Socio-economic factors influencing the electric vehicle buying process in Iceland

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Acknowledgment

All along the process, this Bachelor thesis has been quite a challenging work. From impediments to moments of joy we experienced a very interesting and formative adventure. As a team, we managed to cooperate and work side by side in the same direction in order to obtain the thesis we believe we can be proud of.

This could not have possible without the help of fundamentals actors. First, we would like to thank all the Icelanders participants that contribute to the essence of our project. Then, we shall underline the support and help of our supervisor, the great Icelandic Viking, Albert Thor Magnusson.

We would like to extend our thank you to the women, Ania Kääspelainen and Clemence rentil-cloucli, that we consider the most and who have played their part in supporting and motivating us during harsh times.
We also would like to thank the two most important people that stood there until the very end. Momo Kaczyńska and Benja Kia have been the perfect friends that anyone could wish.

Finally, we would like to dedicate this work to all young professionals who are starting their carrier with idea of creating a better tomorrow for future generations.
“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

by United Nations & Brundtland Commission
Abstract

Title: Implementation of electric cars in Iceland.

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Key words: electric vehicles, Iceland, socio-economical, renewable energy, transportation, alternative transportation,

Purpose/Goal: The aim of this research is the analysis of socio-economic factors that would influence consumer buying process of electric vehicles in Iceland. The purpose of the research is to detect the most crucial factors influencing Icelanders decisions for and against purchasing an electric vehicle, instead of car with internal combustion engine. This research verified people's opinions and can bring companies closer to real mindsets of Icelandic potential buyers. Moreover, this paper might give a possibility to eliminate wrong thinking and barriers by better adjusted marketing. Additionally, analyzed advantages might show what the main reason of shifting to this alternative technology is. Moreover, it shows what might be the customer acceptance price range.
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<tr>
<td>BEV</td>
<td>Battery Electric Vehicle</td>
</tr>
<tr>
<td>EV</td>
<td>Electric Vehicle</td>
</tr>
<tr>
<td>CARB</td>
<td>California Air Resources Board</td>
</tr>
<tr>
<td>EV</td>
<td>Electric Vehicle</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gases</td>
</tr>
<tr>
<td>HEV</td>
<td>Hybrid Electric Vehicle</td>
</tr>
<tr>
<td>ICE</td>
<td>Internal Combustion Engine</td>
</tr>
<tr>
<td>PEV</td>
<td>Plug-in Electric Vehicle</td>
</tr>
<tr>
<td>PHEV</td>
<td>Plug-in Hybrid Electric Vehicle</td>
</tr>
<tr>
<td>V2G</td>
<td>Vehicle to grid</td>
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1. Introduction

In this chapter, problem background is introduced to describe where from the idea of electric vehicles implementation is coming and what the topic is about. Additionally, the electric vehicle summary is presented in order to give a better understanding of the topic. The following part emphasizes the problem discussion and brings the reasons not only why this topic is relevant but also why it was chosen as field of this study. The research limitation indicates which part of the electric vehicles market is going to be main field of interest. In the perspective of making this paper easier to understand few key words and abbreviations are underline in that purpose. The final part of this chapter outlines all the chapters content regarding this paper.

1.1. Problem background

Nowadays, energy is considered the most precious thing that has governed the world since Industrial Revolution. In fact, over the centuries countries have suffered, argued and even went to war to make sure that what is usually called “black gold” will always be considered as granted.

Today, most of the planet resources have been exclusively exploited by industrialized countries leaving the rest of the world in constant demand and dependency (Keeler & Thompson, 2008). However, this unequal situation could not have lasted any longer when people and especially governments started to question fossil fuels (coal, oil and gas) supremacy (International Energy Agency, 2009). The protocol of Kyoto has been presented in 1997 to decrease greenhouse gases emissions worldwide, 184 nations have ratified it except USA and Kazakhstan (UNFCCC) (United Nations Framework Convention on Climate Change, 1998). Even though these not infinite resources are predicted to last a little longer due to the demand in developing countries, the world is right now facing one of its biggest environmental changes in history (International Energy Agency, 2009). The main idea is to stop the increase of greenhouse gas emission as a cause of global warming phenomenon. In fact, most of the oil and gas companies have already decided to cut their budget in order to keep the pace of renewable energy race (International Energy Agency, 2009).

Besides, as worldwide population is expected to increase for more than three billions over the next 50 years (Eric Martinot report), representing a 1.5% yearly growth of worldwide primary energy demand within the next 20 years (CO₂ emissions reached 28.8Gt in 1990 for 40,2Gt projected in 2030) (International Energy Agency, 2009). The conclusion is now clear: fossil fuels will never be the energy of tomorrow. CO₂ emissions and greenhouse gases are now pointed out to let the new energy take place on the international stage, known as renewable energy. Therefore the rule is about to change because the question is no longer whether diesel and petrol will be replaced by electricity or hydrogen to fuel a car, but it is more a question of when.

According to the research done in 25 EU countries in 2003 and 2004, road transportation consumed around 82% of total energy used for mobility (Perujo & Ciuffo, 2010). Therefore, passenger cars sector is responsible for 63% of carbon dioxide emission (Perujo & Ciuffo, 2010). Additionally, transportation sector emits most of particular matters (Wolff & Perry, 2010). World Health Organization estimates that particular matters are responsible for decreasing a life time of average European citizen of 9 months (Dablanc, 2008).
According to the research done in Dijon in France, private cars are responsible for most of carbon monoxide (CO), nitrogen oxide (NO\textsubscript{x}) and hydrocarbons (HC) emissions. Besides, significant share of sulfur dioxide (SO\textsubscript{2}) and particular matters (PM) comes from combustion process in private cars engines (App. II).

Currently, petroleum and diesel are most commonly used fuels in transportation sector worldwide. However, available alternative technologies have a potential to decrease emissions from vehicles. Internal combustion engines used in most of cars might be easily adjusted to combust natural gas. Natural gas is called fossil fuel with a lower impact on the atmosphere, but it has strongly limited possibility to reduce pollutions in long term scenario (Nijboer, 2010). Therefore, it is not taken into account as a potential alternative for petroleum and diesel (Nijboer, 2010).

The other very well-known alternative for fossil fuels are biofuels. However, to estimate GHG reduction, it has to be done in very carefully analyzed process of biofuels production. Moreover, first generation biofuels are called short term solution because it can determine the increase of food prices and lack of food in poor regions in longer term. As a result, biofuels of first generation are not seen as an alternative for fossil fuels. Nevertheless, biofuels of second and third generations are seen as more promising solutions. (Naik, Goud, Rout i Dalai, 2010)

During the last years, most of the car manufacturers have seen the opportunity in technologies based on hydrogen. Thus, the main barrier is the physical properties of hydrogen which makes it very complicated to isolate from environment because of its reactivity (Icelandic New Energy, 2011).

Electric vehicles can be grouped into hybrid- electric vehicles and battery electric vehicles. An emission in hybrid electric vehicles depends on a kind of fuel used by an engine, batteries charging and discharging during drive, efficiency of a battery and energy resources. In battery electric vehicles, emission depends on efficiency of battery and resources used to generate electricity later used by a car (United States Department of Energy, 2005).

Most of the people in the world live in cities, in which there is the biggest concentration of vehicles. Therefore, even if electricity used by electric vehicles comes from fossil fuels, there is a possibility of decreasing local emissions (Dablanc, 2008). Additionally efficiency of energy generation is higher in electric vehicles than in internal combustion engines. According to MacKay, a car traveling 50 km per day needs around 40 kWh per day in case of internal combustion engine (ICE) and 10 kWh per day in case of electric vehicles (Perujo & Ciuffo, 2010). Thus, it is easy to see that there will be less pollution with less energy, if we assume that in both cases the energy comes from the same source. Additionally, the efficiency of power plants is usually higher than onboard engines.

Considered nowadays as “any car or truck that can be recharged from an external source of electricity”, electric vehicles (“all electric” or “hybrids plug-in”) are not a new paradigm as everyone would think (Sandalow, 2009). In fact, EVs have existed since the eighteenth century but have known many pitfalls along its expansion (Electric Auto Associaciation, 2011) (Georgano, 1996) (McMahon, 2006).

Even though the principle of the battery was founded by Italian L. Galvani in 1786 and while one of the electric motors was developed by American T. Davenport in 1837, these were France and England to first develop electric vehicles (Georgano, 1996) (United States Department of Energy, 2005).
In 1847, first vehicles powered by batteries and electric motors (railway locomotives) appeared. Several decades later, in 1888, the first battery powered road vehicle (tricycle) was introduced by the French inventor named Gustave Trouve (Georgano, 1996).

Until the beginning of the 19th century, battery powered vehicle outsold petrol fuelled cars ten to one. Indeed, electric vehicle benefited back then from more positive characteristics (EV did not require gear changes for instance) compared to the ones of the gasoline cars. (Electric Auto Association, 2011)

American companies such as Oldsmobile & Studebaker were the most significant ones that took advantage of this successful phenomenon. However, this new era did not meet the expectations due to its limitations and started to encounter its first impediments in the early 1900’s. As a matter of fact, battery and range issues were pointed out along with the inconvenience of the recharging process. (McMahon, 2006) (Electric Auto Association, 2011)

What is more, roads were in extreme conditions which made it more difficult for those vehicles carrying heavy loads of battery to be lifted or pulled away. The only utilization left for electric vehicles was inside the city judging by higher quality roads and shorter distance. (McMahon, 2006) (Electric Auto Association, 2011)

On top of that, famous car manufacturer Ford set up in 1904 the first motorized assembly line production which enabled him to produce gas powered cars in volume. This sort of economies of scale led to the reduction of the cost and the mass produced Model T (in 1910) left no chance to electric vehicles. By 1914, 50% of the American cars were Ford Model T and electric vehicles were back to being a niche market. (Electric Auto Association, 2011)

Electric vehicle regained interest was noticed few decades later (in the 60’s) when concerns about air pollution were mentioned and highlighted. One of the other reasons would be the 1973/1979 OPEC oil embargo which marked a sudden rebirth and led to a more likely future for electric cars. (Electric Auto Association, 2011) Along with this perspective, governments started to implement laws (Clean Air Act Amendment, early 90’s; Energy Policy Act, 1992) and regulatory actions (regulations from California Air Resources Emissions) enabling the virtuous cycle to begin. In order to facilitate EV purchase among some population, several governments set tax credits reduction and launched incentives to attract potential environmental minders. (United States Department of Energy, 2005)

Nowadays, technological improvements have driven governments to more correct actions. In parallel, countries like Israel, Denmark or even capital cities such as London, Paris and Oslo are planning in the nearest future to replace current fleet by electric vehicles (European Environment Agency, 2010). From Toyota (Prius) to Renault Nissan (Leaf), and from Mitsubishi (i-MIEV) to BMW (Mini-E) the goal is now to implement the most complete electric vehicle model that will ease the new customer appetite and enter the growing sphere of environmental friendly companies (App. I). More than an image, it stands as a symbol, a belief, something more and more valuable that mostly everyone considers. It is said that Electric vehicles could correspond to 60% of worldwide new sales and represent up to 25% of the global car fleet (European Environment Agency, 2010).
1.2. Problem discussion

When taking a closer look at the automotive industry which will be the predominant topic of this thesis along with the Icelandic nation, one of the most noticeable trends of the last decade is the race that every car manufacturer is leading within the electric vehicle market. Actually, customer awareness for “green” vehicles has never been higher than today, especially in Iceland where its entire population, devoted to its natural likelihood, is only praising for electric cars. As a matter of fact, Iceland is looking for a complete electrification of its car fleet by 2012 (New Beginning project) (Sighvatsson, 2009). Its president, Ólafur Ragnar Grímsson, as even expressed his wish hoping to become the first 100 percent clean energy country in the world (Grímsson, Selected speeches: The President of Iceland, 2010).

