some plans for what to change. So of course if it was cheaper even more cars could be changed, if the range was even better, even more cars could be changed as it is now already quite a lot could be changed

with zero business case or in this case with a plus and better comfort for the person and better for the environment so there we have a very good case actually already. And it could be even better with some changes. And then moving to the companies which will be our next or that we are starting up very much to have focus on that. They are having many, especially the bigger companies with fleets we have a similar case here. They again might take a taxi, also that is another case they might take a Tesla for the leaders or something like that, but for most cars they would buy would be smaller and the better cars that have been a bit reluctant because of the start, I know the BMW is coming in also and of course the Nissan also but they need a certain standard usually they have quite big potential there is a very big potential there. A lot of them are reluctant because of issue of how long time to wait, what is the right time to go in. they do not have the political agenda usually some of them do. Usually they do not have as much focus on the political agenda as the municipality has and they are bit more focused on how much hassle will it take and so a lot of them are kind of positive about it, but lets wait a little lets see what happens to the price or the situation but there is a big potential there already with the current framework as long as they keep safe about it. They are a bit unsafe about the sales price, would there come another model next year. There are some uncertainty things that I don't think are an issue but actually a psychological issue so that focus area will be very important also because if you have a fleet with 20 cars or something it is quite easy to change some of them cause the day you want to go far you just take another car. They are nice to drive especially the short ranges. Ok so that was generally about the companies we can go into detail also because of the framework consists of a lot of things including the economically different incentives etc. but I can come back to that talking about the Norwegian case shortly because it is very important. Ok then we have the private consumers. And I split them into 2 groups here the one with 1 car and the one with 2 cars. If we look at the one with 1 car, most of them, of course it is possible to own and EV especially if it is a tesla, but for most people consider it to be difficult, of course it can be possible to have some agreement that if they want to go very far they can rent another car, but in the mind of most people that's a conflict and of course it's possible. Also if you have a car sharing agreement. Another thing: if it's a Telsa, most people find it sufficient, but that depends on the month and the economy ok so the ones that

are mostly relevant in our focus right now are the households with 2 cars. Because for most of them the one car will be a commuting car which will be in most cases all of the normal EVs will be perfect for that purpose now the prices come into the picture of being very important because even though experiences show that if you have 2 cars and one of them is an EV, the EV will be the one most used because most trips are anyways short trips and most people prefer to drive the EV for that type of trip but anyway that would be considered pricewise to consider the cheaper car because it will mostly be used for commuting. Here we have a dilemma at least in the mind again because you have an expensive car being the one used for the long trip used for the trip to France or whatever, then you have a cheaper commuting car even though you are not going to use it as much, then it is going to be compared with the very cheap cars on the market and in Denmark the very cheap cars are very cheap so even though they are more expensive to drive or whatever, we have economics as the main concern or whatever so the issue here is that the micro cars are simply too cheap. They are also so cheap that they give problems to the state budgets, but that is another issue. So that's basically the situation in Denmark and if you have the money it is actually the best choice, but many people are a bit reluctant also because they don't know when they haven't tried likely isn't that strange so of course there are some information barriers. Ok so now we walk into a parallel universe. We go to Norway because it is a fantastic case to see what happens if we now adjust a few parameters here. Because the Norwegians they look and say well we look and say well we thought it was going to be Denmark who should take the lead here and not Norway with shorter distances and a warmer climate. Less mountainous and we are a more dense country. Why have we now, they are very proud when they say so, taken the lead. They have done so for different number of reasons which were actually made before the EV became a success, what actually made the success was the models and the price had been adjusted then the framework suddenly came into action and there are 2 main categories. One is the economic category one is the other incentives which differ from Denmark. In Norway when you buy the car you have reduced taxes which is similar in Denmark so that one is taken away, but Norway they do not pay the VIT for the cars which is a quite big difference because the VIT is 25% and the second economic difference for Norway is that the way taxation works is that micro cars are bit more expensive

in Norway so if you then put the micro cars up and take away the VIT you actually, even when you buy them, its quite close to have a similar price so economically people think they I have to consider them. Then people look at the incentives because they look at the barriers of distance etc. but then they look into incentives and they have in Oslo free parking for EV's, which they actually had in Copenhagen, but they had some issues with relations where it will probably come back, but they have to have it working. They have this congestion tax ring where you have to pay to get through but it is free for EV's and you generally don't pay for toll roads for EV's and you can drive in the bus lanes which in Norway is a quite big advantage because they have public transportation lanes where EV's can go there which if you have quite a long distance for commuting in the car into the city it is a big advantage. People especially commuters look at themselves and say I'm stupid if I do not look at these cars so that makes the uncertainties, the range issues less important so that is why they can sell 20% EV's.

Vin: so with the exemption of the vehicle registration tax on EV's in Denmark, we thought that after reading that we thought that would change the market for consumers but it seems like you said they have to pay the VAT so how much does it really affect anything?

Kare: The funny or sad thing is that consumer tax on cars the EV still by paying the vat and being a more expensive car pays more to the state than the small cars do because of the tax plus VAT so some people are saying we support the EV's but I'm saying hey they pay more than the cars you are comparing them to so how can you say that you are actually supporting them. It makes no sense to me.

Vin: Say someone is looking to buy a more expensive car like an Audi or a BMW they are not even going to be thinking about the normal EV's on the market, is that why?

Kare: This is where we consider the tesla. The tesla is a bit different case because the tax reductions are important along with the VAT is important, but still if you buy a high end car I wouldn't blink for a second to buy a tesla because why not so you have a different patter there.

Vin: so it is really about lining them up against the micro cars?

Kare: yes. It is the normal ones lining up against the micro cars which for most consumers consider car 2 that is the issue and then they lose because of the economic incentives and you can say there are basically no economic incentives.

Larry: What is the biggest reason why Norway is successful, is it the price comparison between EV's and micro cars? Is it more psychological than that?

Kare: the price difference is what makes them able to do it, the other incentives is what makes them want to do it so I think without the economic balance, it will not seriously break through, but you still need other incentives. Then we have tradeoffs because if the economy was completely the same as the small cars, then they would go in saying I have this range issue but that will depend on the battery. People are very irrational when talking about that. There is a lot of psychology reasons that are too much for the first movers. In Norway they have left that stage it is not first mover issue anymore. Normal people are considering it. We would sell a lot more EV's in Denmark if people just psychologically gone to that line.

Larry: So is that the biggest barrier to overcome to leave this initial stage in Denmark? The psychological aspect? Or is it price?

Kare: it is difficult to say what the most important thing is because they lift each other. The price issue is the main one but we could already get somewhere with the information and if the price was changed the information would be even more affectful and the incentives would be better. These things strengthen each other all the time. The price issue. The alliance of EV cars in Denmark are suggesting a tax reform where small cars would be a bit more expensive and EV's stay the same so environmental benefits would be the same but the small cars would be more expensive so hopefully development of the cars would be a bit cheaper, then we are very close to get there.

Vin: what about the aesthetics of the vehicle. If you look at everything on the market, like Tesla, and the new Renault models look like everyday cars. All of the others look, in my opinion ugly. Does this affect consumers? Because in America it would make my status drop if I was driving around in an ugly EV. How does this affect the Danish consumer's viewpoints?

Kare: I believe it affects them a lot. I cannot say what it does, I can say that aesthetics of which car you are buying are very important because status and symbols mean a lot to people. I think that is also why you can see the many different models in the car market because of symbolics and they attract different kinds of people. It is an issue in the EV market and it is a barrier in the way that if you have a very limited amount of cars on the market. It also limits the ones on the market. Some people like to see that it is a special car and some people would hate it. Depends on who you are talking to.

Vin: Even with BWM and the i3. I expected them to come out with a new, sleek model, but it looks like an EV in my opinion.

Kare: They did that on purpose because they believe that they want to have that kind of symbol and that it attracts some kinds of people. Some people would say no way. I think that the main point is that we do not have an egg problem here. The more they sell the more different models will come and those will attract someone else. In that way it is nice because we have like luxury cars and we have some cars like Renault that look like a normal car, also the looks like a normal car. We have the special ones that are new... and the Nissan leaf and the BMW even though they are less. Then again it depends and I would easily drive one say some that symbolize EV's and I wouldn't mind that, but that is my style. Some people would not have it like that. On the other had if you look at the very first simple models you would say that it is too much.

Vin: Would you say that there is a general age of consumers that really focus on EV's and are more likely to purchase EV's or is it scattered?

Kare: I have not actually seen any statistics on that so a gut feeling is would be that if you look into the high end cars it is people that are not too old and not too young but also have the budget basically who would consider it. The cheaper models I believe it is young middle aged people who are usually better educated who are taking this into consideration. That is my gut feeling but I have not seen any statistics on it. You can ask some of those who sell the cars they would probably have the statistics on that. If not, they would at least have a very clear gut

feeling on it. The BMW is for wealthy family with 2 cars, this would be an excellent 2nd car. So it depends.

Vin: In terms of the infrastructure like charging stations and availability. How much interoperability is there regarding charging because there is little standardization between models? Like 1 charger fitting every EV. Do you think this is a problem or no?

Kare: it is an issue but I do not consider it a problem because there have been some different versions but now the EU is coming into terms so probably in the future we will more or less have a combo and working in many places for a long time so the used might end up taking over. This is a very important issue for the psychological issue and in the discussion about this but I think in practice for the current model it is not very important. It becomes more important with tesla for example because with tesla you would like to go far and you would like to have a fast charge on the highway because that is what you would like to do sometimes with a tesla, but with most of the other cars it would still be used as commuter cars and it makes such a psychological problem to people. We have one for the office that we are driving and for the beginning it means very much because we are worried about driving, but when you know the car and you are using it as a commuting car then you hardly ever charge anywhere other than your home or workplace. So it is not really an issue but coming with the new models it will be important and the psychological issues will be important. About interoperability there are 2 main companies. Eon and clever that have public infrastructure. Of course you can say that it is a bit annoying that you need a card for both but it is free to have one for both so if you have the free one, you pay a bit more when you charge but if you have it for safety, why not have both. So psychologically yes, and there are issues to be developed and optimized.

Vin: maybe like adaptors or something?

Kare: Yes in some cases you can have something with you. I believe that the future you will have different technical standards available at the charging points so it should not be an issue and the future that could be the standard.

Vin: If you could focus on one thing to change in order to see a more developed industry in Denmark, what would your focus be?

Kare: The first focus would be the economy flow and make it work better making it more attractive to people. That would be the first one. Then for example, the parking, it would not be important in Jutland, but in the capitol, Copenhagen, it would be very important, to have a rule for easy and free parking and then information activities to break the level because then, if these kind of basic things are just running and no real issue to discuss then it would be very good communication platform that would attract a lot of people, it already attracts a lot of people and many people are interested but you still have some barriers and of course if the price, the companies were selling them cheaper, it would help very much.

Larry: One question I have going back to infrastructure, we've been talking about battery swapping stations, specifically Better Place, I just wanted to know your thoughts on the swapping stations because we know Tesla has been investing in it.

Vin: Renault made the Fluence ZE which was compatible with Better Place, but now Better Place is no longer around.

Larry: like you said, you do not see infrastructure to be that big of an issue, I just wanted to know your thoughts on the technology moving forward.

Kare: Better place had a different concept, and I am talking about the concepts we have now because what better place did was to try to sell it as a car number 1 going into the same market as Tesla is now going in like not that high in price but still the Fluence is still much cheaper than the tesla but still possible to drive far because of the batter swap stations so in that way you can say that in theory it is a very good concept and if they had success in getting the producers more generally, not only 1 model that is like a sedan model that is not really selling in Denmark so that's like it's difficult to post a model that is difficult to sell in many ways and a technology that is new to people and they did not succeed and I think that you can make speculations that if they gone together and tried it I think that technology could have survived but it didn't so it is not really something we are considering and I think the fast charging

technology has improved very much, the cars can fast charge so I think that the fast charging will be the maker. If for example tesla, but I am hearing more that they are focusing on the fast charging, but if they offer that special someplace I would not say it is impossible they could do it if they want.

Vin: All of their Model S can swap out the batteries and they have a system to swap all of them out. They said it would be too expensive to start building these stations everywhere, compared to the supercharges. They said they did the research. Every vehicle is compatible which I was shocked.

Kare: I basically doubt that the batter swap technology will be a general thing. I could imagine some places where you could choose to do it for specific reasons in some areas or some cities or taxis or whatever where it would be suitable and have sufficient amount of cars specifically that model in the area, but when I imagine a large network of swapping stations like what better place did I do not see that coming at all.

Vin: Personally do you have a vehicle and what kind do you drive?

Kare: here at Copenhagen electric, I am driving a Renault zoe it works very fine and we use them as my main car. Privately next time I am definitely going to have one. I just have not had the money I just moved here so purely economically issue that I do not have enough money. Otherwise I would definitely have one.

Larry: do you have anyone else to contact?

Kare: Danish EV alliance, for owners, we have made some case studies that are in Danish that could be translated. For political framework there is the Danish energy agency, which is quite active. Mainly refer to the alliance. Specific issues we can find case studies.

C. Danish Eco-Council

Jeppe: Within the transport sector we work on all levels that is that we work on concrete projects putting EVs on the market. Part of a project where we have 8 electric vehicles "Lets Go

Car sharing scheme” also project manager of another project where we have established gas stations for CNG, compressed natural gas with perspective using biomethane for heavy trucks so it supplies fuel for trucks of the municipality so that it will eventually be run on biomethane. So that’s one of the very concrete things we are doing. Also involved in the behavioral campaign project where we are trying to mess with people’s heads regarding what they usually do with transport. So ok you have a car and you want more time in your life but actually you work five or six more hours in a week to keep your car running because its expensive in Denmark so if you didn’t have a car you could work six hours less a week and spend more time with your children or.... So that’s the kind of thing we also do. We have these very concrete projects to try and promote sustainable projects in practice. We also come with work together with trade unions mostly to promote sustainable transport within a natural framework. At the moment were mostly focused with the taxation of cars because it is expected that there will be a change but in the current scheme it hasn’t come, and actually we had a meeting with the minister yesterday, I don’t know what came out of it cuz my boss went instead of me but we also have been trying to change the framework conditions for sustainable transport in Denmark, EVs, and gas for heavy trucks because for passenger cars EVs is the solution, battery EVs, but for heavy trucks we have to think a little longer, some buses can be run on electricity if there is enough charging space, we have these tests also in Copenhagen where we have these small electric buses but also we have 6 large scale buses which I haven’t seen yet so but overall for longer trucks its not a real solution because the batteries would be too heavy and too expensive, so for them we say biomethane because we have large biomethane production in Denmark mostly because of all of the pigs we have, we have 6 times more pigs than humans in Denmark. They produce a lot of manure and a lot of is used for biomethane purposes but also increasing the production also with sewage and other rationalities from other methods of using biomethane. So we work on the frame work conditions for sustainable transport towards policy in Denmark and then we also work on the European level lobbying for the European framework and the European priorities both regarding biofuels and electrification so a fuel quality director and an alternative infrastructure director which were finish four days ago and its co2 emissions for passenger cars and large duty vehicles which have been done for the last 2 and a half years.