Iceland gathers all the characteristics to demonstrate that BEV implementation can be a successful process. Years ago, most Icelanders thought their country was falling apart after financial crisis. Nevertheless in the perspective of mitigating this disaster, the government suggested that the only way to stay as competitive as possible was to focus on the BEV market. Today, the 320 000 inhabitants of Iceland are already or about to purchase an electric vehicle model and car producers are not even hesitating to launch their new concept car on this country anymore. (Sighvatsson, 2009) Once you have all the multiple areas covered and ensured of their pure renewable energy generated electricity, this country offers you the greatest opportunities that all car manufacturers dream of: perfect territory and a favorably disposed population (Grímsson, 2009).

Some of the car manufacturers are already producing commercially available electric vehicles in order to tap into the Icelandic market. Most of the biggest car companies plan to introduce electric vehicles on commercial scale within the next two years. It is then, the right time to take whatever the means we have to explore more deeply this intriguing country. (App.I)

This means conducting a research concentrated on socio and economic aspects regarding electric vehicles implementation in Iceland. In fact, this research might help companies from auto industry sector to understand consumers’ behavior, evaluate number of potential electric vehicles’ buyers in Iceland and, more likely, define a proper marketing strategy development to increase the effectiveness of one’s promotion.

There were few researches conducted regarding hydrogen vehicles implementation in Iceland that gave very positive results. Icelanders were interested in a new more environmental friendly technology in transportation that might decrease expenses of importing oil and petroleum from other countries. However, there were not any researches done about EV in Iceland.

Moreover, many technical researches proved that existing Icelandic energy grid and capacity of power plants are able to deliver needed amount of electricity for large fleet of BEV in the country (Ólafsson, 2008).
1.3. Purpose

The aim of this research is the analysis of the socio-economic factors that would influence consumer buying process of electric vehicles in Iceland. The purpose of the research is to detect the most crucial factors influencing Icelanders decisions for and against purchasing an electric vehicle, instead of car with internal combustion engine. This research verifies people’s opinions and might bring companies closer to real mindsets of Icelandic potential buyers. Moreover, that might give a possibility to eliminate wrong thinking and barriers with better adjusted marketing. Additionally, advantages might show what are the main reasons of shifting to this alternative technology.

That information might be useful not only for car companies but also for Icelandic Government, local authorities, environmental and energy oriented organization.

1.4. Research questions

What are the main social and economic barriers from the Icelanders' point of view when dealing with EV implementation?

What are the most significant advantages of EV that influence your decision during buying process?

1.5. Research limitations

When dealing with electric vehicles implementation in Iceland one has to take into account all the various aspects of such a broad and complex area. As a matter of fact, it is more likely to consider in the first place all the technical, social, environmental and economic issues that could intervene during the process. The best example to give would be the case in which tests are conducted in order to ensure that Iceland will be suited for such a sophisticated installation.

Besides, it is not possible to present in this paper all the relations between the several variables. This is the reason why there are presented only some of them that are especially related to the research questions.

After having pointed out all the aspects that would need to be covered, it is worthwhile mentioning that this thesis is mainly elaborated on a marketing approach. In fact, it is impossible to discuss all these areas in one project and besides, the field of study in this thesis remains above all marketing oriented. Therefore we will linger on the process of apprehending and understanding the Icelandic electric vehicles buying process by conducting a complete market research.
1.6. Definitions of Basic concepts

BATTERY ELECTRIC VEHICLE - a kind of vehicle powered by large batteries installed in the vehicle, gives a possibility to operate without greenhouse gases emission (Sustainable Energy Ireland, 2007).

HYBRID ELECTRIC VEHICLE – a kind of vehicle powered simultaneously by batteries and engine or fuel cell (Sustainable Energy Ireland, 2007).

SEGMENTATION- a part of the market where customers behave in the same way, have the same need for purchasing products, which means responding in a similar way (Kotler, Armstrong, Wong i Saunders, 2008).

TARGETING- process of estimating attractiveness of different segments and selecting the most promising one to enter (Kotler, Armstrong, Wong i Saunders, 2008).

POSITIONING- the way a product is placed in comparison to its competing products in the mind of the consumer (Kotler, Armstrong, Wong i Saunders, 2008).

1.7. Outline

The next chapters are structured as followed. The purpose is to outline all the chapters in the perspective of contextualizing our thesis.

Chapter 1 underlines the problem background and discussion that mark the essence of our thesis. The purpose is introduced as a main goal to attain. Research question and limitations are also presented in this chapter.

Chapter 2 emphasizes the already existing research regarding socio-economic aspects of electric and hydrogen vehicles in both markets.

Chapter 3 deals with the research methodology. It defines the method used and how the research has been conducted in a very detailed manner.

Chapter 4 entails the empirical data and data collection. The chosen research is both qualitative and quantitative. Questionnaires have been conducted in the case of data collection.

Chapter 5 stresses on the data analysis. The results of the research question are exposed and analyzed for the appropriate purpose.

Chapter 6 and 7 include the discussion and conclusion relative to the results revealed.

Chapter 8 describes the further problems that are set in the perspective of extending our thesis.
2. Theoretical framework

The first part of the theoretical chapter gives an overview of conducted socio-economic analysis regarding hydrogen vehicles in Iceland from 2001 to 2008. Most of those researches are done by Icelandic New Energy Company which deals with hydrogen vehicles implementation in that country. The second part of the chapter presents similar research on EV done worldwide in order to analyze what a general opinion about EV in different countries is. The final part is related to marketing theory needed to analyze the data collected in the survey.

2.1. Hydrogen socio-economic analysis

2.1.1. Survey 2001

First survey regarding social issues of hydrogen implementation in Iceland was done by University of Iceland in December 2001. The survey was done on 1200 people, among who 57% live in Reykjavik area and the other 43% in different parts of Island. Approximately 70% of respondents agreed to answer the questions. It was conducted by telephone on randomly chosen people in age from 16 up to 76 years old. Respondents were asked to answer to 7 questions, first two about recognition of New Energy Iceland and the rest regarding hydrogen as a fuel. (Thorolfsson, 2002)

According to this research, the positive or even very positive opinions on implementation of hydrogen as a fuel for vehicles and vessels had 92% of respondents. The same number of respondents answered that there should be more information available about hydrogen technology. Three fourth of the tested population responded that the hydrogen technology is environmentally friendly. (Thorolfsson, 2002)

2.1.2. Survey 2004

The socio-economic research regarding acceptance of hydrogen as a fuel was conducted in Reykjavik in March 2004 on board of hydrogen buses used in city transportation system. The research was a part of the project supported by European Commission, called Ecological City Transportation System (ECTOS) and proved high acceptance of hydrogen energy utilization development by population. The developed questionnaire includes ten mostly closed questions that were given or read to the bus passengers (Benediktsson & Maack, 2004). Additionally, the respondents were asked some general information such as gender, age. The reaction of respondents on the survey was positive in 92%, 7% did not have any opinion and 2% had a negative opinion. (Benediktsson & Maack, 2004)

According to this research, 86% of respondents have positive opinion regarding replacing oil by hydrogen in transportation and from this number 48.5%, so more than half of respondents have even very positive opinion on the subject. The Icelanders asked to provide the main reason for this, answered that it is due to the following factors: less polluting fuel (44%), more environmental friendly (14%), clean fuel without pollution (6%), beneficial for country (5%) and the other indicated other reasons. Moreover, the result proved that the positive opinion about hydrogen as a fuel decreases with age. (Benediktsson & Maack, 2004)
This research includes also a part related to the economic issues of hydrogen implementation. According to this part, an interesting result is that around 36% of respondents are able to accept higher price of hydrogen than gasoline at the first stage of the implementation. Additionally, the Icelanders were asked about general hydrogen price acceptability. The 71.6% stated that they can accept this fuel even if the price is equal, in this 27.4% could accent price higher of 10% and close to 10% even higher of 20%. (Benediktsson & Maack, 2004)

Close to 50% or respondents stated that they do not have knowledge about safety of hydrogen and the same number of tested people answered it is safe or very safe. However, still around 60% of tested people perceive the implementation of hydrogen buses in their city a very positive matter. It can be determined by environmental issues, because 76% of respondents answered that pollution from traffic is very problematic or problematic for the pedestrians. (Benediktsson & Maack, 2004)

The respondents were asked in the survey which word is connected with the hydrogen in their opinion and close to half of tested people answered clean fuel and only 5.1% chose so negative words or situation (Benediktsson & Maack, 2004).

Additionally there were questions developed on (Benediktsson & Maack, 2004):
- difference between traditional buses and those ones that use hydrogen as a fuel,
- evaluation of their knowledge regarding hydrogen,
- emissions from the buses in the bus stations,
- if the air quality has changed since the time of hydrogen use in some of the buses,
- how arduous is traffic noise,
- to add their own comments whether they would like to know more about this alternative energy source.