So we work on lots of all levels, both very concrete and some more abstract. We hold conferences for example EVs and how to promote EVs in households... which will be held in the future, it's in September. So yeah we do basically everything. We play the full part of the role.

Brodie: when you mention evs are you including hybrids in that or do you separate them?

Jeppé: I see hybrids as a crossover solution towards full EVs for the future as hybrids is becoming... they come in so many different shapes and sizes so its most cars will be hybrids in some way no matter how we define it because of things like start-stop technology and regeneration of the brake energy. Its becoming more and more because its becoming so cheap to do, these quick fixes that the industry uses to comply with legislation on the CO2 emissions which is the main driver for efficiency in passenger cars. Where we have the 95 grams target for 2021 and 130 gram target for 2015. And a stupid target for large duty vehicles.

Vin: so you said you do a lot of work for evs in general and is lobbying the main method to ahh do, or what is the main method?

Jeppé: yes we do everything. We're buying cars and putting in the car sharing fleets to test how consumers take it in and we try to promote it and ask questions to the minister and come with proposals for new taxation systems which propose evs long term solutions, not just that they are accepted taxes for 2015, yeah um we promote evs in every way almost except that we don't promote specific companies and we don't sell the cars but otherwise we work on yeah most areas to actually try and support evs.

Vin: with that's there's a couple of different barriers that are preventing the consumers from really purchasing the electric vehicles without even thinking about it. What would you consider to be the main priority that needs to be focused on to see the electric vehicle industry develop fastest, like to see the most change?

Jeppé: RELATIVE PRICE. Because ehhh about 60 percent of car sales in Denmark at the moment are microcars which are old to an extreme extent in Denmark compared to any other country in the world almost and these cars are mostly sold because of our current tax system which is highly beneficial for these microcars, they have actually become too cheap compared to other

cars which is one of the problems of the sales of EVs. Even with the tax exemption the price of each ICE cars are just so damn low and its been the cheapest car you can buy in Denmark in like 50 years or something.

Brodie: do you mean the smart cars, like the small ones that have only two seats?

Jeppe: different ones then smart but yeah the really cheap ones, the ones around 10,000 euros. Normally we would say you would pay 180 percent tax but on these microcars its more like 20. So ehh that's the huge difference, that's one of the main problems, that the current price between the EVs without the taxes and the really small cars because if the small cars were somehow cheaper and they had a taxation that were more equal to the rest of the car market it would be a lot easier to sell EVs. And we would look to Norway where they actually sell EVs all over, and there's a lot of other benefits to driving EVs there which also plays a big differences. Some of it is just economic and some of it is a lot of psychology about it also....like free parking space. It will come in Denmark very soon but they have agreed on it three years ago yet it still hasn't been implemented. so its but that will play a difference for people when they know they can just drop their car without paying a parking fee so these other things can also play a big role but in the end the difference of the price between the ICE and the e car is very important because I think there's actually a lot of people interested in buying EVs in Denmark, they just need to be a little cheaper than ICEs. And they can be, and they should be. It doesn't cost so much if you have the full scale production, for example, it can compete on the market with the tax exemption but it cant because they sell the ICE cheap because they think they can. It has nothing to do with the actual production cost, and they know it. And yeah that's another part of the main problem they um, the OEMs don't really want to sell EVs and that's of course a more structural problem. Ehhh they don't have a good business case for selling EVs ehh and that's why I think its positive when they try to also sell the fuel because the electricity. I know BMW will also do it but it's a way of trying to, if they can find some type of business case and get a decent payoff so it will help the market because at the moment it will only be based on who actually wants to sell cars. Tesla tries to sell a lot (of EVs), the rest of them are jut making them because they feel like the have to do it and then the don't really want to ell them so they put

them on a very small specific market for example this car sharing scheme. There will be a lot of BMW i3s here in Copenhagen and then they are all there so then they don't have to sell them and then it doesn't pollute the rest of their market and they try to limit the damages towards their sales on their ICE cars. Ehhh so that's a more overall problem for evs on a more global scale and well of course a person like me hopes that tesla will do success in the field , well the have to do something at least also I really hope that they find a business case. The main problem is seems like you know about this but the repair costs are 60 percent lower on evs and since they only earn about 10 percent of the money from actually selling the car and 90 percent is on the aftermarket its means that they just lose a lot of money selling evs. And that's a problem with ehh yeah with the economic model for it. So that's a more structural thing but that's also why they tried to yeah basically just don't want to sell electric vehicles. They all produce some hydrogen cars and some hybrids and evs so that yeah and even with the super credit scheme with which is within the co2 emission which gave a lot of benefits of producing evs its makes a difference because they just don't really want to do it.

Brodie: I wouldn't if I was them either.

Jeppe: yeah but if I was there I would say ok, which situation are we in? were in a situation in which we have to put first our fuels. We cant produce enough biofuels in a decent way to get cars running so which way are we going? Were going towards energy efficiency and electrification is three time as efficient as an ICE so I would go in full scale saying this is the long term solution and I will have the best know how and I would take my best and go in that direction. I think they're just thinking too short term. Tesla could do a new factory and ehh also infrastructure of battery swapping coming in again like the better place in Denmark which also had battery swapping , battery swapping is back on the agenda for tesla which does solve a lot of problems. The problem is tesla is a little like apple in which they have standards in which you can charge the cars on any charger but you cant use their charger for any car because of the length and depth of the plug. So they make things so that they almost comply with the standards but like apple in Europe they want to control the whole chain which is not beneficial for the consumer environment. (android fan) no I also sit on the Danish consumer complaint

board and like apple are some of the worst bastards that don't want to comply with Danish laws and just put all the problems on the retailers so I don't think I could ever buy an apple product the way they behave towards consumers in practice. Yeah don't me get started.

Vin: so with Denmark's ambitious goals for carbon neutrality how important would you say evs are compared to other means of renewable electricity eliminating fossil fuels. On the agenda, where would the implementation of evs fall? Is it at the top or Is it kind of being put on the back burner right now?

Jeppe: ok so you are asking me about what people think or about what I think?

Vin: what you think.

Jeppe: I think that its one of the most important things because the other thing are easy. This is not easy. The transport sector is the main problem for decarbonization of the economy and nobody really wants to touch it because they don't want to mess with peoples vehicles. So they jus done dare. And that's also why they are hesitating changing the regulations. Although most people agree with what needs to be done with the car industry, they don't really dare open the front for the position...in parliament yeah but the transport sector is the main problem like it is in most countries regarding decarbonization. Of course if we want more renewable we can just do it. We have the plans that we can just double the windmills, solar panels, etc. we can increase the biomethane production if we want to its jut pushing a button. The problem is mainly the transport. But it can easily be done. The transformation of the transport sector is more difficult. So that's why I personally think its one of the most important things. Of course passenger cars is the main part of the situation and that's why they are very important.

Vin: and then now in terms of the general public: would you say they're on board with evs for carbon neutrality or is it not being really put into their mind by the government much?

Jeppe: most of all people just want a car but ehh I think there are a lot of people who would like to have an EV because if it was a little cheaper than buying just a microcar I think that people would want it because most people just go back and forth between work anyway and occasionally Jutland to visit their aunt and if it was quite cheap they could easily use it. Mot

people who have tried electric vehicles are actually really fond of it, they don't go back to a more noisy ICE car, and yeah I think if the framework conditions were different and when we have the free parking and more taxation on the small cars maybe even a little less taxation on the EVs, because we still have the VAT which is the tax on EVs. So then of course if we just took the approach and changed the framework of the car sales then we could sell sell sell sell. Most people are like ummm we don't want to spend 25 more euro than we have to so we think to save money. Ok if we want to sell cars we do this and this is not enough so we do more, and then make the sale. Its just a different approach and you could do it if you want to but apparently politicians are just satisfied with saying well we have the tax exemption so at least we are doing something. They don't actually try to drive it to be a success so that's what we mostly criticize, shift in government. They have all the right intentions, parliament wants evs but they just wont make it happen.

Larry: do you think that the general consumer would be different in Copenhagen compared to the rest of the country, like outside of the city?

Jeppe: I don't know for sure but I'm quite sure it would. Because I'm consuming the other parameters are quite different. Of course your need for cars is also different because if you live in Jutland you probably drive longer than if you live in Copenhagen. Because you basically don't need a car in Copenhagen so it will be different need for transportation. And of course the attitude towards environment and modern things are also different in Copenhagen than other places. So its yeah it would surprise me a lot if there wasn't a big difference in the perception. But it's not yeah we don't have a survey saying it.

Vin: so personally you talked about how there's incentives coming forth for three years now for the free parking, and the increase of charging stations....

Jeppe: I don't think that (charging stations) are really important. It has been made important for too many years, of course we have made some station at the big H as we call it (the main central highways in Denmark) but infrastructure is not the main problem. Because when you look at how people actually transport themselves you see most people just take themselves to work shop and then go back home and the drive only about 20 km a day and so for normal use

it doesn't really make a difference. Of course its more of a safety thing and a psychological safety measure for people but there has been invested a lot of money and there will be invested a lot more in 2014 so it will be there but I don't think its one of the most important things. A lot of Danish families also have two cars and there's no reason whatsoever that one of them shouldn't be an EV.

Vin: so hand in hand, charging stations, infrastructure, or range of the vehicles don't have to be as long as tesla's then?

Jeppe: no no no no

I think that 2 and a half year ago the energy agency made a report that said 95 percent of all trips overall in Copenhagen could be made with an ev. So its 95 percent of ALL trips because people just they don't go very far, very often.

Vin: that's so different than in America.

Jeppe: yeah I know.

Vin: because we would need a lot more infrastructure in the U.S. because people are driving much further and if I knew I could only charge at my house I couldn't go to a lot of different places that I would normally go to.

Jeppe: because we are a small country and our travel distance is just smaller and it's almost 100km is a long way in Denmark. Also because we are an island kingdom in Denmark so yeah it's an island so you can't go that far unless it's a bridge.

Vin: so what has been the most um effective incentive that have been put forth, or if there are incentives that haven't been put forth hat should be done, if you have any ideas?

Jeppe: of course the tax incentive isn't making a difference but it is a big things. We haven't sold a lot of cars because of it, however, without it no cars would be sold. So that of course and along with the free parking will make a big differences in peoples minds I think. And then the relative price difference to microcars. That is what's on top of my head at the moment, you

know the most important things. What you could also do is exempt them from paying fees when crossing the bridges in Denmark for example, ehh yeah that would be quite cheap because people use it very often. I think it's about messing with and getting into peoples heads and get something out of it. Even though its not a lot its ahh yeah, normal psychology thing, it does really make a big difference. So there's a lot of smaller things you could also do but also be more cosmetic. I'm mostly focused on the more hard ones, money, and ahh yeah, money.

Vin: so with tesla's success their model s is pretty expensive compared to most cars on the market, so do you think that's gonna really prevent more people, like if they had a cheaper model do you think that that would really.....

Jeppe: I think that most people in Denmark dream of a more cheap tesla car, a more family-price friendly car....

Vin: yeah cause they have the model x coming out which is going to be even more expensive

Jeppe: but the most important things to think about Tesla in Denmark are that the number of cars is a mostly symbolic effect is what is cool and unique, what is it that everyone wants. We started having these small evs and there wasn't totally , wasn't really well thought through in a country like Denmark. The heating cooling system was placed a little stupid so when you get cold you use too much energy for heating and then the car is quite small. So to have a good ehhs symbolic thing for promoting evs in Denmark. But that's the most important thing about tesla in Denmark because they still are a little too expensive

Vin: but they're great cars!

So in terms of electric vehicle questions that's pretty much it, we just wanted to know if you have any contacts that would be of interest to us, because were looking to talk to almost anyone that wants to talk to us.

Jeppe: its very simple, of course the car promoters don't work to promote evs however there is trade unions , Danish ev alliance, ehh and they are the ev business in Denmark, so they are quite important. We also have two large ev service providers promoting evs and its mainly

them doing the promoting. They are Clever and EON. Eon, you know eon, the energy company, E.on, its worlds largest privately owned energy organization. They bought out better place when they went bankrupt. So they have all there charging spots, so these are the main players in the market. So the Danish ev industry and the two service providers I would say are the most important.

Vin: well thank you so much it was really helpful.

Jeppe: how did you end up calling me?

Vin: martin said you'd be a good person to contact so we went ahead with that.

Jeppe: martin? Ok yeah because I don't talk a lot to martin, I didn't think he knew a lot about what I was working with. Probably Claus told him, because we are not many working on this business, yeah it's basically me and my boss.

Jackie: this was very helpful, it was our first interview that we conducted and it's nice to see our research actually be mentioned.

Jeppe: yes I see that you really have a grip on it already.

Vin: at least we think we do.

Jackie: when we were home in America, we just looked around online at anything we could find so thank you, it was nice to hear it in person.

Jeppe: yeah the problem is of course that better place was very good at promoting EVs, but it was also a little too flashy, it was a little too smart, and all the people working there wore Rolexes, so its really it was a little too much.

Vin: it seemed like there was a lot of talk, and then not a lot of action.

Jeppe: they I think their thinking, a lot along the way was very good, and it wasn't the Danish branch who actually went bankrupt, it was the Israeli part that took the Danish part with their fall. Think they wanted things to happen quicker and then they didn't have the financial

capacity of holding out long enough to see it through. I think they could make a difference, I think battery swapping could have a future in a country like Denmark because you only need 12 swapping stations to cover all Denmark.

Vin: and then the other car companies besides Renault didn't want to be a part of it.

Jeppe: I think it was a good thing it's just didn't work but because they don't really want to sell EVs so why invest in standardization so I'm not sure if they are finished. So they just wanted to wait and see if it would take off. Of course it went into a thing about technology. Like you can't just start selling a car like fluence in Denmark, it's just not a normal Danish car. In the Danish eyes it's a company car. Which was the battery swapping car. And so there was a more Danish family car, but it wasn't battery swapping so there's a disagreement between different partners. So in the future there might be a chance.

Jackie: thank you very much

D. Danish Electric Vehicle Alliance

Magnus: um we work with European Policy and Planning and electric cars in Denmark. So you could say that I am an electric car lobbyist. We employ the utility companies having an interest in of course electric cars being promoted in Denmark, because then they will get more customers um we organize the entire industry side of the electric cars in Denmark. So we have like the operators of charging infrastructure, we have the OEMs, the ones actually selling the electrical cars in Denmark, um we have the OEMs from Denmark producing bits and pieces for the larger electric car industry, um we have some relations with the Danish post agency, they have a large fleet of electric cars in use, I guess its 50 or 60, so I guess it's not..... they deliver packages. So we try to, um we have, um we actually have large utilities and we also have Copenhagen Electric as our member. But we do sort of the same thing from different perspectives. As you might know in Denmark we haven't really been able to sell as many electric cars as we once hoped. Umm and also our organization is not that big, we have um now

besides myself we have a director and we have a columnist employed full time. We're not bigger than that. And that's well my perspective just toyeah

Jackie: boilerplate

Jackie: so the first few questions, you gave a god description on if there's anything else you wanted to add, first were looking for your job description at the DEVA.

Magnus: I used to do an internship and then they employed me part time it's called a Danish Student Assistant but since we are so few people I've just been doing every this and that odd job that needs doing. I'm fairly good with statistics and good with working with numbers so I've done some statistical research for the electric vehicle alliance with well computers and internet, because I am at least better than the others. Which I do news and I do we have this weekly news bulletin we send out to our members that I do, um I've been working with trying to set up a database for public charging infrastructure in Denmark for the public in order for app developers and GPS companies and stuff like that to have a complete database over charging infrastructure rather than just having the charging points from this or the other provider. There are mainly two large providers in Denmark at the moment. And then I've been servicing my our we call it our industry chief, our director, she works with the eurelectric which is the European association for power utility companies in Brussels. She worked with their task force for electric vehicles. So I am trying to service her, helping her working that task force as well. So I do, internet, that, and statistics, and I do odd jobs.

Jackie: What would you say is the overall purpose and mission for the DEVA?

Magnus: Well, as I said were a political interest group for people wanting to purchase and electric vehicle in Denmark. So our main purpose is not to sell electric cars but to make electric cars easier to sell. Providing infrastructure presentation on a policy level trying to make a political environment for the electric car that is tax exemptions, other political incentives, and then of course by providing a media and communication outlet so that whenever a journalist or someone like you wants to investigate electric cars, we try to provide as objectively but of course still biased information to them. And also to correct stereotypes like if some say

anything about electric cars in the media that is imprecise. Such as “they won’t go anywhere” or “no one buys electric cars”. Just to know sort of we try to kill the myths that are around electric cars and of course also saying they are obviously not for everyone. If you go 25000km a year maybe you shouldn’t have an electric car. So we do some odd communications and political interest representation.

Brodie: I’m just wondering so the promotion of electric vehicles, does this, I know how you were saying you are working under the DEA is this so your trying to, what’s the purpose of your company? Is it to try to sell more electricity and you think cars as an outlet for the charging infrastructure....?

Magnus: Well we have no doubt that at some point in the near term future electric cars will be a viable alternative to ordinary gasoline powered cars. The reason the DEA back in 2009 established the EV alliance was to,... at some point, it will be established by someone and they preferred that it be in house rather than to have the industry establish itself or even worse to have the Danish Industry Association.. at some point our um, not counterpart, but we do have some conflict lines going against the Danish Industry Association on general energy policy issues. Rather than having the auto industry or the Danish Industry Association themselves put out an EV Alliance we wanted to preempt. But the DIA and our members there that have the Danish power utility companies they have a large stake in selling electric cars. It’s a new emerging market. If they can get as much of the transportation sector in their doors they can sell more electricity obviously. But then also there are these externalities by pushing electricity to cars which is that in Denmark we have a lot of wind power, and we will have more wind power in the future so that the grids with supply and demand it would be practical if a lot of electric cars were out there to charge during night time instead of other times. And to charge whenever there was cheap power in the system. Those are the two main options the main reasons selling more electricity and the supply and demand. But that’s UK in a couple of years. not now because there are too few. The DEA saw the same potential with heat pumps being installed in private homes provide some way of selling more electricity and balance the grids.

Jackie: As everyone's really noticing, the electric vehicle industry isn't having as big of an uptake as preferred I guess, what do you believe are the biggest barriers keeping the electric vehicle industry from developing?

Magnus: Well first of all we distinguish between different kinds of uptake. Our main concern right now is getting fleet owners to buy partial or full uptake of electric cars. Fleet owners are special cases in Denmark I think we have about 600,000 cars being owned by companies and company fleets. Company fleets typically have a known driving pattern, they know how long they're driving and what they're driving and when. And also because company car parks can often be, they're often flexible in that you can take the electric vehicle to go 80km or you can take the gasoline one in case you have to go further. And also there are certain classes for company and fleet owners. We kind of think that we want to address them firstly. And then as people get more accustomed to electric cars as the technology proceeds and develops, and then the infrastructure develops then eventually at some point more people will try to buy electric cars domestically. So we distinguish between two groups and when we talk barriers to uptake I think there are different barriers between the two groups. If we talk about fleet owners I would say the main barriers would be price, currently an electric car is more than twice as expensive as an ordinary car, at least in purchase. And then afterwards you know as they are cheaper to operate, at some point they might be just as expensive. But anyways price is the main issue for fleet owners. Then for fleet owners also there is the risk liability, you are responsible for a large amount say 20 cars, you are somewhat unwilling to take the risk of trying something else. So it is easier to do what you've always done. So that's really an issue. One of these issues is of course range anxiety. So price and range anxiety and risk aversion for fleet owners.

For private households, of course also price. Especially in private households studies of why and how people buy and choose their car, show that they are very keen on the upfront cost and don't really care about long-term operating expenses. This is also because if you don't finance your car, partly if you pay an 8% interest rate then it doesn't really matter if the car is 5% cheaper to own because it is actually the upfront cost that is the concern. And also of course

to many consumers its range anxiety and it's also just a very emotional issue to choose a car in Denmark. When you buy the car you have a large hurdle emotionally to get over for a private consumer to try something completely new. And then as a third or maybe fourth barrier there is the issue of maybe there is a steep learning curve. You have to address charging infrastructure plugs and they are not the same in Denmark, every outlet and stuff like that. So if you're used to having stuff like that in a car its somewhat difficult to learn what and how to use an electric car, for the main barriers. And then there are of course these methods where we try to take down such as um well an electric car is way more expensive, an electric car is just as polluting and stuff like that.

Jackie: On average what do you think is the opinion of the general Danish population concerning electric vehicles? Do you think they're very knowledgeable?

Magnus: Well its hard, we may see that as they are reflected in the public media. And that is mainly the opinion of the journalists writing about the electric vehicle. We spend a great deal of time focusing on the media perspective and how media treat electric vehicles. It's quite obvious that there are some journalists that have a positive stance and think they have a potential. And some media just trashing electric vehicles whenever they get the chance. Um I do believe that the public opinion is very much affected by the media coverage in that sense whenever I talk to you know, friends and family of course and I say I work with electric vehicles they always say "Oh How's that, it's not really good is it?" and then they always address the issue of range. They don't go as far as promised and they don't go far enough. SO I do believe that the main association the regular people have towards electric cars: "they don't go far enough."

But then of course there are also people talking about the prospects and cool sides of electric cars: the acceleration or driving pleasure, people talking about Tesla and that's a whole new thing. But that is people mainly who for some reason or another have a special interest in cars. They read the motor magazine. Just because you know, they like cars. So people who like cars they can see the potential, and then the ordinary people seem to have worries about range.

Jackie: do you believe that car dealerships, that sell both electric and non-electric models are necessarily trying to push the sales of their EVs?

Magnus: That was actually an issue when I started. That is just theoretical evidence but we leased a Nissan Leaf to the DEA and when the colleague went to pick up the keys at the local car dealership he asked one of the clerks there “ I’m supposed to get a Nissan Leaf, is it you I have to talk to?” and the clerk said “Fortunately it’s not, it’s my colleague over there.” As in “I don’t really want to deal with electric cars” and that is an issue we are concerned about, that car dealers are stuffing the electric ones away inside in order to sell their regular cars. That’s what they know and that’s where they earn the most on , because then they can sell service deals and stuff like that. So that was a large concern. Also, BMW they launched their I series, the I3 especially, and we went to test drive it. You know, for the fun of it. That has been really promoted centrally in their dealership. They have two BMWs and you can test drive and they have these robots and stuff around. It seems that at least BMW and maybe other car dealers are shifting towards promoting them. Hopefully. But anyways that definitely is an issue.

Brodie: I think it’s because they just have a better model compared to some of the others.

Magnus: Also, one fun anecdote with BMW in Denmark, we have as you know a rather high tax on a car purchase, based on car price. Not on electrical cars. The BMW, it comes with a range extender option which technically makes it a plug in hybrid electric vehicle but also can use gasoline every once in a while. Physically it’s just this small motor you pop into the existing car and it has a range extender so that is can go further on gasoline. That makes it not exempt from the tax. So we have an expensive car with a humongous tax on top of it. However, since it has been tested to go 166km on the first liter of gasoline because of the battery then there is a rule saying that especially for fuel efficient cars it can be exempted 4000 kroners per liter more than 16 km/ liter. If you’re over a certain efficiency. But as the BMW goes 166km it can exempt 4000 kroners 150 times which makes it exempted from all taxes. So actually BMW just recently found this they have to you know clear it with tax authorities and now they expect the sales of the BMW range extender edition to really boom. Because you have a nice BMW going on gasoline but is also an electric car without paying taxes. So that’s probably also one reason they try to

promote that model and also we were going to try to change the tax scheme in cars in Denmark to go away from a value based one and over to a technical based one. Co2 emissions or fuel consumption or weight or something. The BMW one we keep on pushing.

Jackie: do you think there are any fears in the general public as far as any safety precautions with electric vehicles vs what they know and what they are used to with gas and diesel cars?

Magnus: I haven't actually been confronted by anyone about fears. I guess in Denmark people are very, they feel safe knowing the government takes care, it has to do with the security. So whenever a car is approved by the administration or the authorities it is ok to buy. I don't know how much people really think about safety. There is the euro standard that provides stars for security but most every model has 5 stars. So it's not really....

Brodie: Well in the U.S. I know it's really buying preferences so like if you're a mother and you have young children you're looking at the safety ratings of the car and that could actually change someone's purchase based on how safe the car is.

Magnus: So actually the thing in Denmark right now, so what we call a microcar, that are certainly small cars that have three doors or sometimes 5, they are really cheap. And the reason is that they are so fuel efficient nowadays so they can also be exempt from the taxes from this fuel efficiency scheme and also that they are just really really small. People buy them. Those are, the ten most sold cars in Denmark for the last 2-3 years have been microcars. Microcars are not particularly safe but they're cheap. So everyone just buys them. That would imply that people are not as concerned with safety as they are with money.

Jackie: So what about aesthetics, you know the looks of the cars, some electric vehicle models are distinctly different than the average gas powered vehicle. Do you think that affects the way consumers look at EVs?

Magnus: That's a good question, I mean recently electric cars have started to become even more similar to gas powered cars. I mean recently in the 90s and even 80s there were these electric cars that were not as big as other ones, didn't go as far or as fast, we have a story about a Danish produced car. It had a glass cockpit all around you that opened up like this. And until

recently the electric car in Denmark has just been equal to that. It's something that you drive but isn't really a car. But then in the last couple of years cars have come with ordinary tires and ordinary body and stuff like that. SO I don't think today that people think of EVs as ugly or strange I think that some of the biased is that the electric car looks different. I would say most people probably don't think of it. I don't think anyone thinks that electric cars are ugly. That's not my general....

Brodie: Well if they're buying all those microcars then those looks weirder than a normal electric car would. I wouldn't buy those strictly on ...

Magnus: But you have to consider, the cheapest microcar in Denmark is until recently the Spark, and it goes for 65,000 kroners and then if you have to buy even a slightly larger car you have to pay almost twice as much.

Jackie: So as were talking about how sometimes the perception is segmented, do you see any other ways an EV owner is different, is it a certain age? Like what demographics?

Magnus: To be honest I don't really know. We haven't seen any reports or studies that systematically look into that. This study recently called test an electric vehicle took 1200 families and had them try out an EV for three months, they selected the families based on different demographics, just to you know, catch everyone. I don't know if electric vehicle owners in Denmark represent a certain demographic. I can assume that it would typically be people either wanting to save the planet or people being interested in the mechanics of an electric car, say engineers and stuff. At this point about 1500 electric cars in Denmark, but more than half are owned by companies or municipalities. So it's hard to talk about demographics.

Jackie: Do you think that electric vehicle owners own their EV as their primary car or secondary?

Magnus: We try to push the electric car to domestic owners as a good second car. A good car for commuting and for going round about every day. We tend to say that the areas in Denmark where people generally have two cars, are also the areas where we are more likely to see uptake of Evs of course. I don't know for sure but many Danes have started to have a regular

car for vacation and typically a microcar on the side. Especially if they are a couple and work different places. This sort of family it would be obvious to have a regular car when you have to go a distance and then a small EV because they're easier to maintain and they easier to operate. But that's I guess the ideal scenario. Because we don't try to think that everyone can make do with only an EV.

Jackie: Basically, in order to see a larger uptake and a more progressive electric vehicle industry in the near future, what do you think is the main course of action that should be taken from different perspectives?

Magnus: Well what we work a lot on these days is a reform of the Danish car tax, that would be our top priority. This is also because the reason people don't buy electric cars is that microcars have become so cheap. Also, the government agrees that the current administrations 4 year plan wishes to accomplish a larger reform of the tax. However they haven't been able to secure one because there has been some controversy.

We would like for the smaller cars to cost more. So would Danish auto dealerships and so would the car manufacturers importing or selling the cars to Denmark because you don't really make as much from selling a small car as you would a larger one. So that's the general impression that we would like the tax regime to change. That's one thing we would hope the government to do. Also of course the government should invest in informing people about the good and bad sides of having electric cars. Maybe even an objective level comparing EVs to GVs to Hybrid EVs to fuel cell vehicles and gas and diesel.

Brodie: The consumer council should do that.

Magnus: I would be amazed to see just one page where the consumer council would say "ok so you want to buy a new car, what should you think about?" So then have what are the operating expenses, what are the total costs of ownership over an 8-year period or a 5-year period. Stuff like that. Where can I find charging infrastructure? What would it cost to charge my car compared to a gas car. In the U.S. I think the energy authorities have like a webpage informing about the price of the E-gallon is the equivalent amount of energy in electricity that would take

you the same distance as a gallon of gasoline. Because that's really an argument. So the government should do taxes and information. And then of course schemes supporting infrastructure and schemes supporting residential areas uptake more charging stations. Small schemes that matter but are like peanuts.