### 2.1.3. Survey on hydrogen buses drivers

According to *CUTE* survey conducted in Luxemburg on drivers of hydrogen buses, drivers from Reykjavik did not expect such a positive reaction of users of public transport related to hydrogen vehicles. Additionally they thought that hydrogen buses implementation was a great idea for future technology development. (Maack et al., 2008)

### 2.1.4. Survey 2008

The other social survey regarding hydrogen vehicles implementation was done in Iceland as a part of *HyFLEET: CUTE* project and published in 2008. The goal of this research was to analyze the Icelanders’ preferences regarding environmental issues and alternative energy in transportation. The results of the survey were very positive and very similar to the ones conducted in 2004. 80% of respondents supported the idea to replace all the buses based to be run on fossil fuels in city transportation system by hydrogen buses. (Maack et al., 2008)

This survey was based on different research method in comparison to the previous one, it was based on open questions and discussion regarding different problems in different focus groups. As it is written in the report, this kind of method is very useful for the marketing strategy development, because it provides better analysis the customer preferences. However, the results of this method should not be generalized. (Maack et al., 2008)
The first part of the survey was conducted in March 2007, the tested focus group includes young people, mostly students who answered the questions categorized in four main groups, listed below (Maack et al., 2008):

- Did you find any surprising information on alternative energy in transportation, if yes what kind of information was it?
  The answers were yes and they commented that materials are obsolete and fuels are not enough connected enough to discussion on environmental problems in Iceland. (Maack et al., 2008)

- The second question was related to the use of local renewable energy resources. The possible share of potential that can be utilized. What should it be used for in your opinion? What is the public permit for changing natural environment for renewable energy generation? (Maack et al., 2008)
  In this case, respondents agreed that the purpose of renewable energy utilization is important; the knowledge about the use of renewable energy for transportation should be more familiarized with public and that aluminum smelters are not the only solution for increasing of renewable energy use in Iceland. Many political aspects were included by tested group. (Maack et al., 2008)

- The third question is more related to the purpose of renewable energy use. Is the purpose of renewable energy utilization important? How is it important for the Icelanders to have energy independent economy?
  The tested group was more concentrated on visible, existing solution in daily life, like diesel engines and methane. Their knowledge about other alternative vehicles was unsatisfactory. (Maack et al., 2008)

- The fourth question area was related to the implementation stage of alternative energy in transportation. Questions were related to subsidies, information campaigns and a kind of alternative fuel that is preferred by population.
  Chosen group agreed that economics criteria are considered as an essential barrier for hydrogen in transportation market; as a solution for supporting alternative energy in transportation it was suggested to eliminate import tax for this kind of vehicles. Additionally, it was pointed out that free market and infrastructure convenience for customer should still be the factors that decide about customers’ decisions, but all public transport should be environment friendly and free of charge. (Maack et al., 2008)

According to the survey among young people, it might be stated that the main source of information in problem discussion are the media and the public usually accepts what they get from the media. The other important issue is that economic aspects are still the main influencer in the process of purchasing, but not environmental problems. (Maack et al., 2008)

The second focus group was divided into: owners of hybrid cars using internal combustion engine and batteries, so early adopters (9 owners, age: 30-50 years old) and specialists (8). This survey was conducted between September 2007 and April 2008, only few months before the crisis in Iceland. According to hybrids cars owners, a larger group of questioned people was skeptic about hydrogen technology, but plug-in hybrid cars and battery electric vehicles were seen as a possible alternative for traditional cars in terms of private fleet. (Maack et al., 2008)
Table 1. Developed issues during the discussion of alternative vehicles drivers

<table>
<thead>
<tr>
<th>Issues listed by ecological drivers</th>
<th>Criteria at purchase of environm. vehicle</th>
<th>Criteria in use of environm. vehicle</th>
<th>Criteria in refuelling</th>
<th>Criteria for future fuel systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st criteria</td>
<td>•Good impression</td>
<td>•Image – clean conciousness</td>
<td>•As easy as gasoline</td>
<td>•Too high price for oil will drive the development</td>
</tr>
<tr>
<td></td>
<td>•Esthetics</td>
<td></td>
<td></td>
<td>•Safety</td>
</tr>
<tr>
<td></td>
<td>•Curiosity</td>
<td></td>
<td></td>
<td>•Environment second</td>
</tr>
<tr>
<td></td>
<td>•Interest in technology</td>
<td></td>
<td></td>
<td>•Access, convenience and familiar know-how in operating vehicle</td>
</tr>
<tr>
<td>2nd criteria</td>
<td>•Positive image / enviro. image</td>
<td>•Efficiency</td>
<td>•Understandable</td>
<td>•Plug in electricity cars using Icelandic electricity and established grid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•proud of participating in pushing for development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd criteria</td>
<td>•Efficiency</td>
<td>•Space and convenience</td>
<td>•Easy access</td>
<td>•Hybrid systems foreseeable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•Good performance in snow</td>
<td></td>
<td>•Hydrogen efficency questioned</td>
</tr>
<tr>
<td>4th</td>
<td>•Cost</td>
<td>•Too much snob</td>
<td></td>
<td>•Fuel mix</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•Go for fuel independance without subsidies</td>
</tr>
<tr>
<td>Controversial</td>
<td>•Silent running</td>
<td>•Not efficient enough</td>
<td></td>
<td>•If Iceland can take own course and should</td>
</tr>
<tr>
<td></td>
<td>•Technology</td>
<td>Powerless</td>
<td></td>
<td>•Vehicles still imported</td>
</tr>
<tr>
<td></td>
<td>•Worse enviro</td>
<td>•More danger of catching lightning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Maack et al., 2008

The main opinions and discussion topics of specialists in energy market are presented in the table below. The arrows in the table illustrate conflict areas.
Table 2. Developed issues during the discussion of experts on the future of fuel systems

<table>
<thead>
<tr>
<th>Issues listed by experts on the future of fuel systems</th>
<th>Criteria at purchase of vehicle</th>
<th>Criteria for selecting new fuel types</th>
<th>Criteria for future fuel systems</th>
<th>How will transition happen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st criteria</td>
<td>NO new fuel vehicles on market</td>
<td>•Security of supply</td>
<td>•Price will rule the development</td>
<td>•Let the market have its way</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•Price</td>
<td></td>
<td>•Government must set policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•Efficiency</td>
<td></td>
<td>and support energy companies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•Locally made</td>
<td></td>
<td>in tests</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•Clean fuel and vehicles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>should be less taxed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•Best option NOT a political</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>choice</td>
</tr>
<tr>
<td>2nd criteria</td>
<td>Convenience</td>
<td>•Depend on international technical</td>
<td>•Environmental factors</td>
<td>•The value of environment</td>
</tr>
<tr>
<td></td>
<td>Accessibility</td>
<td>trends</td>
<td>will influence but not drive</td>
<td>and nature should be</td>
</tr>
<tr>
<td></td>
<td>cost</td>
<td>•Test what scientists recommend</td>
<td>Hybrids for efficiency</td>
<td>included in charge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•Companies should cooperate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>in testing new technology</td>
</tr>
<tr>
<td>3rd criteria</td>
<td>Environmental concern</td>
<td>•Electricity ideal</td>
<td>•Begin with fuel mix on market</td>
<td>Public movements should</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•Hydrogen too low efficiency</td>
<td></td>
<td>inform about all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•Methane too scarce, Ethanol</td>
<td></td>
<td>Warn about dubious</td>
</tr>
<tr>
<td></td>
<td></td>
<td>questionable</td>
<td></td>
<td>decisions</td>
</tr>
<tr>
<td>4th</td>
<td>Keep an open mind during transition</td>
<td>•Clean image good for Iceland</td>
<td>•Link to the independent locally</td>
<td>•Drawback that friends get</td>
</tr>
<tr>
<td></td>
<td></td>
<td>•Power production will cost</td>
<td>developed energy system</td>
<td>most funding rather than</td>
</tr>
<tr>
<td></td>
<td></td>
<td>environment. Impacts</td>
<td></td>
<td>all ideas.</td>
</tr>
<tr>
<td>Controversial</td>
<td>Ethanol not considered a local option / will develop internationally</td>
<td>Energy independence/ Cheaper to import fuel for a small market</td>
<td>Not consensus on taxation to low CO2 emissions. NGO's too negative, supportive discourse lacking Market-direction vs. Technology-direction</td>
<td></td>
</tr>
</tbody>
</table>

Source: Maack et al., 2008

The other focus group research as done during the workshops, when people were asked about their opinions in prepared discussions (Maack et al., 2008).

Since the hydrogen projects have been launched, greater interest in alternative energy transportation by media can be noticed (Maack et al., 2008). Therefore, the Icelanders have probably higher knowledge about hydrogen technology and electric vehicles than any other society because they were included in the process of new technology implementation.
2.2. Socio-economic analysis of electric vehicles worldwide

2.2.1. Survey of purchasing intentions

“Electric vehicle purchasing intentions: the concern over battery charge duration.”

(Cheron & Zins, 1997)

Fifteen years ago, according to the article entitled “Electric vehicle purchasing intentions: the concern over battery charge duration” electric vehicles concerns were back then presented as followed: weight, cost, limited charging capacity. Potential customers were at that time reconsidering the viability of such a concept that many limitations were associated with. Then, the question was set: What will the EV Market be needing to attract enough customers in order to assure its long term durability? (Cheron & Zins, 1997)

In other terms, it was clear that very few customers were willing to pay more just to hinder the effect of the pollution. The only way to position the electric vehicle in people mindset was in case of a second car. In fact, this could be seen as a good alternative when considering the limited driving range, limited autonomy and smaller size. Nevertheless, some studies and research argued whether or not the limited range could be seen as an impediment. One of them, concluded that it totally fitted into 80% of the population driving habits. (Cheron & Zins, 1997)

Furthermore, some correlated attitude survey advanced the conclusion that electric vehicle established good attitude results due to its clean and innovative image. However, when speaking about buying intentions, there is still a remaining difference between attitude and purchase that is why the report stressed on the development of the hybrid fleet as the first step of one promising transition. (Cheron & Zins, 1997)

Today, it is really hard to say that time has changed because EVs still struggle to be accepted due to their limitations. Prices are lower, the range is broader, the battery longer but other issues were questioned and additional motivational aspects were pointed out. Some studies and researches have been conducted recently in the perspective of understanding the behavior within the buying process (Heffner, Kurani, & Turrentine, 2007) (Caulfield, Farrell, & McMahon, 2010). (Cheron & Zins, 1997)

2.2.2. Survey conducted in Germany in 2009

“Who will buy electric cars? An empirical study in Germany”

(Lieven, Mühlmeier, Henkel, & Waller, 2011)

One particular survey released in Germany in 2009 describes perfectly the perception of German population sample regarding not only the use of the car but also the type of it. It was explicated and available on internet in 2010 through the article entitled “Who will buy electric cars? An empirical study in Germany”. The survey conducted online gathered no less than 1152 individuals (35, 9% female, average age 39.9 years old). (Lieven, Mühlmeier, Henkel, & Waller, 2011)
The procedure of the survey presented below includes input, data processing and output. Input includes individual priorities and preferences (Fig. 1). Later on this data is categorized and simplified to create individual barriers that affect the buying process. The final output illustrates the willingness of buying or not an EV.

Social preferences regarding price, range, performance, environment, convenience and durability were the criteria presented to the participants (Lieven, Mühlmeier, Henkel, & Waller, 2011). The goal was to shed light on purchase process barriers concerning the EV market and in order to identify vehicle models that may show signs of market potential for EVs (Lieven, Mühlmeier, Henkel, & Waller, 2011).

Figure 1. Overview of the procedure of research done in Germany in 2009

Source: Lieven, Mühlmeier, Henkel, & Waller, 2011
As anticipated, prices are showed to be the most important criteria for nearly all uses and types for both conventional and EV automobiles (Fig. 2) (Lieven, Mühlmeier, Henkel, & Waller, 2011). The range item is without doubt the best suited for EV with a continual increase while others criteria such as performance and durability plummet regarding people mindset (Fig. 2) (Lieven, Mühlmeier, Henkel, & Waller, 2011).

Use of car

The following part presents the German population preferences based on car use. According to the Lieven’s survey conducted in 2010 in Germany, some interesting findings could be underlined. The following charts are based on those survey results and have been simplified for better comprehension (Lieven, Mühlmeier, Henkel, & Waller, 2011).
On 1152 people interviewed, the chart shows the percentage of people that would choose a car according to its use. 80% of respondents declared that the purchased car will be used as a first car, only 20% of respondents will use the car as a family, secondary, commercial, leisure or an off road car (Fig. 3).

![Figure 4. Percentage of potential customers who may buy an EV](source: Own work based on Lieven, Mühlmeier, Henkel, & Waller, 2011)

For every different use, the figure 4 shows the percentage of people that would buy an EV. For instance, among the 80% of the sample who will choose to buy a car as their first car, approximately 5% of them will be ready to buy an EV. However, among 1% of the sample who will buy a car as an off road, 50% of them declared being ready to buy an electric vehicle.

![Figure 5. The most important factors regarding to the use of car](source: Own work based on Lieven, Mühlmeier, Henkel, & Waller, 2011)

Figure 5 represents the most important factor regarding the use of the car. The scale chosen varies from 0 to 6, where 0 is considered as insignificant factor and 6 is seen as an important
one. Without taking into account the difference between conventional or EV cars, the chart shows that the price is always more important than the range.

According to the use of the car, the price will be most important for the purchase of secondary cars compared to first cars. (Then, the amount of money spent to purchase a car according to its use will be higher for commercial cars > Off Roads > Leisure cars > Family cars > First cars > Secondary cars).

![Figure 6](image)

**Figure 6. The most important barriers according to the use of car**

*Source: Own work based on Lieven, Mühlmeier, Henkel, & Waller, 2011*

Figure 6 represents the most important barriers regarding the use of car. The scale chosen varies from 0 to 100, where 0 is considered as insignificant barrier and 100 is seen as an important one. According to the use of the car, the range will be most important for the purchase of secondary cars compared to first cars. (Then, the importance of the range to purchase a car according to its use will be higher for commercial cars > family cars > First cars > Secondary cars > Off Roads > Leisure cars). According to the chart, the price for the purchase of a first car is a more important barrier than for a secondary car. Moreover, the price could be seen as an economic barrier concerning First cars > Secondary cars > Family cars > Leisure cars > Commercial cars > Off Roads. As the chart shows, the range for the purchase of a first car is a more important barrier than for a secondary car. Furthermore, the range could be considered as a social barrier concerning First cars > Family cars > Commercial cars > Leisure cars > Off Roads > Secondary cars.

According to the Lieven’s survey conducted in 2010 in Germany, some interesting findings could be underlined. The following charts are based on those survey results and have been simplified for better comprehension.
Type of car chosen

The second part of this survey includes characteristics of chosen cars type by German population.

As it is presented on the figure 7, 31% of the sample will choose to buy a Compact cars, 30%, a MidSize cars and 15% will choose a Van.

For every different type, the chart shows the percentage of people that would buy an EV. For instance, among the 80% of the sample who will choose to buy a car as an executive car, approximately 12% will be ready to buy an EV.
Figure 9 represents the most important factor regarding the type of car. The scale chosen varies from 0 to 6, where 0 is considered insignificant factor and 6 is seen as an important one. Without taking into account the difference between conventional or EV cars, the chart shows that the price is always more important than the range if the type of the car is taken into consideration. Depending on the type of the car, the price will be most important for the purchase of compact cars compared to micro cars. (Then, the amount of money spent to purchase a car depending on its type will be higher for MidSize cars > Vans > Sports cars > SUVs > Executive cars > Luxury cars). Depending on the type of the car, the range will be most important for the purchase of Sports cars compared to Executive cars. (Then, the importance of the range to purchase a car depending on its type will be higher for MidSize cars > Micro cars > Compact cars > SUVs > Vans > Luxury cars).
Figure 10 represents the most important barriers regarding the type of car. The scale chosen varies from 0 to 100, where 0 is considered as insignificant barrier and 100 is seen as an important one. According to the chart, the price for the purchase of a Micro car is a more important barrier than for a Compact car. Moreover, the price could be seen as an economic barrier concerning MidSize cars > Vans > Executive cars > SUVs > Sports cars > Luxury cars. As the chart shows, the range for the purchase of a MidSize car is a more important barrier than for a Vans. Furthermore, the range could be considered as a social barrier concerning Compact cars > Executive cars > Micro cars > SUVs > Sports cars > Luxury cars.

The study sheds light on potential categories of EV buyers. Out of the 1152 interviewees it has been possible to identify 5% of EV potential buyers. This result can give the impression that the future of EV cars in Germany is not really promising. However, judging by the 3.5 million of vehicles sold per year, this small percentage will further represent at least 175,000 EV sales in Germany. The previous study brought some quite useful information which help understand some social and economic aspects that need to be taken into account in terms of EV buying process. The criteria mentioned are mostly the ones that always come up when dealing with EV. Other surveys have nevertheless pointed out some different items that are going to be discussed.
2.2.3. Survey on potential benefits and barriers of batteries

It is indeed the case in the article entitled “Beyond batteries: An examination of the benefits and barriers to plug-in hybrid electric vehicles (PHEVs) and a vehicle-to-grid (V2G) transition” published in 2008 (Sovacool & Hirsh, 2009). The authors Benjamin k.Sovacool Richard f.Hirsh have discovered through their research other aspects that also play their roles, what is explained further. For instance, the survey shows the necessity for some drivers to apprehend a more aggressive driving behavior with higher top speeds and more frequent acceleration. Those are some of the characteristics that one could have difficulties to encounter with an EV. (Sovacool & Hirsh, 2009)

Inversely, back in the 70s the Sherman survey on household travel behavior mentioned another example. For those who really desired to buy EV vehicles, their purchase was made regardless the performance. In fact, instead of criteria such as cost or range, the survey concluded that more psychological items stood out. For example, the style of the car referring to the shape or the color but also other attributes such as mobility or comfort. (Sovacool & Hirsh, 2009)

In parallel, another survey dating from the 90s pointed out the idea where EV purchaser was not only interested in buying EVs in order to make savings regarding fuel expenses but also to alter driving habits. As matter of fact, the idea was to create an “alternative traffic” with more careful driving habits. (Slower speeds, reduction of car accidents) (Sovacool & Hirsh, 2009).

The survey revealed also some facts regarding the charging time. The findings showed that the majority of people preferred to recharge their cars during the day instead of nights. The reason was that they found it annoying to ask hotel staff or parking attendants to do so. Furthermore, it was mentioned that most of these people were indifferent regarding the operational change of their EV into V2G configuration (Sovacool & Hirsh, 2009).
2.2.4. Survey in Ireland from 2010

The following article entitled “Examining individuals preferences for hybrid electric and alternatively fuelled vehicles” (Caulfield, Farrell, & McMahon, 2010) written by Brian Caulfield, Seona Farrell, Brian McMahon took a closer look at the EV implementation process when describing the limitations encountered in Ireland. A survey was conducted in order to deliver social and economic aspects.

In July 2008, taxes (vehicle registration tax and annual road tax) were introduced and proposed to the Irish drivers. The idea was to encourage people to buy EV vehicles in the perspective of lowering the gas emissions. The results are as follows (Caulfield, Farrell, & McMahon, 2010):

- It appeared that the change in tax rates had a tremendous impact on the EV sales (+30%).
- Also, the amount of new petrol cars sales has decreased by 19% after the VRT implementation.
- EV vehicles represented 3% of all the cars purchased in Ireland in 2008 after the VRT introduction.

Few surveys were cited in the article in the perspective of supporting the authors research and following results.

_The Potoglou & Kanaroglou survey (2007)_ mentioned in the article (Caulfield, Farrell, & McMahon, 2010) relates to that specific matter because it concluded the statement where “monetary costs, purchase tax relives and low emissions rates” would bring people to purchase EV cars. (Caulfield, Farrell, & McMahon, 2010). In the previous article (Sovacool & Hirsh, 2009) it was declared that federal tax credits managed to help ease high first costs. Nevertheless it was mentioned that facilitating tax policy was not applied to all owners.

Then, the _Dagsvik survey delivered in 2002_ and conducted in Norway shed light on two important aspects. The first one stated that Alternative fuel vehicle will be seen as much competitive as conventional cars if the infrastructure for refueling would be actually provided and available. The second one concerns the Driving range item, seen as an key attribute, considering that its improvement will dictate the future of electric vehicles (Caulfield, Farrell, & McMahon, 2010).

After covering these different areas, the authors leaned on the survey related to the Irish population regarding EV implementation. In the interest of obtaining valuable information, 500 questionnaires were sent to the customers of an Irish car company in March 2008. Only 168 questionnaires returned, leading to likely biased results due to a response rate of 34% (Caulfield, Farrell, & McMahon, 2010). The chart below presents the answers of the interviewers who were asked to rank the different criteria. The answer mention “Very important” was associated with a value of 4 while “not important” was attributed a value of 1. The criterion that was placed as most valuable to the interviewers was reliability followed by safety and vehicle price. The alternative fuel criterion was perceived to be less important compared to the others.
The VRT item was placed ninth followed by CO₂ emissions. Annual road tax seem to have little impact on EV buying decision process.