While the industry is already doing a great but, and what has recently changed is that ever since Better Place and they went belly-up in May it was like oh the EV industry is doomed and no one is going to have an electric car in years and we really felt that. My boss Laerke she had so many calls from different journalist saying are you looking for a different job now? But then the electric car industry have recently been more and more assertive that in the future we will have electric cars. Volkswagon is launching new models, BMW. When you go to autoshows in Geneva or Frankfurt they have electric cars every and also energy suppliers and energy companies really really want electric cars to happen, and expect them to happen. So the entire industry has been more and more assertive and I also do think that being assertive reflects upon how consumers think about electric cars. When Better Place went belly-up, having bought an expensive as hell electric car that couldn't go anywhere, many Danish consumers are of course very risk avoiding and don't want to buy an electric car from a company that might go bankrupt within a year so we need to also reestablish and even more establish and develop the trust in electric cars having a future. And it seems the industry is really putting out to do so.

Brodie: Would you think, pushing as far as lobbying for policy change as far as standardization goes?

Magnus: There has actually recently been a director from the EU saying that from 2018 every plug is the same as far as regular charging goes. The problem is fast charging. We have 2 maybe 3 different standard. We have one recommended now that should be the standout in 2018 and then we have Tesla's supercharger. But I mean there will only be 1 or 2 in Denmark so that won't really matter to ordinary EV users. It would be nice of course if the government said we need one standard and we need it now. So we will support and incentivize of course the deployment of that standard and also change the old standard into the new one. That's probably

not going to happen. Also because right now we have 1500 cars on the old standard. We have 60 across Denmark on the old standard.

Brodie: Do you know how many chargers there are in total?

Magnus: I think there are about 1500 public and some private. But the number is growing. And then there is of course the issue of roaming because if you have a subscription to one operator there are Clever and E.On, if you are subscribed to E.On its hard to go to Clever and if you charge you have to buy a guest card and it has to come to you by mail. If you are a guest card holder you can go to E.On chargers and there's a telephone number you can call and say can you please open it up? And then they charge 80 or 100 kr to charge. So there are these market models. As you said standardization will happen but of course we would like it to happen sooner. And we would also like the government to support it but we don't expect them to do so.

Jackie: That's pretty much all we have, you said you don't own one yourself? Are there any other contacts or colleagues you may have either would be knowledgeable on the subject or happen to be an owner themselves?

Magnus: I don't personally know anyone who owns one. I know of some who participate in car sharing schemes but don't really use it. However there is something called Dank Elbil Committee. They are like a club of EV enthusiasts and also owners.

E. Danish Standardization Organization

Larry: Please state your name, title, and your organization:

Regnar: The organization is Danish Standards Foundation, Regnar Schultz and I'm the Senior Consultant in Standardization.

Larry: What is your organizations purpose and what methods do you use to achieve these goals?

Regnar: The organization is mainly doing standards that means we do we are appointed from the Danish Government to take care of all standards in Denmark. Meaning that we have the connection to all the international European standardization organizations. We are taking care of all standards that are adapted to Danish law in terms of complying to the European directives, I would say that's mainly the most important. Framing different areas to show for a company to show that they comply with the directives. We have supporting standards so it's easier rather than looking into the directives themselves and finding all these paragraphs do we fulfill them or don't we. Its easier for them to say well if we fulfill the standards we know we will fulfill the requirements of the directive.

Larry: Moving forward, and getting more specific, does our organization have any relations to electric vehicles?

Regnar: Ya we don't have electric vehicles ourselves but we do standards and actually I'm running a small department on, no not department, technical committee I should say where we invite different companies and authorities to participate to find out how its more or less standards on the infrastructure. We are not interest in the standard for the vehicle itself. A little bit about the battery management system and also the batteries. In terms of the motors and all the types of drives is not in our interest. So mainly infrastructure.

Larry: So did you have any ties with Better Place?

Regnar: Absolutely. Better Place was part of the technology committee and was actually one of the first movers when we set up the committee. They were together with Danish energy company dong, were the ones to contact us and see if we were interested in building up this technical committee. We were involved with that. I had good connections. I was invited when they opened they very first battery switch station so yes I have very good connections. They were very active also. I had contact with the Israeli office also because many of the comments to our drafts for standards actually came from Israel.

Larry: What would you identify to be the main reason why Better Place didn't work?

Regnar: As a matter of fact I think the way they worked was brilliant. I think the idea of having a battery switch station was brilliant. Firstly because you could then extend your distance, its of course quite easy to understand. The big problem today is of course the distance the car can drive is too short. So this idea was very good and because also they could charge the batteries using green energy. Meaning they could charge a lot of batteries using the wind turbines and so on. This idea was brilliant actually. So a pity they didn't have enough money to continue. And a pity actually also because we have put forward a proposal for a battery switch station how they should work and how should they operate as a whole. And they were of course the proposer for that, but since they disappeared I think nothing will happen with it because no one else wants to make battery switch stations.

Larry: So you mentioned that range was going to be one of the big issues with electric cars... is that the biggest barrier preventing Danish Consumers from buying?

Regnar: No not at all, if you compare to Norway you will see a lot of cars there. They have I don't remember how many but compared to the size of their country they have many many cars. No, the problem is tax. The Danish government, they lowered tax on small cars. Four years ago, I don't remember exactly but Martin knows that. They lower the tax on small cars so they were cheaper because they were more green. Then the EVs came in and which is not taxed, we pay VAT so because the EVs are quite expensive you add VAT the price will be higher than if you buy a traditional small car. Usually the second car in this country. So that's the main problem. Actually the tax. So and I've seen some of the vehicle ev organizations, you probably have them on the list also. Danish Elbil Alliance. Laerke Flader. They actually raise the tax which is quite unusual for a Dane too say. But we really want to have more EVs in the streets. This is the only way. You could remove the VAT also. In Norway they have no VAT so the car is much cheaper than usual cars. So this is the way they should do it. Completely remove the taxation.

Larry: You mentioned it would be more of a second car, is that the realistic market that Denmark is looking at for potential EV buyers?

Regnar: I think so ya. Most of the travel today is much less than an electric vehicle can drive. Its about 50-60 km per day. So if you have a range of at least 100 it's not a problem. But if people

buy it as their first car, they want also to go on long distance travel and that's the problem. So yes, and most of the EVs today are quite small. So they will use them as a second car.

Larry: So in general what is the opinion of the Danish population concerning electric cars?

Regnar: I actually think when you ask people, and I've often done that, they say the distance is the problem. As I mentioned before, if you buy it being the only car for the family its true. But if it's the second car is not a problem but they still focus on the distance and the price of course.

Larry: so overall, there is more concern about the distance than the price?

Regnar: I think so.

Larry: So what needs to be consistent between all models of EVs in order for the industry to see growth?

Regnar: Well batteries is up to the manufacturer. We don't care about that. Of course, if we have battery switch station it should be.... No its of course the charging. Charging Infrastructure. Plugs of course. But the EU has now taken out one of the proposals and said this is the plug that should be used throughout Europe. This is called the type 2 plug. So it shouldn't be a problem. But within the next couple of years we still have the different connectors. As of 2017 we will have one and only that one. For AC charging and there's a combo for ACDC.

Larry: In the future in order to see a developed EV industry what needs to happen?

Regnar: Well first of all I think better batteries, more range, and also for instance introducing fuel cells, I know that there are a few cars with fuel cells and they are quite expensive. So batteries have to be developed better, more efficient, and cheaper. Than you can lower the price on the whole car and you will see a better move because then there will be cheaper compared to the small cheap cars.

Larry: So that kind of brings into the picture the Tesla because that has the largest range out of the cars we've been studying. Have you found that to be

Regnar: I was promised a test drive but haven't had it yet. I invited them to our last technical meeting and they didn't show up. Cool car?

Larry: Do you see the Tesla to be too expensive??

Regnar: Yes, way too expensive. I don't think we will see many of them on the Danish streets because of course there will be some but again compared to Norway if you go to Oslo, that is the biggest market outside California I was told. First of all Norwegians have a lot of money. It's an oil producing country. But not in Denmark. We will not see many of them.

Larry: You mentioned the fuel cell cars and they're also very expensive. I know from what we've been told that the Danish government does not remove the tax on the fuel cells. Would that be a possibility in the future or no?

Regnar: I think so, I think it's just because they have been focused on charging cars so the infrastructure about that. When its more or less kind of, you know you have to add fuel. Its more or less a usual car, but it's not true so they have to look into that and I'm sure Laerke and others will put pressure on the minister.

Larry: We've heard that they (fuel cells) can be a potential solution in the future.

Regnar: I think so, I definitely think so.

Larry: Just too expensive?

Regnar: Ya it needs development like the batteries were very, of course they will get cheaper and cheaper so that will happen with the fuel cells as well. Then you have the bigger range and you can drive as far as you like than. Just add a liter of vodka and then you can go off. Your choice, drink it or.....

Jackie: So with the standards organization, how do you feel about the car infrastructure in place? There's two different companies I believe E.On and Clever? How do you feel about the feasibility for the drivers in using that system?

Regnar: At the moment they are different in the way that you cannot just go to one of them, like if you have an agreement with one company you cannot go to the other company but this will change and I think also probably the government will go in and make as is with the telephone, roaming so that this should be possible. And I know that the town, the city, of Copenhagen is working on a proposal for the infrastructure in Copenhagen on the charging spots that are in the parking lots that they will say it must be possible to charge wherever you park your car. Not depending on whether its one or the other. That has to change. It could be driven from the government simply saying like the telephone company, you must do that.

Larry: So coming to the end here, do you have any other contacts that we could potentially speak with?

Regnar: Maybe it's easier for me to ask who you contacted because I have a lot of them. Clever?? There's a guy called Pier Prime at Clever. There's is another guy... Niels Dollum. I'll find the

Clean Charts.... Is the company. And then Clever...

Larry: We will send you an e-mail tomorrow.

Regnar: Yes we will be in touch. I can give you a list of others.

Larry: So you don't have an Ev yourself?

Regnar: No I don't actually, we were planning on having one for the company so I don't have to take a taxi when going into town but the company is moving. So we didn't start doing that. It will be a future plan, a company car when we move.

Larry: Do you personally own any vehicle?

Regnar: I have a diesel, I'm considering buying an electric car but you see I have a caravan that I drive in Europe, so I don't think I would get very far with an EV as big as my caravan. So that is why I have bought a diesel. But I'm considering selling the caravan within the next couple of years. So if we have got good batteries at that time I will hopefully buy one.

F. Federation of Danish Electric Vehicle Drivers

Jacqueline: The first thing we're going to ask you here is to state your name and your title at your organization.

Steen: My name is Dean Fredrickson. I am the chairman of the association called United Electric Vehicle Drivers of Denmark.in Danish. As an organization we've been there since last year in May. In fact we are based on as you probably know Better Place was here, went bankrupt, I and others had bought that car, the Renault Fluence. ON the basis of that we really started because we had to do something around looking from the point of view where we had taken on the car which we loved. And of course we tried really to save that kind of operation. The battery swap station continue. Which we tried to ask money for it. Didn't materialize but then we said ok. We will continue. The battle around it which we did. And eventually when we couldn't save the battery swap stations we molded into kind of a consumer council because what we did was okay, then we have to fight Renault around it. Because they sold us a car which is the car we bought. Because we cannot go around Denmark anymore. So this in essence is what our purpose main purpose is, but we have a second one and that is we came from the point of view of being consumers and built that into a concept, a green concept. That was the driving force for us really. Meaning that the association now, we have fought the battle with Renault and it was settled. They took back our Fluences and now we move forward saying so right now we at least are saying okay what do we do now to really support the whole roll out of the Electric vehicles? That was a very short way to put it.

Jacqueline: So you talked about the purpose and everything, do you have any specific goals for the upcoming future and what methods does the organization use to achieve those goals?

Steen: Well our goal is really how is to support the whole roll out of the EVs in Denmark? That's the clear purpose now. As you say well as a goal we haven't got a goal in terms of how many cars there should be because we are not a business. So it's more the purpose is to help anyone who helps supporting the whole rollout of EVs in Denmark. We will work with basically.

Larry: So what is the main barrier, or one of the main barriers preventing the uptake of EVs in Denmark?

Steen: The main ones I think currently and still it is still the range of cars. Range of cars, and then secondly is still also the price of the car. And then it is also the extension. The range extension. How far you can go in an EV. But those are probably the three main barriers. But then it is also the lack of knowledge. I think the key prerequisite for people to consider an EV is really that they tried. So there's a trial, which will bring people to what I call the wow. It is a fantastic car and gosh I thought EVs were these animals and old stuff. This has been a easy car to drive as well. So I think that is definitely a barrier to our thinking about what is an EV.

Jacqueline: What do you think is the general opinion of the average Danish population regarding electric vehicles?

Steen: I think a big part of it is ignorance. They don't know them. I think not misconception but conception that the battery doesn't last long. I think that is the general opinion and so meaning a lot of people are in essence indifferent because they haven't tried it.

Larry: We've heard a couple times that the Better Place, because it didn't work, gave kind of a negative opinion on electric cars. Is this true?

Steen: I think it's true, I think its and of course, I'm saying this having been a Better Place customer and having been having the FLuenze. It's a fantastic concept. The first thing was that this concept died even before, two months after all the battery swap stations were up and running, they had an up time of 95%. Then they went bankrupt. That means that the whole concept never really had a chance. It never stood a chance. But of course it's clear when something goes bankrupt, people in turn are like oh okay we don't want that car. Fluenze owners backed it and tried to get it continued and never succeeded with it, but with that said of course now we've tried to move as many of our members to But you can say well but yes it has put a dent into the understanding of the EVs, and yes.

Jacqueline: As far as the industry and the dealerships go, specifically the ones that have two model types EVs and gas, do you think they are even trying to push the sales of their EVs?

Steen: No I understand the question. In essence dealerships themselves are fucking it up. You could say that we as consumers are much more knowledgeable than we are. Initially it's when you are visiting a dealer, the best of them, will probably try to convince you, but if they have to spend more time and a hassle on it, they will swap to another car and even try to convince you to go with a petrol car. It's sad to say but that's really the truth it's crazy. And then of course in some dealerships you will find someone that was really key on it. They of course are good ambassadors but other than that in total terms definitely they are not pushing it to the limit that they should. In essence the concept is wrong. Car dealers should never have both options in the dealership. You have to put those two and divide them. They are compete against each other.

Jacqueline: **DO you think that with this internal competition that they might be raising the price of their EVs in order to keep up the sales of their gas vehicles? Because we're hearing that they make most of their money on the return service.**

Steen: I think they I think to some extent you might be able to put evidence to it. I think that they have a.... they don't know "is this going to kick off?" Right now the problem is they have not really found there business model for how do we handle EVs going forward? How do we handle this concept of having, what's the value chain, where do I make the money going forward? And as long as they do not crack that, we will have issues with the EVs not having an uptake. I'm not sure it's true, but you might dig into that. And it was interesting because the thing was when you looked at the way the automobile industry has to put together their range of cars, they have to look at range rather than measure what is the average CO2 output for the whole range of cars that they have. Meaning that they put in an EV then their whole range of cars is making their whole portfolio ok. But it doesn't really matter if we sell any of them because it's not based on volume it's based on well I have the model here. I think that's one that you could test with the automobile industry if you get to have a discussion with them. Say is this right?