Table 3. Top ranking Ireland survey

<table>
<thead>
<tr>
<th>Rank</th>
<th>Attributes</th>
<th>Average score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reliability</td>
<td>3.76</td>
</tr>
<tr>
<td>2</td>
<td>Safety</td>
<td>3.75</td>
</tr>
<tr>
<td>3</td>
<td>Price</td>
<td>3.15</td>
</tr>
<tr>
<td>4</td>
<td>Style/appearance/image</td>
<td>3.11</td>
</tr>
<tr>
<td>5</td>
<td>Size of car/interior space</td>
<td>3.08</td>
</tr>
<tr>
<td>6</td>
<td>Fuel consumption</td>
<td>2.81</td>
</tr>
<tr>
<td>7</td>
<td>Performance/power</td>
<td>2.66</td>
</tr>
<tr>
<td>8</td>
<td>Brand name</td>
<td>2.48</td>
</tr>
<tr>
<td>9</td>
<td>Vehicle registration tax</td>
<td>2.48</td>
</tr>
<tr>
<td>10</td>
<td>CO₂ emissions</td>
<td>2.44</td>
</tr>
<tr>
<td>11</td>
<td>Road tax</td>
<td>2.25</td>
</tr>
<tr>
<td>12</td>
<td>Alternative fuel</td>
<td>2.23</td>
</tr>
</tbody>
</table>

Survey: Caulfield, Farrell, & McMahon, 2010

The rest of the results were presented as followed (Caulfield, Farrell, & McMahon, 2010):

- Fuel costs are most important for group aged from 17 to 25 years old and from 46 to 65 years old.
- The groups from 26 to 35 years old, from 36 to 45 years old and from 46 to 55 years old showed the same interest in Vehicle registration tax (VRT) when purchasing a new car.
- The groups from 36 to 45 years old and from 46 to 55 years old ranked the item CO₂ emissions higher than the other groups.
- The groups with income less than 19.999 Euros and those from 20.000 to 39.999 were perceived to be the most concerned regarding fuel costs when dealing with EV car buying decisions.
- The groups with income from 20.000 to 39.999 and those from 60.000 to 79.999 were seen to be the most concerned about VRT levels when dealing with EV car buying decisions.
- As income increases, the preoccupations toward CO₂ emissions lowers.
- Most of the interviewer declared that HEV vehicles are better for the environment than conventional vehicles with 34% strongly agreeing, 45% agreeing.
- Among all the respondents 40% agreed that HEV cars were cheaper to run compared to conventional cars while 35% neither agreed nor disagreed.
- These results show clearly that people seem not to be entirely aware of the advantages that HEV could represent.
- 43% of all interviewers mentioned the idea that HEVs would be the car of choice in the next 10 years.

In order to draw a relevant conclusion it is important to say that presented results give us a very good insight not only into the motivations of future purchasers but also a better understanding on how they might be influenced. When respondents were asked which attributes were the most important, criteria such as VRT and CO₂ emissions were low ranked, fuel consumption was mentioned as important given that it was ranked 6th out of 12. HEVs were considered by most of the respondents “better for the environment and cheaper to run than conventional vehicles”. However, they were recognized as “more expensive to buy than power fuelled vehicles”. Additionally, the majority of the respondents declared that HEV’s could be their future choice car in ten years’ time.
2.2.5. Survey conducted in California in 2007

The following article entitled “Symbolism in California’s early market for hybrid electric vehicles” written by Reid R. Heffner *, Kenneth S. Kurani, Thomas S. Turrentine (Heffner, Kurani, & Turrentine, 2007) exposes different aspects than those previously mentioned. As a matter of fact, EV can also be portrayed as a symbolic phenomenon.

In fact, this leads to the idea of self-identity where the selection of a specific car defines who you are through your interests, beliefs and values. It symbolizes ideas other than mobility, especially in vehicles that make use of new technology (Heffner, Kurani, & Turrentine, 2007). For instance, some recent EV owners shared opinion that by purchasing the EV they protect their family’s future or even making a grown up decision. Symbolic meanings speak more to early adopters, which according to an CNWMK research conducted in 2006, 31% of actual HEV owners declared that they purchased their car because it represented who they are. This relates to the idea of signifier (HEV) and signified (idea of environmental concerns) exposed by Ferdinand de Saussure.

The article also emphasizes all the associated meanings to the symbolic aspect of an EV vehicle. For instance, it cited preservation of the environment, the need to save money, the new mindset for renewable energy (Heffner, Kurani, & Turrentine, 2007). (Caulfield, Farrell, & McMahon, 2010)

2.2.6. Survey conducted in Sweden in 2001

This survey from 2001 starts with a different approach. As a matter of fact, the authors agree on the idea that such a product such as Electric Vehicle rarely sells itself to future customers without the support of national policies and a very accurate marketing strategy. The marketing aspect stands out when the authors mention the necessity to employ a “skillful marketing in the perspective of being accepted and diffused throughout the society”. In that case, they require a two phased marketing approach: (Thogersen & Garling, 2001)

- The first phase that is supposedly targeting and attracting innovators and early adopters
- The second one is the result of the former one considering that word of mouth, imitation processes, modeling along with other marketing tool will lead to the awareness of the mass market.

In parallel, they point out the inequality where potential customers stand. They explain that not “everyone is equally ready to adopt new products, services or ideas” depending on how he or she will perceive the different attributes and also regarding his or her personality traits. This, even if the diffusion by the early adopters will have a tremendous impact on the followers. (Thogersen & Garling, 2001)

They insist also on the concept that by analyzing customer’s attitude and its background it will be easier to apprehend “individual drivers and group adopters and their impediments to adoption”. (Thogersen & Garling, 2001)
The survey took place in Sweden. Questionnaires were sent via e-mail format. The sample of population is restricted to the greater Gothenburg area due to EV possibilities (short driving distance, environmental superiority). Structured in two distinct waves, the survey has been fully completed by 165 respondents (response rate at 37.3%) in the first wave and by 787 in the second one (response rate at 34.6%). The questions concerned aspects such as perception, knowledge, innovativeness and environment. (Thogersen & Garling, 2001)

The results were presented as follows and identified segments were identified (Thogersen & Garling, 2001):

- **Innovativeness and Knowledge:**
  According to the survey, people who are in the high innovativeness/high Knowledge part are the easiest to convince regarding the EV buying process. The only reason why they would not buy an EV is a certain preference for other alternative vehicles such as hybrid for instance. Consequently, in order to convince them into buying an EV one would have to do so relying on technical and infrastructural issues only. (Thogersen & Garling, 2001)
  People who are in the low innovativeness/ high knowledge part are those really hard to convince. The reasons why they would not buy an EV is not only that they are more interested in conventional cars but also they do not believe in the EV feasibility even with a high knowledge. (Thogersen & Garling, 2001)
  People who are in the high innovativeness/low knowledge part are the ones who search for knowledge. Having that in mind, this actual stage is the one before the high innovativeness/high knowledge segment. For those people, the marketing process has to be made in a long term perspective. In fact, what they aspire the most is information and the guarantees that this product will suit them in the future. In the table 4 presented below, it can be noticed that women in this segment are well represented.
  This made the authors think that this specific target might be able to play a strong part in the EV market. Several factors are pointed out:
  - Car choice and especially for the second one is not a male dominated process anymore.
  - More and more women are living alone.

People who are in the low innovativeness/low knowledge part are not interested in any marketing approach. The authors emphasize the uselessness of targeting such a segment because too much effort will most entirely be made in vain. The criteria “price” is what they would see first, meaning that if buying an EV remains an onerous purchase regarding the one of the conventional cars. (Thogersen & Garling, 2001)

- **Car ownership and environmental concern**
  As mentioned in the title the segment concerns “green people”, the ones that feel attracted to a product not because of its characteristics but more because of what it represents (Heffner, Kurani i Turrentine, 2007). As a matter of fact, their ideal car would be an “environment friendly second car for multi car households. However, even if this segment looks inclined to any marketing approach, the questions about technical issues and driving distance still remain a problem. This is why it is important for them to focus on Electric Vehicle technology. (Thogersen & Garling, 2001)
Table 4 shows different characteristics of those previously described as identified segments.

Table 4. Characteristics of identified segments (scale: 1 the lowest, 5 the highest)

<table>
<thead>
<tr>
<th>Source: Thogersen &amp; Garling, 2001</th>
</tr>
</thead>
</table>

2.2.7. Survey conducted in Switzerland in 1996

As a final result in this case study EV-users where categorized into four segments (Harms & Truffer, 1996):

- **Transport Eco-Promoter**: 31%
  The group characteristics: strong political interest and economic issues. (Harms & Truffer, 1996)

- **Transport Tech Promoter**: 19%
  The group characteristics: most of the users from this group are technical engineers. Those customers think that current cars in transportation are too heavy and not energy efficient. (Harms & Truffer, 1996)

- **Transport Individual Urbanite**: 26%
  The group characteristics: users in this segment still have higher environmental concern, but not as high as transport Eco-Promoters. However, the main reason of buying EV is perceived by them as a fascinating new solution for urban transportation. Nevertheless, they do not think about supporting technology development. (Harms & Truffer, 1996)
- Transport Affluent Inquisitive: 24%
  The group characteristics: This group of users is more concentrate on the prestige effect and optical aspects. Customers in this group do not care about environmental characteristics of the car but some technical issues are important for them. (Harms & Truffer, 1996)

The three first groups are considered satisfied with the product, which is mostly determined by their knowledge of the product before any purchasing decisions. Thus, they knew about this type of car limitations and agreed with those before they bought their electric vehicle. However, the consumers from the Transport Affluent Inquisitive group are dissatisfied with purchase decision and they tend to resell the product much faster than others. As a final statement regarding this case study, it was written that environmental concern is the most important reason of buying this kind of car. (Harms & Truffer, 1996)
3. Methodology

This chapter explicates how we conducted the survey. The idea was to give a good understanding of what methods we used and why we used them. It is also described the approach chosen, the sample selection, the data collection, the validity and reliability of the results (Saunders, Lewis & Thornhill, 2007).

3.1. Research approach

Generally, two school of thought stand out when dealing with theory development and knowledge to build in order to design a research methodology. The two different approaches are the inductive and the deductive. In some cases, however, both approaches can be presented in the same research methodology. (Lancaster & Crowther, 2008)(Saunders, Lewis & Thornhill, 2007)

3.1.1. Inductive approach

The inductive approach is frequently linked with a qualitative method. Inductive approach is often used in case of searching new information or creating a new theory. Besides, it introduces the empirical data and helps establish comparisons with early theories and researches. (Lancaster & Crowther, 2008) (Saunders, Lewis & Thornhill, 2007) (Jacobsen, 2002)

3.1.2. Deductive approach

The deductive approach is frequently linked with a quantitative method. Deductive approach is the means by which the researcher tests the existing theories or likely hypothesis through the empirical data collecting process. Therefore, it regularly leads to conclusion and last results. (Lancaster & Crowther, 2008) (Saunders, Lewis & Thornhill, 2007) (Jacobsen, 2002) Following the purpose of research, we chose the deductive approach in order to conduct our survey. As a matter of fact, the deductive approach enabled us to answer our issues thanks to the already existing theory.