Jacqueline: **As far as going back to the consumer opinion, do you think there are any barriers or any problems regarding the safety precaution of electric vehicle?**

Steen: No, that is not an issue at all.

Jacqueline: As you know some models of electric vehicles have a very specific look, they're very different from what people are used to normally, do you think aesthetics of most EVs are causing any people in favor or against?

Steen: I think the issue has more been as a starting point that there was, the range was really one car. That was the Fluenze. Now of course we have a wide range of five or ten models on the market. But I think the aesthetics of the early ones were an issue. Then they seemed to be small, ugly, not particularly nice. Now if you have been to BMW, now we are getting there. I think that's where you start to see this happening. The Fluenze has also definitely, the aesthetics of the Fluenze, is ok. It was a nice car. They were thinking about that one and that's why you have an issue. It's a sedan and a sedan is not a big seller in Denmark. This is because here you typically only have one car. That means it's usually a family car so you need to have a booth where you can put stuff and kids and everything. The Fluenze didn't pick up as a car, sadly. A truly believe now that you see small cars the E.Up from Volkswagen, the Clio, not the Clio I mean the Zoe from Renault, you see now the BMW coming. And what does this mean? This means now you start to get into another segment compared to where you were. With cars that end up being car number 2 for the family. And it is the segment alone of car number 2 in Denmark is to my knowledge roughly 400,000 cars. And the population in Denmark is 208 million. You probably have the numbers. But that means if there is a big study just converted that car number two, because here range anxiety is not an issue. Because if you have two cars, you can always pick the petrol car when you go long distances. The EV is for going to work, and pendling and so on. So that is where I truly believe things will happen. When the prices start to go further down and now it starts to untangle the segment with car number two, it will go up.

Larry: So you're saying the market for electric vehicles is for families with two cars?

Steen: well it's a big one. I think for me it is the biggest segment. For a few it will still be car number 1. Myself for an example. I only have one car. As long as I could get around Denmark with a battery swap station fine I was happy. I will do fine. I don't need to go to Germany or Sweden or whatever. It doesn't matter. As long as I could do that it can be car number one as

well. It will most likely, the big uptake will be car number two. All things depending on your driving pattern really. It's much more about can I go to work, can I charge, and can I go back? And of course now typically the cars look like they can do roughly 120 km at the least but perfect if you're only pendling and going from work and going back. If you can charge in the city, fine as well. Which you can, so.. I still think from my perspective, the big uptake is car number 2. If we simply do not get the range up it will always be car number 2.

Jacqueline: As far as people that do buy EVs, do you think that they fall into a certain demographic, a certain age or anything?

Steen: Interestingly enough I think there was a difference. There was a tendency that I can see from the member base that we had quite a few elderly couples who took on the car. They had the money for it as well. It's still an expensive car. And then you also see what I'll call all the nerds. The look at it and go wow it's fantastic. One thing I can recommend you. Have you spoken to Laerke Flader? She's from the association....because there's a segmentation, they have done a segmentation study which in fact where they have made a topology of whose going to take the car when. Which is pretty interesting, I think it could be good fun for you to read. It's a psychologist who has done it. Like who will be the first movers and it describes these with 8 archetypes. I'll send that to you.

Jacqueline: How do you feel about the current system in place as far as the charging infrastructure? Do you think it's standardized enough or should it be more?

Steen: I think it should be more standardized. Eventually it has to I think it's a bit sad to see how the industry is taking it on. In history the Better Place and Clever. Here of course I would have had an expectation that the Danish Elbil Alliance had reached out to all of them. More cleverly, they should come up with a solution for every car. Some kind of roaming. They need to get to a roaming system. The sooner the better because it's also a stopping point for consumers. I will also say it's not the biggest issue. There's a misconception that you need a big network and the thing is you don't. The main charging is happening at home. And for me, if I look at my driving pattern, I will typically want to charge at home. Only if I'm so far away that I

need to charge to be able to get home again then I would do it. But that's pretty seldom. It's more the home charging spot that is important compared to in the city and elsewhere.

Jacqueline: So you agree that it should be more standardized, however this lack of standardization is not the biggest barrier to uptake?

Steen: It should be but it's not really. I wouldn't say it is.

Larry: Going back you mentioned that more people are buying smaller cars nowadays and previously. We're wondering where you stood on why consumers are picking the gas models versus the electric that are more similar in price?

Steen: You probably know the taxing system in Denmark now which you know is completely nuts. It's crazy, the prices we pay for a car. And of course right now were in a situation where 70% of all cars sold in Denmark today are those small petrol cars. Like the Peugeot 107 Citroen C1 small cars. This of course is because there's no tax on it. It's very low taxed. It is a combination of price and emission and they have put that together. So that means in essence for the small cars you're only paying 20000 in taxing system on it. Which means that they are so low in price that if you go from a car costing 80,000 DKK, take the E.Up as a good example in the Petrol version, the Volkswagen Up will cost roughly 90,000 Danish. Now we can get an E.Up as an electrical car and now the price is 190,000. That means it's double the price still and you do not have the range. So of course there's still a large imbalance, and one of the ways to do it is that eventually we need to change the whole taxing system so it's made that even the small cars will have a higher price. Only some of the bigger cars who are having very good standards some of the Audis, and BMWs would use their price because not only based on price, not emissions. So there is a way to do this if they want to but it's such a hot topic. I'm sure you can imagine people who just bought cars who paid 150 and now the whole used car market and secondhand car market will go ballistic. And of course what makes it even worse now is that 75% of the cars sold to the middle class which of course means if you change all the motors they're sitting with the car that would potentially be more expensive afterwards. So the motors are probably heavy for the politicians how to do it. But that's just the way it works today.

Larry: Another one that we've been asking a lot of people, you mentioned that you had the Fluenze? Do you have another electric car now, or do you ...

Steen: Right now I'm having a range extender and joking with it because what I have done is get used to it. We closed a deal with Renault around our Fluenzes, I don't know if you know what we did with them, but in essence eventually after the fight, they agreed to take back the cars with a certain depreciation. We recommended all of our members to deliver the car back. And then they could take their money Renault offered or they could stay with a Renault Petrol car or the Zoe electric vehicle model and they got an extra rebate. All in all a good deal, everybody was happy. The issue now was I had to consider, do I sit back now and that is what I decided to do because I figured the Fluenze was the old EV. It was not going to be the new, like, it could not quick charge and so on. The issue is we do not have the swap stations. So we recommended our members to leave those and take a new solution. Quite a few took the Zoe then. At that time I had to consider do I take the Zoe, or do I wait for a new type of EV. I decided to wait. Because some of the car makers don't seem to understand what they are doing. They put the Zoe to the market, but they didn't bring a cable for 230 volts. Meaning that the Zoe could not be charged on the main parts of all the charging spots meaning that in essence you have a situation where you definitely have to charge at home but you need to change your charging spot at home. So they put up a barrier for themselves for the switch to the Zoe. Which is crazy but that was what they did. On that basis I decided to not take an electrical vehicle right now, but to wait for the BMW i3. With range extender. Because this for me is the biggest, this is going to be the biggest hit for EVs build up. As you potentially know they have two versions of it. They have the pure EV which is the one I'm sure you've seen at the dealer in Lyngby, but then they also now put forward the range extender. It is awesome they've done it. The reason is the thought, they thought, fantastic, that because it has a range extender, it has a 9 liter motor for generating electricity. But because for them themselves marked it as a petrol car they expected they had to pay all the taxes.

G. Federation of Danish Motorists

Vin: So to start we need you to state your title in the Federation of Danish Motorists.

Tom Lund Kudsk: My name is Tom Lund Kudsk, head of public affairs at FDM.

Vin: What does the Federation of Danish Motorists do in general and how does this relate to electric vehicles.

Tom: The federation of Danish motorists is the primary consumer interest organization in Denmark, the biggest, we have 242000 households as members and we are the only organization presenting the consumer interests of motorists so that is our purpose and we are dealing with all the criteria which is relevant for motorists being the legislation being relations to car dealers and the market and these kind of consumer issues. We provide legal service to our members and trying to make political interests even.

Vin: Are you guys focusing on electric vehicles at all or is it on the side?

Tom: yes of course, it is part of the future so of course as representatives of consumers and the future of motorist, how to handle the climate change, how to handle the future from a political point of view, many Politian's want to see a fossil free energy sector and transport sector in a world where it is easy to see that energy prices will rise. It is of course in our interest to find alternatives to gasoline and electric vehicles are one of them.

Vin: if you had to point out the main barriers preventing consumers from digging deep into the EV market what would they be?

Tom: The main concern for consumers is the price of the vehicles in combination with what the vehicles can do. You can take for instance a Nissan leaf, which is a very popular midsized electric vehicle and compare it to the Volkswagen gulf diesel. You will see that the total cost of

ownership of each vehicle would be more or less the same. You cannot do the same thing with the car. That is the leaf has a limited range and that is the struggle for many people. From an academic point of view, 90% of your daily driving you could easily do with an electric vehicle, however many consumers react irrationally saying well for us, the last 10% of journeys is important for us. In a country where we have the highest world record for car taxes it is not many families that have an income which would enable them to have 2 good sized cars. You would normally see a small car and a larger little older car in many households. It is an economic concern perhaps irrational when combined with the range, but it is the range combined with the price. It is too expensive compared to what you can use them for.

Vin: So if the ordinary consumer could have an EV, would you say it would be a secondary vehicle?

Tom: yes it would be definitely

Vin: In terms of the infrastructure for electric vehicles, how standardized are these charging stations and is it a concern?

Tom: they are pretty good because there are 2-3 different systems, but many of the charging points have the 2 different kinds there is the Asian Chatimo where you can charge a car like 80% in 20 minutes. It is on DC or AC I cannot remember they are the 2 different kinds of electricity that we use and the other one is the European standard which the EU is backing which is the Compo charging plug. These 2 systems are now integrated in most of the charging points. Then we have the American system with Telsa which is a different story, if they use the potential in fast charging they use a special design charging point which Tesla is about to set up here in Denmark. We have a charging point outside here from a company called CLEVER and yesterday there was Tesla charging there and there is normally a taxi, a Tesla S, charging there as well, he normally charges there. You can easily charge it, but you cannot fast charge it as much because the technology of the car cannot do, but you can still charge it quite fast. The

charging infrastructure is more or less on track. There has just been a decision to put up charging points on the motorways or highways. Today it is more on the singular roads or in the cities so you would have to drive off the highway to get to your charging points. Now they will put them in service stations along the highway and motor way so that will come in place in the next year or two.

Larry: Talking about Better Place, is the batter swapping idea still relevant or is it phased out?

Tom: If I was doctor, I would say it is a flat liner. It is completely dead. I guess there are 17 swapping stations and they are closed down except for maybe 1 which was converted to a carwash. The German company EON bought what was the remaining part of the infrastructure that Clever owned so they bought all of the charging points, but they did not want to buy these battery swapping stations because the idea is dead. There are no car manufacturers who want to make cars with this swappable battery. It was a stupid idea. Car designers want to design their cars individually so you cannot ask car designers to put in a uniform batter. They will not do it. Even Renault who was the only company to buy the idea firsthand planned a second type of battery for the Zoe. So there was one type of battery for the Fluence, which was the first car with the batter, but the second car they were marketing the Zoe, the smaller one, that would be another type of battery so not even 1 type of manufacturer could standardize the battery, and then the idea is dead. A battery costs 10,000 Euro so imagine 15 different models of car driving around with 10-15 types of batteries and each battery has a value of 10,000 Euro, you have to have a variety of full charged battery hanging around and its simply. The guy who thought about it was from the software industry and if you have been working at Microsoft you might believe that you can rule the world and say that I design a program for computers and the computers need to make the physical arrangement so they can use my program but that is not the way to deal with the car industry. It is the other way around.

Vin: if you are looking at Norway and their industry is 1st in the world, what are they doing that is different than Denmark?

Tom: First of all, Norwegians are very wealthy people. Many Norwegians are very wealthy so what you see is that the EV in a Norwegian family is typically car number 2, 3, or even 4. They might have their Porsche Cayenne to drive in the mountains on the weekend and they might have a tesla to drive during the days. That is important because around Oslo, there is a charging zone. You have to pay to go into Oslo. If you have and electric car you can drive without paying. Second congestion is also a problem in Oslo, like in many other cities around the world, but the EV's are allowed to drive in the bus lanes so you can pass all the other cars. So we call it an EV VIP lane. It has become so popular now that the bus companies are now complaining that EV's are hindering their services with the busses so the 3rd thing is they have a lot of dedicated parking spaces inside Oslo. It can be difficult to find parking spaces, but you can park for free and they are dedicated parking spaces. So you have a car without taxes, Norway has the second highest tax on new cars after Denmark, so you have a car without taxes, you can have it has car number 2 or 3 if you want because you are wealthy, you can use the VIP lanes or the bus lanes, are always secured parking place, and you are going without paying anything. So it is super-efficient. You could ask the question is it super-efficient way of using tax payer's money for a green revolution? I would say no. they are targeting very small market. We have 2.3 million cars in Denmark. We have 1500 EV's. They are not the green revolution in Denmark. If we could do something to the remaining car park say increasing the amount of biofuels in the gasoline for instance, that could work for the rest of the population of cars or you could introduce a different kind of cars. Cars driving on natural gas or cars driving on hydrogen fuel cell cars. There are many possibilities, from a political point of view, to try to give incentives to people to buy more green cars and at the moment they are only focusing on EV's and that is a dead end in our point of view. You cannot beat the market. The politicians believe they can beat the market. They think they can control the market but they can't. The Danish car market is not bigger than Hamburg. 1 city in Germany. So each year there are no more cars sold in Denmark than in 1 city in Germany so a car manufacturer wouldn't give a damn about what is happening in Denmark, they couldn't care less. Were just a marginal market so therefore, when Danish politicians think that they can drive the market by giving incentives for EV's and talk about

them, then hopefully they will come down from the sky. They will not. Consumers are irrational in that sense because they want something for the money and at the moment they believe that electric vehicles are not giving them what they want.

Vin: Do you know any contacts that would be beneficial for our project?

Tom: There is a specific branch organization representing the energy companies and the car manufacturers called Danish EV alliance. Larke is in charge of this area. There is the company CLEVER. They have a program where they have 250 EV's that people could rent for 3 months without paying anything and they could give away the data and opinions. More than 2000 families have had this throughout the past 3 years. The possibility to rent an electric vehicle for 3 months for free. We have been a part of it and capturing the public experience of it. We have a very good relationship with clever.

Vin: is there any way to find the results online.

Tom: it's called testenebil.dk that is the specialties. Clever can talk to you more. They have not finished the project yet but have very good information. What they are saying is that people are thinking they can live with an electric car but they are not buying them. They are thinking that it was fun and I could live with one, but it's too expensive when it comes down to the dealer and also because you are used to having the option to decide what kind of car you would like, what color, station wagon or sports whatever but with electric vehicles you are very limited. Only a few models on the market yet. We are at the beginning of a change. The politicians believe that they can put all their eggs in the same spot and that is the problem. They see EV's as the solution but we see EV's as a part of the solution not THE solution. In the long run, the solution will be fuel cell cars. Fuel cell cars will be the solution for long hauls. If you are driving 300, 400 km then it will be fuel cell cars no doubt because we cannot see a development where batteries can last that long. The Tesla is a very unique car; it is a very expensive and heavy car. It takes ages to charge it fully if you do not have the right charging

infrastructure. There is not enough electricity in the cities to provide that much power. 20 Tesla's on 1 road would cut down the power too much. So we will see a mix between fuel cells and electric cars on the long run. In the meanwhile we need to focus on all the different technologies not just one. That is our message to the politicians. They should give up the idea that the EV's is the only solution. it will be the solution for the future, but it is not the only solution and they should open up for competing technologies now to make this change they want.

Larry: so that is the first step in the green movement?

Tom: Yes a change in the Danish car tax system. Today you have this very high tax, 25% VAT and on top of that you have 180% tax. You have some very specific deductions, how far it goes, but at the end of the day, it is the value of the car which is the primary value of taxation. If you go away from a value based taxation to a technology based taxation, like Norway, and then you open the bridge for different kinds of electric cars. At the moment in Denmark, it is only battery electric cars, even the Chevy Volt is full tax in Denmark because it is not an EV. In the US I know EV's, or even hybrids, have a small support even though the majority have V8 engine. And it is very small. Even in Denmark, a plug in hybrid is not a battery car so that is something to work on politically. That is what we do. Stress to the politicians that they need to change their tax system. Better today than tomorrow.

H. Norwegian Consumer Council

Gro: In Norway we work some with this issue of electric vehicles but not extremely much, it's not one of our main.....so I work some with it, not my full job. There are some organizations that work more with it, so I'll give you the input I have and try to link you to other people and other information sources.

Vin: So just to start, we wanted to know your title at the NCC.

Gro: I'm an advisor within transport. Can I ask you something also? You are students from the U.S. for the DCC right? They have a project with your school? I just wanted to understand your background.

We don't travel just short distances in Norway, so that's why we use electric vehicles instead. Let's see....Did you know in Norway last month Tesla was the most sold vehicle? It was the number one vehicle in Norway last month.

Vin: What is the Norwegian Consumer Councils involvement with electric vehicles?

Gro: I could do that and I could also say a bit about how this market is functioning in Norway. So your goal is how to get the customers to adopt EVs? Personally we have something called the trans????? Which is a public department targeted on giving financial support to environmental transport methods. We have been involved in some groups with this agency. We are representing the consumer part. Last year there was group payment methods for cost charging and I represented the CC in that group. In this our goal was to help make the payment as easy as possible. For people who want to charge without having a customer relationship with a specific provider. It should be as easy as gasoline. In Norway there have been different actors given financial support who made these charging stations and they all wanted different payment methods. The consumer, when he gets there, he doesn't know if he needs to call somebody, or ring a doorbell or send an SMS.....and this provides insecurity. It makes the point financing these charging stations disappear kind of because the point is to make the consumer feel safe in knowing they will be able to charge. We took in this group, and there has been some improvement on this now as of 31 March, this year, this Monday, they have all the people who had got financial support from the government, they had a deadline to either open the charging stations to charge for free or they had to have a simple drop in payment method. So there's some possible development. It's an emerging market. It's a bit messy. So that's one of the things we've been doing. Like trying to improve, make it easier.

We also participated something in partnership with the association for people who own EVs, I sent you a link to their page. We and they and the COA have developed some consumer advice on electrical vehicles where we have decided on some criteria, we made some things

you should think about when you choose your electrical vehicle such as range, how long the car will last, whether you can charge it, which ways you can charge it, everything and then with some advice in general. I can send you this list which was recently updated this week. I can send you a link to that. Its elbil.no. It would be much easier for you because Danish people can read Norwegian perfectly. But it is alike when you write it but different when you speak it.

Vin: So Norway has the best EV industry in the world so far. So what has happened over the last few years that has really enabled Norway to become the leader?

Gro: There are several reasons, if you think of our situation when it comes to power, we have very much access to cheap power because we have a lot of water power. Because in Norway compared to others we charge our evs with very green power because of hydroelectric power. When you think about whether a country should really focus on developing evs instead of other alternative of fuels, the power mix should be brought into consideration, whether or not it will be green. We export oil but use hydropower for our electricity to a large extent so our electricity is quite cheap. Another thing is a wide political majority that has wanted to give this priority. Therefore evs have a number of advantages in Norway. That's all kinds of advantages, I'll try to list what I remember: its everything from using the ferry for free, you can use the bus lane, for instance There's a lot of free parking and free charging in Oslo, so there are practical advantages. On the other you have a lot of financial advantages such as you're paying less. In Norway there's quite high total price for emission and tax in general. You have to pay to use the road and additionally no annual fee for using them. ALSO, when you buy a car in Norway, there are financial advantages.

In Norway there's discussion on the incentives right now. Two criteria will be continued. Some will be phased out at some point. Either it will expire when the number reaches 50,000 or in 2017. For instance the environmental organizations really want this to last until 2020. They have given a report where they suggest which of these can be phased out first. The first should be access to public lanes. There's like an open discussion on this, but I think our view is that the government has to make sure these things are predictable for the consumer. The consumer should know these things for a long time upfront so their car will last a long time. The whole

point for the consumer is to be able to measure their advantages when buying an EV. That's the whole point. Insecurity will make it less/ worse for those who could be possible buyers for EV. We haven't said like 2017 or 2020 but it should be predictable and you can't keep the consumers in a limbo. They can't have to worry or wonder about what happens when.

Vin: You mentioned that the Tesla Model S was the best seller in Norway, however the Model S seems to be very luxury compared to other electric cars on the market. It looks like a car you would normally buy. Whereas other electric vehicles have a certain look that isn't similar to cars were used to. How does this new look and the aesthetics of the general EVs in Norway affect the consumers decision on buying the cars?

Gro: I haven't done any reviews, I don't know like when I present my personal views. I guess the body doesn't really look like a car, but many of them of the electrical cars now look a lot more like cars and the Tesla looks really fancy car. I think the main reason people have bought the Tesla in Norway, it's a combination of practical and financial advantages, its good looking and cool. Also our economy is quite strong. There a lot of people that feels that they can afford this car. I would say a lot of these EVs now look quite good don't they?

Vin: In Denmark we found that a lot of the people who own electric vehicles have an EV as their second car. So its only people who can afford 2 cars who are considering buying? Is that similar in Norway, or are EV owners owning it as their primary car?

Gro: I don't have the statistics for that in my head. If I were to guess I would guess that that is the case in Norway also but I don't have the numbers.

Vin: So you were talking about how you worked personally on making sure the charging for consumers was very easy. In terms of the standardization and interoperability of the charging stations, has the Norwegian government stepped in and said like there's a standard where all the charging stations are going to be like so? Because with a gas car you can use any and all stations.

Gro: This is a national strategy and finance plan for the infrastructure for EVs. It was launched yesterday from transnova? However this document pretty much sums up what our country

thinks is important as far as developing infrastructure. I understand we haven't really said that this is the standard... they're kind of letting all of the flowers blossom. Then they will narrow down a bit more the technical things in a report, I can send you a link. The strange thing they're doing when talking about interoperability is that they're not necessarily saying there has to be one way. For customers there should make the payment process easy for them. There planning to launch like a second system that is a battery system.

Those companies that want to have a specific customer relations if I want that type I can have that and then I can use this card everywhere and have interoperability between the two. It's a bit messy to start that system. So what they're thinking about is forcing everyone who gets money from the government into having this system which is additional cost and not so customer friendly. Those companies that want to have like a customer relationship, therefore those customers get a special price. Now people can have that relationship and still have access to others. The strange thing I think is it will be like a second system. So what they're thinking about is forcing everyone who has money from the government to have this system. An additional cost is not so customer friendly. The same as gasoline, you just pay there and then, no carrying around extra parts. That is our view, that it should work the same as just paying for a hot dog.

Vin: If you were to talk to the Danish government or Danish consumers, what would they need to focus on for a flourishing electric vehicle industry?

Gro: They would need to... I don't know exactly how it works in Denmark. However, what has worked really well in Norway is to make the advantages for consumer surpass the insecurity of the range. You need that and you need predictability and feasibility for consumers so they know this will last for some time. Like if they start phasing things out around 2016, they should start catering to the consumers as fast as possible how this is going to happen. Let them be knowledgeable as to on which parameters these will be phased out and which will be kept and for how long. Also I think its rational to think that these EVs are becoming so much better than they were before. Phasing out some of the advantages may be rational also. We're not

opposing the idea of phasing them out were just saying if they are to be phased out we need the predictability.

Vin: In Denmark, it seems to be that micro-cars are outselling the EVs. Is that a similar problem in Norway? Or are EVs the first choice for consumers?

Gro: Tesla is in a special position. I think there are still many other cars being sold. Remember EVs are still a small part of our market by a long range. I guess thinking EVs...it could be small vehicles are still outselling them for all I know. I think that we are the country in the world we most EV sale or whatever but it's still quite small. I think we have like 20,000 or something. It's not like they're everywhere all the time. It's kind of baby steps. A lot of people in Norway are questioning if the electric vehicle will be the final solution. Next year they're introducing hydro? And at least Toyota expects that in around 2020 that hydro will be kind of umm quite not like bigger than fuel, but it will be quite important also. Because it doesn't have this range problem.

Vin: In Denmark people don't have that long of a commute. How does that compare to Norway?

Gro: 50% of car travel in Norway is less than 5 km. But there are also a lot of people who commute but they use the train or car or whatever. We have a lot less people biking in Norway rather than Denmark. We have only like 4% of travel by bike. Denmark is at least 20 or something. It takes quite a low share of the whole transport. I think a few people commute 2 hours each way. They are records on those types of things. I will find you some general statistics on EVs I think. Because one can get the perception that 90% of vehicles being bought are EVs and that's not the case, but it is just a high share compared to others, even though it's not so high in total numbers or in share. I would say the part about the power makes it quite important. Some places, maybe EVs wouldn't be that helpful because it depends where the electricity comes from.

Vin: Do you own one?

Gro: No, I don't have a car. I'm a part of a care sharing scheme. I'm not considering buying a car, but if I did I would buy a hybrid. I would rather buy that because of a gas to be more

environmental, but I would buy it before an EV because of the range. That's what I would do right now.

Vin: Thank you for your time, I really appreciate it.

Gro: Could you send me the report when you finish? Also, if you record me on something I'd like to see it first.

G.2 Electric Vehicle Dealerships

I. BMW Denmark A/S

Vin: we wanted to talk to BMW specifically, we already talked to tesla and Renault, but the i3 seems to be revolutionary.

Martin: yes I would like to think that, if you listen to the journalists they are all saying that the i3 is the new thing. For a factory like us that had made a car that is really sustainable and can do the job.

Vin: we wanted to know your position with BMW

Martin: I have been at BMW for 10 years. I originally worked with selling traditional cars, now I have the responsibility for the BMW I in Denmark

Vin: from your experience so far, how many i3's have been bought based on the deposits put down

Martin: to some cars here in November for what we call a soft launch, so the customers can test drive and see what it was all about. If the customer wanted to have one of the first i3's in Denmark, they could put down a deposit of 20,000 kroner, and would be put into a pool of buyers that will be released in may June and July this year, we have a goal of about 100 cars this year in Denmark, now it has been increased to 200, and we have sold 80 already.

Vin: that's pretty good, that's a large amount compared to the total EV sales in Denmark last year.

Martin: yes its really nice for total sales, but of course it's a product, and we are trying to show the focus on this product and how cool it really is without flaunting that it is a BMW.

Vincent: **What have you seen from potential buyers that come in to look at the i3, what are their main concerns.**

Martin: Range, definitely range. Its not the product it's the technology, its how you start with the customer. If the customer is on the highway all the time, the I3 is not meant for them. The i3 is a city vehicle, it is meant for the city. Have you driven it yet? You are more than welcome to come by and try it out. Once you drive it, it adds so much more. It has this one pedal feeling, so when you remove your foot from the gas pedal it decelerates. Its meant for that in the sense of a city, not the freeway. The range is about 160km in the city, but on the highway it's about 100km. The customers that we are selling these cars to are in this area.

(Copenhagen) It is not being sold in the south or near Jutland. Its being sold to people who are traveling from 100-120km a day. It's not a problem of range, its our focus.

Vin: **we have been finding that most of the electric vehicles in Denmark are secondary cars**

Martin: Yes, except for the Tesla

Vin: **Yea but that is because of the huge battery.**

Martin: yes it weighs over 2 tons

Vin: **so with that have you had anybody come in to see the i3 as the primary car?**

Martin: not until recently, have you read about the range extender? Due to the high taxation in Denmark the car would cost 830,000 but due to the fact that it runs 160km for 1 liter of Petrol we have a deduction for 600,000, so the price with the range extender is 335,000 which is really nice, because it will give you a range of up to 300 km and you will never run out of range. As long as you just put the gas on for a short time.

Brodie: this is something BMW has just found a couple of days ago right? It is not exempt from the Vehicle Registration Tax right? Is this a different way around the tax?

Martin: It is, actually it has its own place, 180% tax 25% VAT, but this car is slightly stout in between these positions. And that is why we have been able to have this huge reduction in tax.

Vin: So we have been told that the micro cars in Denmark are the ones really taking EV's off the mind of the consumer because they are a lot cheaper. Where does the BMW compare in terms of price to the micro cars?

Martin: its still around 70,000 different and the customers we are often selling to are either Audi, BMW, or Mercedes facs, so it is targeted towards a different group of people than the ones looking at micro cars. If someone was looking for an EV vehicle that is more comparable to the microcars in price one would look at the Volkswagen UP, it's under 100,000 kroners.

Martin: If you look at our pricing the i3 is actually the cheapest model we have. In Denmark it is a cheap BMW, but in Germany or anywhere else it is very expensive.

Vin: so when the general public thinks about EV's they tend to think of a different look, and the i3 kind of has that different look but it looks way sleeker than most EV's.