3.2. Research method

There exits two methods of conducting a research: quantitative and qualitative (Jacobsen, 2002). The major difference between those two methods stand in the type of data collected and analyzed for the relevance of the study (Bryman & Bell, 2007).

3.2.1. Quantitative method

This method focused on relating situations by collecting numerical data. It is based on measurement and quantity of the population sample characteristics (Jacobsen, 2002). Moreover, it enables the researcher to test the theory (Bryman & Bell, 2007).

The greatest advantage is that this method is cost efficient and easy to apprehend thanks to the help of the computer. However, the main drawback regarding the data is that sometimes it can be superficial. Indeed, the researcher can easily assume the answers before conducting the survey (Jacobsen, 2002).
3.2.2. Qualitative method

This method focuses on describing the population sample characteristics. It is based on the respondents’ words and expressions because it enables them to answer the question in a more detailed way. The qualitative method is best suited for deeper understanding of the individual thanks to the collection of secondary data (Jacobsen, 2002)(Saunders, Lewis & Thornhill, 2007) (Backman, 2009). This method is also good to acquire more accurate knowledge about the field in question. However, it is quite demanding resource due to the amount of secondary data required (Brinkmann & Kvale, 2009) (Jacobsen, 2002) (Backman, 2009).

Following the purpose of the research, we chose both methods to help in conducting our survey. On the one hand, the qualitative method, with the help of secondary data, led us to a deeper understanding of the matter but it was also useful for the first question of our survey when respondents were asked about their thoughts. On the other hand, the quantitative method enabled us to collect data in the shape of numbers and statistics figures thanks to respondents ‘responses.

3.3. Research model

Gibbons distinguished two kinds of knowledge production: model one which is more academic oriented and model two which is more practically oriented (Bryman & Bell, 2007). This paper represents second model of research approach because it provides valuable data for EV manufacturers for whom the most important factors are socio-economic as they can influence purchasing process of their products.

The concept of this research is strongly based on the social survey conducting model that has been made by Bryman and Bell, which is presented below (Bryman & Bell, 2007):

```
Choosing research area  ➔
  ➔ Study of existing literature  ➔
  ➔ Research questions development  ➔
  ➔ Decide if a social survey is right method  ➔
  ➔ Choosing population will be considered  ➔
  ➔ Deciding of kind of sample design will be employed  ➔
  ➔ Explore whether there is a sampling frame that can be employed  ➔
  ➔ Decide mode of administration  ➔
  ➔ Develop questions  ➔
  ➔ Review questions and assess face validity  ➔
  ➔ Pilot question  ➔
  ➔ Revise questions  ➔
  ➔ Finalize questionnaire  ➔
  ➔ Sample from population  ➔
  ➔ Administer questionnaire to sample  ➔
  ➔ Transfer completed questionnaires into computer readable data  ➔
  ➔ Analyse data  ➔
  ➔ Interpret findings  ➔
  ➔ Considering implications of findings for research questions.
```

Figure 11. Social research model

3.4. Sample Selection

This chapter deals with the reasons why we chose Iceland as our country of reference and what were the advantages that we took advantage of. The first selection is done regarding the choice of the country. The nation selection was based on renewable energy resources availability and utilization, population concentration, existing technical infrastructure and government support in electric vehicles development in their country.

The other selection was done in terms of factors that can decrease or increase EV purchasing decision. The factors were chosen on the basis of available literature reviews which explain the advantages and disadvantages of electric vehicles. Analyzed theory proves that Iceland is prepared for electric vehicles implementation as far as the technical aspects are concerned. Therefore, it has been decided to take a step further and concentrate on the socio-economic aspects of electric vehicles implementation. Thus, after available literature review, the most significant advantages and disadvantages of electric vehicles have been set and the research questions have been developed.

3.5. Data collection

This chapter describes the collected data that we managed to amass. The concept of data collection is divided into two components: primary data and secondary data.

3.5.1. Primary data

In order to create primary data, we used the secondary data in which we extracted most of the main and accurate information that further led to the elaboration of our questionnaire. The survey in a form of an online questionnaire was conducted via Facebook. Facebook was picked regarding the high percentage of Icelanders owning an account (65%) (Internet World Stats- Usage and Population Stats, 2011).

The questionnaire was administrated through online communities (blog, forum, chat, and website) and word of mouth. The issue was to target Icelanders from 18 years old to 65 years old and more situated in the whole Icelandic territory considering that we had no direct connections with any Icelanders. Besides, the Facebook application only enabled us to set multiple questions and only open ones. Other possibilities such as LIKERT scale for instance could not be considered in terms of questionnaire structure.

3.5.2. Secondary data

The secondary data used for theoretical and practical parts come mostly from various books, articles, reports and websites. Those positions were published in different countries, mostly in Iceland, United States and the United Kingdom. Therefore, most of them is available in English language, only few positions were written in Polish and French. Furthermore, during the process of writing the resources of the following libraries were used: The Halmstad City Library, The Halmstad University Library, King’s College London Library, The Metropolitan University Library in London and The British Library.

Moreover, some of the articles come from scientifically valuable websites such as sciencedirect.com or springerlink.com. The most frequently searched quotations on the Internet were: electric vehicles, EV Iceland, socio-economic aspects of electric vehicles, electric vehicles implementation, battery electric vehicles, etc.
This research required specific data about Iceland. Therefore, very significant secondary data was found on the websites of the following Icelandic institutions:

- Iceland’s Ministry of Industry, Energy and Tourism
- The Official Website of The President of Iceland
- Statistics Iceland

The scientific and research institutions in Iceland that supported this research are the following:

- The Innovation Centre in Iceland
- The University of Iceland,
- The University of Akureyri

3.6. Analysis of the method

The practical part of the thesis is based on empirical research. That part presents how the results of the questionnaire survey regarding socio-economic aspects of electric vehicles implementation were extracted. The results of the survey were analyzed in the software SPSS and through statistics methods. The Pearson’s coefficient was used to find correlation between several variables in the perspective of sustaining the relevance of the analysis. The analysis was also operated through comparisons between previous researches and our actual research associated with all secondary data. Regarding the questionnaire data extraction we must mention that incompleted data was deleted in order not to bias the further analysis.

3.7. Validity and reliability

This chapter regards the quality not only of the research but also of the results and can be split into two parts: validity and reliability. The validity of the research is used to make sure that the study has used the right tools to get the right information. The concept of reliability concerns the results in the case of whether they can be trusted or not (Saunders, Lewis & Thornhill, 2007).

The sample was certainly small (115 respondents) but regarding the results we managed to get very diversified respondents for most of the key variables such as gender, age, education, range of salary and occupational work group. Considering that Iceland inhabits a small population of more than 320 000 people even the small sample still gives a good overview of Icelanders way of thinking regarding socio and economic barriers.

Moreover, the confrontation of primary and secondary data enhance the relevance of our results. The combination of two brought strong accuracy of the extracted information and the analysis based on it.
4. Empirical data

The empirical data chapter includes collected primary and secondary data. Primary data gives results of conducted survey and secondary data includes information about Icelandic EVs market, political and financial situation in Iceland. Electric vehicles market part is split into energy market share, which is strongly related to EV and transportation market in Iceland.

4.1. Socio-economic survey of EV in Iceland

It was managed to get 115 responses having the characteristics presented in the table 5.

Table 5. Characteristics of respondents

<table>
<thead>
<tr>
<th>Number of respondents</th>
<th>115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>53% were male and 47% female.</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>56% were aged 26 to 45 years old.</td>
<td></td>
</tr>
<tr>
<td>30% were aged 18 to 25 years old</td>
<td></td>
</tr>
<tr>
<td>12% from 46 to 65 years old</td>
<td></td>
</tr>
<tr>
<td>Only 2% of the Icelanders surveyed were aged more than 65 years old.</td>
<td></td>
</tr>
<tr>
<td>Driving license</td>
<td>99% of them have a driving license.</td>
</tr>
<tr>
<td>Access to a car</td>
<td>92% of them have access to a car.</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
</tr>
<tr>
<td>5% of the respondents have Compulsory school or lower as a level of education,</td>
<td></td>
</tr>
<tr>
<td>32% of the respondents have Upper secondary school as a level of education,</td>
<td></td>
</tr>
<tr>
<td>35% have a Bachelor degree as a level of education,</td>
<td></td>
</tr>
<tr>
<td>23% have a Master degree as a level of education</td>
<td></td>
</tr>
<tr>
<td>Only 4% of the respondents possess a Ph.D. or higher diploma.</td>
<td></td>
</tr>
<tr>
<td>Occupational group work</td>
<td></td>
</tr>
<tr>
<td>30% work in Intermediate occupations,</td>
<td></td>
</tr>
<tr>
<td>26% work as Executives and intellectuals,</td>
<td></td>
</tr>
<tr>
<td>16% are unemployed, 10% work as employees,</td>
<td></td>
</tr>
<tr>
<td>9% are craftsmen, traders and entrepreneurs,</td>
<td></td>
</tr>
<tr>
<td>4% of the people surveyed are workers,</td>
<td></td>
</tr>
<tr>
<td>3% are being employed in the primary sector</td>
<td></td>
</tr>
<tr>
<td>2% are retired people.</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>37% of the respondents cohabit,</td>
<td></td>
</tr>
<tr>
<td>31% of the people surveyed are married,</td>
<td></td>
</tr>
<tr>
<td>28% of them are single,</td>
<td></td>
</tr>
<tr>
<td>3% are divorced,</td>
<td></td>
</tr>
<tr>
<td>1% of the sample is widowed.</td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>52% of the respondents have children</td>
</tr>
<tr>
<td>Range of salary</td>
<td></td>
</tr>
<tr>
<td>37% earn less than 250.000 ISK,</td>
<td></td>
</tr>
<tr>
<td>32% earn from 250.000 ISK to 399.999 ISK,</td>
<td></td>
</tr>
<tr>
<td>18% earn from 400.000 ISK to 600.000 ISK,</td>
<td></td>
</tr>
<tr>
<td>9% earn more than 600.000 ISK.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own work
The first question was an open question and the main goal was to check people’s perception of EV. The question asked was what word comes first to mind when you see “electric vehicle” written. The results are presented in the table 6. Nearly half of the respondents chose positive word to describe electric vehicle, 44.6% choose neutral and only 5.8% of them chose word with negative connotation. Most of the words were related to two categories: environment idea technology. Additionally it should be mentioned that close to 12% of the respondents chose very positive words: “savings” and “future”.