Martin: it looks like the future, very futuristic and that is one of the things that BMW has looked into. We have developed this new car that started 6 years ago, and everything about the car is based around electric, and sustainability.

Vin: we were asking different organizations and they say that some people like the new look, while others are turned off by it, were their studies done by BMW so they knew whether or not to make it look like a classic Beamer, or to make it look futuristic.

Martin: Here we have taken a solution where it is ok to flash the idea of being safe for the environment, and the future idea is attractive. If you look at the i8 it looks like a car in a Hollywood movie. The EV needs to be so much different that the customer will say they want to be a part of the future with BMW.

Vin: and of course just being a BMW will help it sell itself. So in terms of who has put down deposits on the i3, is there a certain demographic of people committing to the i3?

Martin: I would say its mainly BMW owners, but out of the 80 we have sold 20 of them are first movers, that have seen EV's in the past couple of years, maybe owned a Nissan leaf or one of the others. And now are looking for a car that is a product of good quality, good range, and possibly a sellback, resale is key to consumers.

Vin: going back to EV's in general, are there any other barriers you see preventing the consumer from purchasing EV's besides range?

Martin: the infrastructure in Denmark is one of the best, but people just don't know about it. So the people say o I've seen one but its way far down away from me. Once people see all the different charging stations they will see it is not a problem at all. Consumers can also purchase a wall box to charge at their homes, it also provides a faster charge.

Vin: It takes a 2 hour charge for the i3, correct?

Martin: yes it can get down to a 2 hour charge, but this one we have in the showroom is a 4 hour charge. It's like your iPhone you get home and you plug it in. It doesn't just charge, it preheats the car and the battery so it is always ready to go. The funny thing about the i3 is called a technical carrier, and it has some very new gimmicks in the model.

Vin: so the i3 uses E-ON and Clever's charging stations?

Martin: at the moment the i3 uses E-ON, Clever, and one other companies' charging stations. The main partner is clever, you get the BMW charge card with a premium price for charging, we are also starting a system where Clever is purchasing the Wallbox and then leasing it out to the customers because in Denmark there is a law that says if you lease the Wallbox you will get 1 kroner back for each hour you charge.

Vin: why is there such an incentive,

Martin: I am not quite sure

Vin: I'm sure you have heard of Better Place and their battery swapping technology, has BMW considered using a battery swapping system?

Martin: only when we are going to operate the package, which means when the second generation of the I models come out you will be able to take out the cells and put in newly charged ones where you will have triple of the range, it will come out in a couple of years. We are working with Samsung on the batteries. Getting back to Better Place, it's a talk of the town that it's an old technology of battery swapping, but it is terrible they closed because it gave all these writers to say I told you so and gave bad media coverage towards EV's.

Vin: Why is Norway more advanced?

Martin: they have a government that has been more focused on EV's in general. They have a tax deduction, they can park for free, they get free passes on tolls, they can drive in the bus lanes. If you have a company car you will get a taxation of the company cars price, so you will get another tax reduction if you chose an electric company car. It is like selling candy to children.

Vin: Apparently they are selling 1 out of 5 cars as an EV

Martin: In Norway for BMW's case we sold around 8000 i3's as a startup and Norway took 1500 of them. Its not that long to Norway or to Sweden, but their governments are very different. We have a government that says that you have to watch CO2 emissions, but they don't follow up on it like the Norwegian government.

Vin: it seems like you have this great goal to becoming carbon neutral but the government isn't advertising much. What do you think do you think Denmark can be carbon neutral by 2050?

Martin: we hope that they will look at the whole case in Denmark. We have been contributing sort of lobbying

Vin: with the exemption of the vehicle registration tax, it says that it is expiring is that a concern for consumers

Martin: they are extending it to 2018, but it was a major concern.

Brodie: I know you mentioned you have the early adopters coming in, how do you think BMW is going to tap into the early majority

Martin: the consumer way of looking into cars is different and the use of cars is different. We think we are going to see more of this car sharing service. Which means you have an online service where if you live on a block with 100 flats there will be 20 cars available for if you want to visit family or friends or if its raining, you can book one of these vehicles with an app on your phone.

Brodie: are you trying to sell the i3 to fleet owners and companies as well

Martin: the range extender has led us to this case because the companies were concerned with the range. Now I am getting calls all the time asking when I can have some models ready for them. That will be the next big thing.

Vin: Do you know how Tesla is coming out with the model x, is BMW coming out with something similar.

Martin: Yes we are going to have i3-i8-i9-i5, when I was in Munich there was talk that about half of the vehicles in our showroom by 2020 will be EV's. so it is just the beginning. The entire division of I has a 5 billion investment, it will not fail.

Vin: Seems like not many companies are willing to change or adapt to the future

Martin: yes actually Audi closed down their electric vehicle project a couple of years ago, and now that the i3 is booming they have to start up again but they are many years behind.

Vin: what do you think needs to happen in Denmark?

Martin: we need to focus more on infrastructure, and the government needs to advocate more for their environmental goals in terms of EV's. the government hasn't been working with us much. Were continuing to lobby.

Brodie: do you own an EV?

Martin: yes I own the i3.

Brodie: why did you choose the i3?

Martin: it really drives so nice, and for the price its pretty fast , and of course I represent BMW so I have to have one. Its very spacious. BMW makes us do it, it makes sense.

J. Renault

Jackie: To start, why do you think more electric vehicles are being sold in Norway than in Denmark?

Peder: There are some financial reasons for that. If you take them first. First of all you have that when you buy a car here you have 2 kinds of taxes. You have the VAT and the registration tax in Denmark. Electric cars have no registration tax, but they have the VAT which is 25% added. That VAT they do not have in Norway so the cars are cheaper in Norway and there are a lot more free charging points or hotspots in Norway so a lot of Norwegian people for not pay much for charging cars. They made some studies about the Norwegian driving patter and it shows that even though Norway is a huge country compared to Denmark, they do not drive as much. So I think the pricing and the charging is unique selling points for electric cars. That is only a guess.

Jackie: Here at Renault, what is your position and the description of what you do?

Peder: I am the steady guy in here. I worked at the Renault store before. I am not the head of sales here at Renault, but I am the one you come to if you have a question. That is why I take the electric vehicles under my wing. I am just a salesperson, but it is my responsibility to pick up the news and distribute it to my colleagues.

Jackie: On average, how many people come into the dealership or contact you per day looking for an electric vehicle?

Peder: It varies. For the moment, Renault has an add on TV about charging and free stuff you get with the car. That of course gives more heads, the head rate is a little bit higher but it varies a lot. Some weeks we do not hear from anyone, but sometimes we hear from about 4-5 per week. People have to get used to electric cars so I think it will accelerate a bit.

Jackie: Does Renault have a specific plan for the future regarding pushing the sales of EV's

Peder: The new strategy is that you get a charging point at your home for free and you get another cable we call it the EVSE cable which means you can put it into a wall socket if you are at home or a summer house or somewhere you can just put it in the wall. So you do not need the home charger. Of course this one is a lot slower but it gives you the opportunity to go visit your parent's one night and drive home fully charged. So I think that kind of a new way of thinking about it. It gives the buyer some extra things you don't have to think about like having to pay 10000 DKK for the power and 4000 for the cable. This one is included. So I think that is helping to boost the sales.

Larry: What is the difference in charge time between the standard home charger and the wall charger?

Peder: The charging time for the one in the wall depends on the power you want to pay for. The standard installation is 3.7 kW which will take 8-9 hours. The one is 16 amps and the other for the wall is 10 amps and that one will take 18 hours for a fully charge so the difference is 10 hours between the 2. That cable that you put in the wall, the Danish term is grandma cable, gives you the opportunity to go somewhere where there are not charging boxes.

Jackie: What have you found to be the major concern for potential buyers of EV's?

Peder: Range and charging points. Studies have shown that 85% percent of people driving are able to use an EV when thinking about range. But if I give you a limit and say you cannot drive to Sweden or to the other part of Denmark, people would say they like to do that even though

they do not do it and never did it but they like to do it. You are now telling people that they cannot drive into a gas station and you need to think about where you are going first. Normally when you are selling a normal car, you ask people how many km or miles they drive per year. Now we have to ask them how many miles or km they drive per day because that is the normal driving pattern that is becoming more important. If you are driving to the other end of Denmark second week you are not able to use an electric vehicle. Range and charging points are the biggest concerns.

Larry: Do you consider price to be a big concern?

Peder: No because luckily for EV's Denmark has some of the highest tax on cars so when we buy a petrol or diesel car in Denmark there is a 180 percent tax on the car. There is no tax for the electric cars. Take Tesla for example, which is the big success at the moment, it costs around 500000DKK at the moment and if you had to compare it to a similar car like a BMW, you would have to pay 3-4 times the amount for the same specs. The pricing on the car is not bad; it's the Danes tax system that gives the EV the advantage.

Jackie: what are the main barriers keeping the industry from flourishing?

Peder: Range. You can look at your car and see when you need to fill up with gas and go do it. You are looking at the meter go down and it is an extra stress even though it is about the driving pattern, the way you push the throttle the way you drive the car can actually be improved when you are driving an EV. It is becoming a challenge for each buyer to see how much mileage I can push out of the battery every time. You are driving more careful to drive more. It is distressing for people to look and see if I can get home. If I turn up the heat will it use more electricity? The range is the main concern for the common buyer.

Larry: Would you say that the battery capacity is limiting the future of the EV market?

Peder: Definitely and when Renault, I don't know if you know it, the difference is you rent the battery compared to say Volkswagen where you buy the battery. Here you rent it. That means that the Renault car is cheaper than the competitors, but that also means you are paying a monthly fee for renting the battery. This fee is varying depending on your mileage per year. So

if you are driving a lot of miles you are using the battery more and in that way pay a little bit more money. The reason why Renault is renting the battery instead of buying is because if the batter goes below 75% of the original capacity, then they will give you a new one. Everyone is saying if I buy this one, maybe when the battery goes below 75% maybe there is a better batter that can go double that. If you were able to get a battery that could go double the distance for example, you would see many more people interested in electric cars.

Jackie: are there any other things that the industry is doing to help see a developed EV industry?

Peder: I think there's some problems. I think if they made the same sockets that you put in the car. For example, the Volkswagen, Zoe, tesla, and leaf are using the same socket. There are other cars that are using other ones. If they standardize these things, then it would be easier for electric vehicle owners to go to any charging point and put in my car there. Roaming agreements that you have on your mobile phone, like going to another country, if they could make this kind of agreement together then it would be easier.

Jackie: Is this the job of the government, or companies, or higher up?

Peder: I think it is the job of the European Union because now this iPhone has a specific charger and this one doesn't. The EU just put in a law that says that future cell phones sold in the EU for some time in the future should be mini usb. They should do the same for electric cars. You need this socket. We cannot make that law in Denmark; it needs to be higher than Denmark or Norway. It needs to be the European Union.

Jackie: Based on consumers looking to purchase an EV, are people looking to purchase the car as a primary or secondary car?

Peder: a bit of both actually. Some people do not drive as much. One customer who bought a Zoe came in yesterday said it is his main vehicle. He is going to the most northern point of Denmark, which is 600 km, and he just rented a normal car to go there. So most the people coming in to look at an EV is mostly secondary cars so they have one for skiing vacations or wherever they are going and they have this one for everyday use or he is driving one and the

wife is driving another. So they need 2 cars and this one is the one used for going into town. So it is a bit of both but a little bit more to secondary cars.

Jackie: Is there anything Renault is doing moving forward, other than the charger, to sell more EV's?

Peder: They are at the moment give the free stuff and the company is giving us extra money for companies. So if a company customer came in and said they were thinking about having the car as a company car then we have extra money so we can give them some free charging power or free charging gear or make the car cheaper. Renault is really up front when we are talking extra money for government buildings. We have these districts or small communities where local mayors are sitting and all these public workplaces are bound by law to have EV's for local driving. Renault is very upfront helping us financially. We just sold 12 Renault Zoe's to a town called Bellot and that is for old people sitting at home. They get help every day help and food. Those cars are being used for that. Renault is really trying to help us financially for that. So they have a big vision about EV's.

Larry: Are the majority of you EV sales towards companies looking for a company car or towards individuals?

Peder: at the moment, company because of the government regulations saying you need that. That is of course because when you are buying 5, 10, and 20 cars at once, that is the majority. I think that people's mindset is becoming more green. We have to be more environmental and that way you will see a lot of average people coming in saying they are thinking about buying an electric vehicle because it is good for us, the environment and our kids. So I think at the moment the company is winning but it is public. There are not many private companies, some but not much. I think that it is the average you and me.

Jackie: what is your take on the fallout of Better Place?

Peder: I was a big fan of Better Place because it gave you the opportunity to go further than the charge on your batter. The idea was brilliant because we had a lot of customers, like 10, come in and buy the car because they could really see the difference. The good thing about people

living in the city in apartments who were not able to get the wall box could actually buy an EV and could park for free in the city because it was free at the time. It is very expensive to park in the city. They could go to work, switch the battery and keep moving. I think it was a brilliant project they put into reality, but when it fell through it really hit the market because people were thinking oh better place, good thing we didn't buy that electric vehicle. Electric vehicles don't work, look at better place. It gave electric vehicles a bad reputation because when people thought about electric vehicles it was better place and it didn't work. When they thought about electric vehicles they thought about better place. They couldn't divide those two so I think it was as big setback for us, but luckily Renault was really aggressive here and bought all those cars back from those who wanted to sell and said if you do not want your car, Renault actually wasn't bound by law to do so, but they would just say ok, if we don't do anything they will say if something happens in the future Renault doesn't care about us. They did not want that reputation. It was just a setback and it was a shame that the technology to swap the batteries to go further did not work out.

Jackie: which EV model draws the most interest?

Peder: the Renault Zoe at our place. A small 5 door 5 person car.

Jakckie: to wrap up, do you own an electric vehicle yourself?

Peder: no I do not because I could use it every day because I have 9km but my parents live 350km away ffrom hereand I have a family in finland which is 1850 km that way so it is not possible. The funny thing is that we have our own EV outside and if one of our co-workers is going to buy some food or something they always take that one because it is the fun one to drive. I do not have one, but I do not. I would like to have one but the range is the issue. But that is a little bit extreme. There are a lot of people who live in Copenhagen whose family lives in Copenhagen and always lived there. If they live in the other side of Copenhagen could easily use an electric car. But for me moving over here, it puts in the brakes.

K. Tesla Motors Copenhagen

Vin: So our first question is, What is your job title here?

Viktor: IM actually called a Product Specialist, so my role within the company is to do marketing and direct consumer relationships. So it's either plan a strategy on how to penetrate the Danish Market, how to put electric vehicles on the road, and how to form a direct relationship with the consumers, basically sales as well. Although in my title I'm not a salesman. But more marketing.

Vin: So on average, how many people a day contact this dealership looking for an electric vehicle?

Viktor: It goes through our headquarters in Amsterdam, we have actually, we have, a webpage and most of the requests are around trying out the car. If it's because people want to buy it, or if they're excited about it, about the car. And most of those requests come in in Amsterdam. And then people in the headquarters book in test drives for us here. Eh I would say we do now run ten to fifteen test drives a day. But that's only because we only have that much time during the day. But....with walk ins and everything we could say, I don't know, 20 or 30 people.

Jackie: so there's a large demand for it like you pretty much fill up every day?

Viktor: ya, that's also because a lot of people that are fans that are maybe not serious about buying, but they want to try out the car and see what it is about, and we are happy to oblige them because we know that we need to communicate the values of the vehicles because they are very different from normal vehicles to anybody. And then, they might sell it at a dinner party or something. To somebody who would then buy the car.

Vin: that's another way of advertising.

Viktor: ya we don't do commercial marketing, so ...

Vin: umm what have you found to be the major concern for these potential EV buyers?

Viktor: eh range mainly, what I've found personally is that people, when you have a product for 100 years which is the ice car, and it has established itself with a range of 500 kilometers, 300

miles it's difficult for people to accept less range. And then on top of that, our smallest model especially. But our biggest model it is not a problem. It has a range of 450-500 km. but the thing is that when you have an established product, people always relate to the values of the established product, they want to see those values in a new product as well. But when you have something disruptive in innovation I think, and some of these values are missing, at least in the beginning, what people don't realize in the beginning is that they don't need 500 km of range. Like 95 percent or 99 percent of your daily driving, you drive within your own city, and that's only about 30-40 km a day.

Brodie: so you're saying it's more of a consumer concern, but it's not actually as important as they believe? Because I know in Copenhagen they don't need to go that far, but if you're living in maybe the outskirts.....

Viktor: yes, it's not nearly as important as they believe. They just relate to the previous product, and they believe that everything the previous product could do, is needed for the new product. Although, they might not need it after all.

Vin: So to push that further, if Denmark's going to see a developed electric vehicle industry, like they're trying to implement further their environmental goals, what needs to be the industry's top priority, or the government's top priority, or Teslas top priority?

Viktor: Let's start with the government. The government's top priority would need to be to have some sort of subsidies, to help out the EV industry at the beginning. Personally I believe that when you have such a new technology, such a disruptive technology, trying to take over a new platform, you will have something that's called technology, lock in affect. That's because you have some things for your new product which is the electric vehicle missing in the beginning, infrastructure, this and that, and you will only get those things with more diffusion of electric vehicles. You need more electric vehicles to build the charging stations. Which comes first, do you start with the charging stations or do you start with the electric vehicle. That's a dilemma, the chicken or the egg. So that's when the government should step in and really help out in creating the infrastructure, and as Denmark is doing, there's no registration tax on electric vehicles, normal registration tax on vehicles is normally 180% the highest in the world,

and a 25% VAT. So Denmark, they're doing a good job now, they could do even, going in further. Abolish the VAT. As well, as they have done in Norway, that would help. Also, done a good job in building charging infrastructure here actually, through clever which I believe the government owns a bit in. What was the other? There was government and

Vin: and then Tesla, are you working with the government, are you like trying to, is there any kind of, lobbying, or anything like that?

Viktor: I can't see, I haven't seen the lobbying directly, it's probably more upper level than here, but were probably doing it at some places, like uncasually, not on paper. What we're going to do is build a supercharger network. That's how were going to spread it, and um, I don't know how we are lobbying actually. But with the current registration tax it will not be on electric vehicles until the end of 2015, and that's according to the laws that are in place now. SO there's probably someone lobbying to prolong that period.

Vin: and then, you mentioned how in Norway they have the best EV industry in the world, what are they doing, because Denmark does have these incentives, um and they seem to be pretty similar to Norway's, so what do you think is leading to Norway having a much more developed industry?

Viktor: They have even more incentives for Ev's, so first the VAT. They don't have the VAT on electric vehicles, and they have the same registration tax, just like Denmark. They allow Evs to drive on bus lanes, free for ferries, free for tunnels, free for everything for electric vehicles In Norway. They have a lot of money, the Norwegians. Their currency is very very highly priced, but still cars are expensive with the registration tax which makes the Tesla model S a very cheap model over there. It's cheaper for a Norwegian to buy a Tesla Model S than a Dane because his salary is much higher than a Danish persons. But it is expensive to buy normal cars there. And then the third thing that is very important for the Norwegian is that they produce their own electric vehicle, ten, twelve or thirteen years ago which is called Think. It was bought by GM later. But it means that EVs have been promoted a lot some years ago in Norway, I believe that ah the values of EVs have been communicated better there, over a longer period of time. So they are actually less skeptical than for example Denmark.

Vin: so when consumers come looking for the Model S, or I guess they can pre-register for or sign up for the Model X, um are they looking for it as their primary car or their secondary car?

Viktor: Most people want it as their primary car. Because they know that we can offer that in that car.

Vin: Because of the Model S with their range,...

Viktor: and then the superchargers, so you can actually travel.

Vin: so since the model S has really blown up, I'd say, even in the U.S. too, you see them everywhere now, we'd probably say you're the leader in the EV industry right now also, how does the model S, compare in its specs, compared to the hybrids, gas and diesel, the other cars on the road today.

Viktor: You mean performance wise? Or efficiency wise?

Vin: efficiency.

Viktor: If you charge a model s at home , the biggest model has an 85 kw/hr battery. From charging the vehicle to driving it, you get about 80% efficiency. So you're using 80% of the electricity you're getting out of the plug. 20% goes to waste, through converters and heat and stuff like that. If you have a normal gasoline engine, you had around 20% efficiency on the energy that's in the gasoline itself. You have around 30% efficiency in a diesel engine. It's much much much better. If you compare to a hybrid vehicle. I studied this a lot actually. Not hybrid, did you say hydrogen as well?

Vin: No hybrid. Hydrogen seems like it kind of died a little.

Viktor: ya ya ya you have some extra processes, it doesn't really make sense to me that technology. But um to hybrid vehicles, because, I read some studies about hybrid vehicles vs diesel vehicles and that's not a big difference in how much fuel is actually used. But then again, hybrid vehicles are much more popular in the U.S. than in Europe. And 4 states in the U.S. ,

selling of diesel is banned, because of emissions. So my theory is that American's buy hybrid vehicles because they don't have the choice of buying diesel. The infrastructure is lacking for that. So they get the fuel efficiency to have a diesel vehicle, but still having the infrastructure of gasoline.

Vin: ya it also seems that the diesel vehicles provided to the U.S. citizens are higher class models. Like the Mercedes, their SUVs, are blue tech diesel.

Brodie: I would say you can get diesel like at a normal gas station, but you don't see as many diesel cars in the U.S. unless it's like a big truck or something like that.

Viktor: It hasn't caught on somehow.

Brodie: In the 70s they had a car called I think like the something rabbit and it got like 450 miles.

Viktor: I think I saw a photo of that. And it was a talk or something and it said this is the reason it hasn't caught on because it was a horrible vehicle.

Vin: so even though the model S is superior compared to other EVs but it seems to be pricier because of what you're getting out of it, it's also I'd say, I'd call it a luxury car, so is tesla ever going to try to focus on a lower end car. That is just as efficient, maybe a lot less luxury, that's more common for every class to buy?

Viktor: Definitely. We're going in that direction in the next years. We started with the Roadster, which is just a toy, its actually built on a Lotus body, we took the chatty from the Lotus, it's very cool. And then in 2008 first a huge battery pack was just put in the back of the car using only laptop batteries. Normal laptop batteries. Not modified at all. Just stacked together, I think it was 7000 pieces or something. You can get 3 or 400 kms out of it. It still um 3.7 seconds to 100 or 3.7 to 60 mph. and then the model s which is cheaper more practical. It's also a sports car that is more practical as well for families you can have 2 children in the back and then 7 adults, so 7 people in the car. So our plans in 2017 is is to give our a 3rd generation tesla, we haven't got a name on it yet. It's going to have at least 200 mi range and it's going to cost 50 to 60% of

what the Model S costs. It's going to be similar in size to the BMW () or the Audi A4. And that's our plan to penetrate a bigger portion of the market. The reason we have done it this way first the roadster then the model s, and then the third one. This is to allow us to develop the technology and to gain some cash. To do that actually. And also, its easier to sell high end product, because you can sell less and still get the same money. It's difficult to penetrate the market from the low end. It's very difficult. That's our plan and it is working.

Vin: So you're aware of better place and their former failure, but , their idea of battery swapping, technology, is tesla ever, or are they considering that, or is it fading out of the EV industry.

Viktor: Actually the car is designed to do it. Have you been on our webpage? There's a video we had this huge event in California, we show that the model S, we drive it in, and then we have a video in the background of someone driving in an Audi v6 or something, and we switch out the battery of the model S with a robot underneath in 90 seconds, put a whole new battery in, but we haven't implemented it in a single station yet. We might do it in the future I just heard that they were talking about doing it at one or two stations in California, just to test it out, see how it works, but then again you can't get 320 km of range just by charging at a super charger in half an hour. SO it's a question of if you want to get a full battery in 90seconds or get 320 km in a half hour for free. Because at super charging stations they are free. When you buy a car its included in the lifetime of the car.

Brodie: You get the charger if you buy the car?

Viktor: ya

Brodie: so what would the cost be if you're putting in a battery swapping stations like somewhere in the country that's not in someone's home? Compared to putting in one of those superchargers?

Viktor: Cost for us? Or cost to implement?

Brodie: to implement, because if like someone wanted to charge like out on a highway, vs a battery-swapping...

Viktor: ya to implement it is very expensive to put in a battery swapping station. I don't know how much it costs but I heard some rumors that it might not be practical though because the supercharging is free so and were going to sell, well sell like, one battery swap or less on 100 ??so it would be less than filling up an Audi A something but nevertheless we think a lot of people would choose to do it for free instead. And how would we then justify the investment if we already have free current design. It would only be for a niche group that is always in a hurry. So maybe but were going to do one or two stations in California to test it out.

Larry: so the supercharger only takes about 30 min?

Viktor: ya for 300km of range, but the thing is that when you charge a battery the last 20 % takes just as much time as the first 80% so you would never wait for a full charge... that's how batteries work.

Vin: and then ahhh the last question that we have scheduled is just asking about the model X and how much interest has it generated so far.

Viktor: Huge. The thing is that we have I think official information that we have around 7,000 reservations already given that we sold I don't know how many model S's in the first year. At least we produced 20,000ish . So 7,000 compared to how much we sold in the model s the first year is huge. Were already selling so much of it, well sell thousands and thousands even before producing it. So it's going to be a huge success I think.

Vin: so does that have the same battery system?

Viktor: yep. It's actually built on the same chattythe components of the car are around 60 percent the same. And that's how we achieve economies of scale as well. It just makes economic sense. But it's going to have seating for 7 adults and these crazy falcon wing doors. Pretty cool. Our plan is to release the first ones to customers December this year in the U.S.

Vin: what's it going to be going for?

Viktor: We don't know yet actually, well I don't know yet, it's just a little bit heavier than the model S, it has 60% the same components, it's just a little bigger and has more seats so it should be a little more expensive in my opinion.

Vin: I agree.

Viktor: I hope it's not too much more expensive, because you have like Audis, you have Audi Q7 vs Audi S8 or something and you don't see the Q7s or Q5s much more expensive than the other ones. SO I think they should be similar priced. Maybe a little more on the X.

Vin: Ok, do you guys have any more questions?

Brodie: ya could you tell us more about, I know you did some type of project with Iceland, what were your findings with the major barriers?

Viktor: ya um actually our recess question was, I can't remember it literally but what are the ehh barriers and drivers to the diffusion of electric vehicles in Iceland? And how can product business and government overcome the barriers to penetrate the market of some sort. And we found, have you read the theory by eh what was his name again, Arret Rogers, Diffusion of Innovations? Check it out, Diffusion of Innovations, he is like the father of the diffusion literature of innovations and eh he made these groups, you probably have heard, of the early adopters, you have innovators, adopters, early majority, late majority and late adopters. And you just, he began with agriculture sciences I believe it was in the early fifties, and he found this curve and he created those groups and everything. And a lot of research has been done on those like crossing the chasm, have you heard of that? It's when you go from what was it, umm early adopters and you have a big hurdle because you have very enthusiastic people in the first category....no sorry it was after early adopters to early majority. That is the big hurdle. At the chasm. You have enthusiastic people at the beginning of the early majority, ehh there might be success at the beginning sold to the innovators and early adopters. So we would try to find ways how to penetrate the early majority given that this theory is correct. And we found a lot of empirical evidence that supports that. And our main goal is that you would need to me identify a niche market group in the early majority. So first find the early majority, you don't need to

focus too much on the innovators and the early adopters because the car will sell itself. As a given. You just need to provide them with good service and do what you do. The other ones, those are the big challenge. Our thing was with we identified that Icelanders who live in the capital area, we have two-thirds of the people living in the same area. If you're in there then range is not really an issue. So families that have private houses so they can charge the car, we found that they own two or more cars as well, because if you sell them one electric vehicle that has maybe 180km of range they can use it for 95% of their needs. But they need to own another car to have the possibility to drive somewhere further. So if they focus on these people you will be able to sell a lot of electric vehicles and you have a very very good niche group in the market. I think. Ehh what else did we do? Then we found out ya we found out by reading another theory by Clayton Christianson which is about value the value of disruptive innovations vs. innovations. So when you have such an innovation like an electric vehicle it really hard to come to terms with for people because it breaks down the values of older innovations, like for example in range, an electric vehicle with 180 km you might, it might be enough for you, you might not need the same as a previous innovation. But 180 is enough. This is difficult for people to understand. They need to know there might be less performance but it is still good enough for you. So our suggestion, or my suggestion, we didn't write it but for like in a dealership in Iceland, selling Nissan leafs, about 200 km range, I would just take, I would pluck people out of this market, the niche group and just lend them the car. Have this car for a week and do the charging and everything and then they would actually realize that they don't need the same performance as in the other vehicles. The best way of selling products is just lending it out so and then we have someone who is willing to adopt it, in the early adopters majority group, people in the early majority group are the most likely to communicate with each other. That's why you need to grasp. You have early adopters that don't communicate with early majority. There different kind of people and that's the problem. But if you penetrate a little bit of the early majority group it's just like innovation of Normandy on d day or something. You need to go to one point at the beach to be able to penetrate the whole of Europe. You couldn't like attack it at all places at once, you would have lost so... similar.

Vin: do you guys have anything else?

Jackie: do you have one yourself?

Viktor: not yet I graduated in august but I'm working on it.

Vin: so how did you get involved with tesla?

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