Table 6. Categorization of respondents’ perception of EV

<table>
<thead>
<tr>
<th>Perception</th>
<th>Share of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>49.6%</td>
</tr>
<tr>
<td>Neutral</td>
<td>44.6%</td>
</tr>
<tr>
<td>Negative</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

Source: Own work

The following graphs have been drawn from the results obtained with all the information extracted from the survey.

In this graph, we can emphasize the consideration that Icelanders bear towards Electric Vehicle. As a matter of fact, 67% of the respondents declared willing to replace their actual car with an EV while 28% were against it. Besides, 5% of people surveyed started to question the Electric Vehicle necessity after seeing our questionnaire.

Source: Own work
When looking at the figure 2, it is obvious that most of the respondents are ready see the Electric Vehicle being implemented in their country. According to the graph, 69% of the people questioned showed a very positive attitude towards EV implementation. Along with this optimistic statement it is important to mention that 25% of the respondents are also have a positive attitude towards this process. Only less than 5% of the Icelanders surveyed consider to be either neutral or rather negative regarding the EV implementation.

Figure 13. Icelanders opinion on the implementation of EV

Source: Own work

All the people surveyed were asked what would be their main reason to buy an Electric Vehicle. According to the graph, the main reasons that were pointed out are Electricity price vs. oil (45% of respondents), Environmental benefits with a 33% of respondents rate and Energy Independency which reached 17% of respondents. The other criteria did not catch the interest considering that all of them (Trend, Uniqueness, Support/Interest for innovative technology and other) represent less than 5% of the Icelanders surveyed choice.

Figure 14. Icelanders main reason of buying EV

Source: Own work
Several respondents were then questioned about the amount of money they would be willing to pay if the price of the EV was to be higher than the price of a conventional car. The results show that 29% of respondents are ready to up to 20%. The number of respondents willing to spend up to 10% more reaches also 29% of the people surveyed. 17% of the respondents declared willing to pay only the same price and 10% of them answered that they would only buy an EV if the price was to be lower in comparison into conventional cars. An insignificant number (15%) of respondents claimed that they would pay more than 20% more to afford an EV.

The following graph shows the results of the part of the survey in which the Icelanders were asked what would be the utilization of their Electric car if they were about to buy one. 45% of them would buy the Electric vehicle as a family car, 39% would prefer the utilization as their first car car and 11% of the respondents would use their car as a second one. 5% of the answers regroups some secondary utilization such as commercial car (2%), leisure car (2%) and off road (1%).
Respondents were then asked what type of Electric Vehicle they would like to buy, meaning what kind of car is the best suited for an Electric Vehicle. To that question, 59% answered that they would prefer a Mid-size car, 24% claimed they would choose a Compact car and 6% would pick an SUV. The rest of the answers are split between Sport car (3%), Van (3%), Micro car (2%) and Luxury car.

The purpose of this question was to measure the knowledge of the respondents. In that purpose, we can observe that 78% of the people surveyed declared that buying an EV would decrease their transportation expenses. Only 13% of the respondents do not think that buying an Electric Vehicle would decrease their expenses and 10% have no opinion on that matter.
In this graph the idea was to emphasize the main advantages when dealing with Electric Vehicle, represented in the horizontal axis. The vertical axis represents the numbers of respondents. It is easy to notice three dominant criteria listed in their order of preference: lower price of electricity vs. oil price, the use of domestic renewable energy resources and greenhouse gases reduction. The last three items such as noise reduction, convenience in urban transportation and performance and durability were seen as secondary compared to the others (cited by less than 25 people out of 115).

In this graph the idea was to emphasize the main advantages when dealing with Electric Vehicle, represented in the horizontal axis. The vertical axis represents the percentage of people that answered the questionnaire. Price was seen to be the most important factor when looking at EV disadvantages, followed closely by the charging time and the driving distance. Limited charging infrastructure, car speed and high insurance cost were cited by 20% to 35%
of the Icelanders questioned. The last three criteria i.e. size, safety and aesthetic were mentioned by less than 10% of the sample.

4.2. Electric vehicles market in Iceland

4.2.1. Energy Market

Only 28% of total energy consumption in Iceland comes from non-renewable energy resources (Ingasona, Ingolfssonb, & Jensson, 2008). Consequently, about 72% of total energy consumption comes from waste, hydro and geothermal power plants (Ingasona, Ingolfssonb, & Jensson, 2008).

According to the International Energy Agency data from 2008, the total energy generated in Iceland was equal to 4.36 Mtoe (International Energy Agency, 2011c). In the same year 15.89 TWh of electricity was consumed in this country, which gives 49818 Kwh/ person and locates Iceland as the biggest electricity consumer per capita in the world (Nation Master, 2011). Besides, the price of electricity was the lowest in comparison with all EU’s countries. The carbon dioxide emission equaled from burning fuel equal 2.20 Mt and comes mostly from transportation sector (International Energy Agency, 2011c).

Mostly all of the electricity is generated on the basis of renewable energy sources, 75,5% by hydropower plants, 24,5% by geothermal power plants and only less than 0,02% from oil and wastes (International Energy Agency, 2011a). Therefore, emissions from electricity generation are close to zero.

The consumption of electricity by sector is as follow (International Energy Agency, 2011a):

- Industry: 13056 GWh,
- Residential: 860 GWh,
- Commercial and Public Services: 1063 GWh,
- Agriculture and Forestry: 224 Gwh,
- Fishing: 38 GWh.

According to Arnason and Sigfusson by 2000, only 15% of hydro and 1% of geothermal potential was utilized (Arnason & Sigfusson, 2000).

As it is presented in the figure below, the use of fossil fuels decreased, as coal and oil were replaced by geothermal and hydro power plants. However, oil and petroleum in transportation cannot be totally eliminated because of any available alternative.
There are seven main areas where electricity is generated on the basis of geothermal resources in Iceland. Most of the capacity is installed near Great Reykjavik Area in south-western part of Iceland, what is partly determined by the population density in that region.
4.2.2. Transportation market

Transportation market in Iceland strongly depends on imported gasoline and diesel, as it is in most of the countries. According to the International Energy Agency, import of motor gasoline in 2008 equals 152 000 tones, aviation gasoline: 1000 tones, gas/diesel: 409 000 tones, fuel oil 88 000 tones. However, final energy consumption was slightly lower: 152 000 tons of motor gasoline, 350 000 tones gas/diesel, fuel oil 84000 tones. (International Energy Agency, 2011b)

According to The Road Traffic Directorate in Iceland, in 2009 there were 45 electric vehicles which makes Iceland the top country with electric vehicles per capita in the world (The Road Traffic Directorate in Iceland, 2009). Road vehicles were responsible for 29% of CO₂ emission in 2006, which makes them the biggest polluters after industrial processes (Fig. 23).

![Figure 23. Distribution of CO₂ emissions by source in 2006.](source: National Energy Authority Iceland & Ministry of Industry, Energy and Tourism, 2009)

Most of the oil is used in automobiles, fishing vessels and aero planes, as it is presented in the figure below. Only small share of oil is combusted in equipment, industry and other vessels. However, it is possible to notice the increase of oil consumption regarding automobiles and airplanes industry since the beginning of 21st century. The situation is completely the opposite in case of fishing vessels, where it is now considered as a declining trend.
According to the National Energy Authority in Iceland forecast, oil use in aeroplanes in domestic use, cargo ships in domestic use and ships for international use is slightly decreasing and will remain stable until 2050. The biggest increase of oil consumption is going to be through international aeroplanes use, but oppositely we will be observing a decrease in fishing vessels and automobiles.

According to the Statistics Iceland, passenger cars are around 83% of total registered vehicles in Iceland and there has been only a slight change since 1990 when passenger cars where equal to 88% of total registered vehicles in the country. Lorries and vans had 12% share of total registered vehicles in 2009, when motorcycles and buses had only 5%.
The goal of Icelandic government is to become first energy independent economy worldwide using only energy generated based on renewable energy resources. Icelandic New Energy Programme was established in 1999 to support hydrogen technology development in the country. However, it was preceded the introduction of many other initiatives supporting hydrogen use in transportation sector since 1970. (Icelandic New Energy, 2011) In 2009 Iceland had the biggest fleet of hydrogen cars in Europe in 2009 and was the first to set up a commercially available hydrogen station (IceNews, 2009). This dynamism proves that the Icelanders are the early adopters and are open to welcome innovative solutions in transportation sector.

The main player in implementation of electric vehicles in Iceland is the Northern Light Energy Company. This company cooperates with most of the electric cars’ manufacturers worldwide and tries to convince them that Iceland is the best market to start selling cars with this alternative technology. (Northern Lights Energy, 2011) The company’s goal is to accelerate electric vehicles implementation in Iceland which might help to improve economic situation in the country and change Icelandic image after financial collapse in 2008.
4.2.3. Political and financial situation

According to Human Development Index created by United Nations, Iceland is in the group of highest developed countries in the world (United Nations, 2010). Additionally, it is one of the Nordic countries, which has one of the highest incomes per capita in Europe. However, the financial situation of this small country located in the middle of Atlantic Ocean has been changed after the collapse of the largest banks.

For many years, Iceland has been a state of Norwegian and Danish Kingdom, until 1944 when it used an opportunity to declare their independence, when The Kingdom of Denmark was occupied by the Nazis (Loftsdóttir, 2010). That time, Iceland was one of the poorest countries in Europe and their GDP was at current level of some of the African countries (Benediktsdottir, Danielsson & Zoega, 2011). The economy of this small country has been growing for many years mainly because of the use of natural resources. The fish industry and renewable energy utilization have been giving a lot of workplaces in the country, increasing energy independency and export (Thorhallsson & Rebhan, 2011). Therefore, there has been a significant increase of the number of the immigrants, especially since the beginning of the new century.

According to the World Bank estimations, the GDP per capita in 2007 equaled $ 65 566 and it gave Iceland 7th position worldwide. Therefore, Icelandic banks expanded on the new markets after joining European Economic Area (Loftsdóttir, 2010). As a result of this situation, the bank’s assets rose and became several times higher than Icelandic GDP (Thorhallsson & Rebhan, 2011). However, in the fall 2008 Icelandic banks collapsed just five years after full privatization and the crisis has started.

The public debt in 2007 equaled only 23.2% of GDP, but it increased to 87,2% of GDP in 2009 (Organisation for Economic Co-operation and Development, 2011). The other market indicators as unemployment or inflation were not that optimistic as before the fall 2008. However, in comparison to the countries like Ireland, Greece, Portugal or Spain, it has been possible to notice a positive change in GDP and unemployment since 2008 (Benediktsdottir, Danielsson & Zoega, 2011).

After the elections at the beginning of 2009, a new Icelandic government has begun to integrate with European Union to improve financial stability and introduce euro in near future. However, there is still strong disagreement of the society to join EU, because of convenient enough for Iceland fish industry policy (Thorhallsson & Rebhan, 2011). Another problem might be the rejection of “Icesaves” repayment to the Netherlanders and the British in the second referendum.

The strongest advantages of Iceland that might be significant in rebuilding the country’s economy are the high renewable energy potential, fish industry, good infrastructure and well-educated population (Sigurjonsson & Mixa, 2011).

1 Offered by the largest Icelandic bank saving accounts in internet
5. Analysis

In this part, it is analyzed how respondent characteristic influence the main variables of the survey.

5.1. Willingness of replacing actual car

This part describes how respondents are inclined or not to replace actual car by an EV according to the respondents inner characteristic.

![Figure 27. Willingness of replacing actual car by an EV vs. Age](image)

Source: own work

By confronting on one hand the willingness of replacing actual car by an EV regarding sample aspirations and on the other hand the population sample age some conclusions can be drawn. Most of the respondents from all age group have already thought of replacing their actual car by an EV when looking at the small percentage of the different age group that did not think of this until now (approximately 5% of every age group).

Among the respondents who are willing to replace their actual car by an electric vehicle, approximately 80% regards the age group 46 to 65 years old, approximately 70% regards the age group 26 to 45 years old and more than 60% regards the age group 18 to 25 years old.

Among the respondents who are not willing to replace their actual car by an EV, more than 30% regards the age group from 18 to 25 years old, 25% regards the age group from 26 to 45 years old and more than 10% regards the age group from 46 to 65 years old.
By confronting on one hand the willingness of replacing actual car by an EV regarding sample aspirations and on the other hand the population sample gender some conclusions can be drawn.

Most of the respondents both male and female already thought of replacing their actual car by an electric vehicle when regarding at the small percentage of the different gender that did not think of this until now (approximately 5% for both gender)

Among the respondents who are willing to replace their actual car by an electric vehicle, more than 70% are male and approximately 60% are female.

Among the respondents who are not willing to replace their actual by an EV, 35% are female and approximately 20% are male.
By confronting on one hand the willingness of replacing actual car by an EV regarding sample aspirations and on the other hand the population sample level of education some conclusions can be drawn.

Most of the respondents from every level of education already thought of replacing their actual car by an EV when regarding at the small percentage of the different level of education group that did not think of this until now (less than 10% for every group).

Among the respondents who are willing to replace their actual car by an electric vehicle, approximately 80% regards the upper secondary school group, 65% regards the Bachelor group, 55% regards the Master or higher level of education group and 50% regards the compulsory school or lower level of education group.

Among the respondents who are not willing to replace their actual by an EV, 50% regards the compulsory or lower level of education group, 35% regards the master or higher level of education group, approximately 30% regards the bachelor group and approximately 20% come from the upper secondary school group.

Figure 30. Willingness of replacing actual car by an EV vs. occupational work group

Source: own work

By confronting on one hand the willingness of replacing actual car by an EV regarding sample aspirations and on the other hand the population sample occupational group work some conclusions can be drawn.

Most of the respondents from every occupational group work already thought of replacing their actual car by an EV when regarding at the small percentage of the different occupational work group that did not think of this until now (less than 10% for every group).

Among the respondents who are willing to replace their actual car by an electric vehicle, 90% regards craftsman, traders and entrepreneurs group, 70% regards the workers group, primary sector and retired people group, approximately 70% regards the intermediate occupations group, more than 65% regards the executives and intellectuals, 60% regards the unemployed group and 50% regards the employees group.
Among the respondents who are not willing to replace their actual car by an EV, more than 40% regards the employees group, more than 30% regards the unemployed group, 30% regards the workers group, primary sector and retired people group, approximately 30% regards the intermediate occupations group, more than 20% regards the executives and intellectuals and approximately 10% regards the craftsman, traders and entrepreneurs group.

By confronting on one hand the willingness of replacing actual car by an EV regarding sample aspirations and on the other hand the population sample range of salary some conclusions can be drawn.

Most of the respondents from every range of salary already thought of replacing their actual car by an EV when regarding at the small percentage of the different range of salary group that did not think of this until now (less than 10% for every group). Among the respondents who are willing to replace their actual car by an electric vehicle, more than 70% earn from 250,000 to 399,999ISK, more than 70% earn more than 600,000ISK, more than 6% earn from 400,000 to 600,000ISK and approximately 60% earn less than 250,000 ISK.

Among the respondents who are not willing to replace their actual by an EV, approximately 35% earn less than 250,000 ISK, more than 25% earn more than 600,000 ISK, approximately 25% earn from 250,000 to 399,999 ISK and approximately 25% earn from 400,000 to 600,000
By confronting on one hand the willingness of replacing actual car by an EV regarding sample aspirations and on the other hand the population sample marital status some conclusions can be drawn.

Most of the respondents from every marital status already thought of replacing their actual car by an EV when regarding at the small percentage of the different marital status group that did not think of this until now (approximately 5% for every group).

Among the respondents who are willing to replace their actual car by an electric vehicle, more than 70% come from the divorced, widowed and single group and more than 60% come from the married and cohabiting people group.

Among the respondents who are not willing to replace their actual by an EV, 30% come from the married and cohabiting people group, 20% come from the divorced, widowed and single group.
5.2. Advantages

This part describes what are the main advantages of EVs according to different characteristics of the respondents.

By confronting on one hand the main advantages according to the sample population and on the other hand the population sample age some conclusions can be drawn. Judging by the graph the preferences in terms of electric vehicle advantages vary according to the age group:

- From 18 to 25 years old, the population sample lists its preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, then greenhouse gases reduction followed closely by the use of domestic renewable energy resources. The three last factors such as noise reduction, convenience in urban transport and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

- From 26 years old to 45, the population sample lists its preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, then the use of domestic renewable energy resources followed closely by greenhouse gases reduction the use of domestic renewable energy resources. The three last factors such as convenience in urban transport, noise reduction and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

- From 46 years old to 65, the population sample lists its preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, then the use of domestic renewable energy resources followed closely by greenhouse gases reduction the use of domestic renewable energy resources. The last factors such as performance & durability and convenience in urban transport, listed in their order of
preferences, are seemed to be considered less significant as advantages. The criteria noise reduction was never mentioned by this age group. Considering that the age group from 65 years old and more only regarded two respondents, there was no point of commenting on it.

As an overall conclusion, three advantages (Lower price of electricity vs. oil price, the use of domestic renewable energy resources and greenhouse gases) stand out compared to the other when dealing with age population sample.

![Bar chart showing preferences for electric vehicle advantages by gender](chart.png)

**Figure 34. Electric Vehicle main advantages vs. Gender**

*Source: own work*

By confronting on one hand the main advantages according to the sample population and on the other hand the population sample gender, some conclusions can be drawn. Judging by the graph the preferences in terms of electric vehicle advantages vary according to the gender of the group:

- **Female list their preferences in the following order:**
  Lower price of electricity vs. oil price is seen as the most important criteria, followed closely by greenhouse gases reduction and then the use of domestic renewable energy resources. The three last factors such as noise reduction, convenience in urban transport and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

- **Male list their preferences in the following order:**
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as convenience in urban transport, noise reduction and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

As an overall conclusion, once again three advantages (Lower price of electricity vs. oil price, the use of domestic renewable energy resources and greenhouse gases) stand out compared to the other when dealing with the gender of the population sample.
By confronting on one hand the main advantages according to the sample population and on the other hand the population sample level of education, some conclusions can be drawn. Judging by the graph the preferences in terms of electric vehicle advantages vary according to the group’s level of education:

- Respondents with Compulsory school or lower as their level of education list their preferences in the following order: Greenhouse gases reduction is seen as the most important criteria, followed closely by lower price of electricity vs. oil price and then the use of domestic renewable energy resources. The last factors such as convenience in urban transport and noise reduction, listed in their order of preferences, are seemed to be considered less significant as advantages. The criteria performance & durability was never mentioned by this age group.

- Respondents with Upper secondary school as their level of education list their preferences in the following order: Lower price of electricity vs. oil price is seen as the most important criteria, followed closely by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as convenience in urban transport, noise reduction and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

- Respondents with Bachelor as their level of education list their preferences in the following order: Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as performance & durability convenience in urban transport and noise reduction, listed in their order of preferences, are seemed to be considered less significant as advantages.
Respondents with Master or higher as their level of education list their preferences in the following order:

Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as noise reduction, convenience in urban transport and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

As an overall conclusion, once again three advantages (Lower price of electricity vs. oil price, the use of domestic renewable energy resources and greenhouse gases) stand out compared to the other when dealing with population sample level of education.

By confronting on one hand the main advantages according to the sample population and on the other hand the population sample occupational group, some conclusions can be drawn.

Judging by the graph the preferences in terms of electric vehicle advantages vary according to the sample occupational group:

- Craftsman, traders and entrepreneurs list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as convenience in urban transport, performance & durability and noise reduction, listed in their order of preferences, are seemed to be considered less significant as advantages.

- Employees list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by greenhouse gases reduction and then the use of domestic renewable energy resources. The three last factors such as performance & durability, noise reduction and
convenience in urban transport, listed in their order of preferences, are seemed to be considered less significant as advantages.

- Executives and Intellectuals list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as convenience in urban transport, performance & durability and noise reduction, listed in their order of preferences, are seemed to be considered insignificant as advantages.

- Respondents working in Intermediate occupations list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by greenhouse gases reduction and then the use of domestic renewable energy resources. The three last factors such as noise reduction, convenience in urban transport and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

- Others (primary sector, retired and unemployed) list their preferences in the following order:
  Use of domestic renewable energy resources is seen as the most important criteria, followed by greenhouse gases reduction and then lower price of electricity vs. oil price. The three last factors such as convenience in urban transport, noise reduction and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

As an overall conclusion, once again three advantages (Lower price of electricity vs. oil price, the use of domestic renewable energy resources and greenhouse gases) stand out compared to the other when dealing with population occupational group.

![Figure 37. Electric Vehicle main advantages vs. Range of salary](image)

*Source: own work*
By confronting on one hand the main advantages according to the sample population and on the other hand the population sample range of salary, some conclusions can be drawn. Judging by the graph the preferences in terms of electric vehicle advantages vary according to the sample range of salary:

- Respondents earning less than 250,000 ISK list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by the greenhouse gases reduction and then use of domestic renewable energy resources. The three last factors such as noise reduction, performance & durability and convenience in urban transport, listed in their order of preferences, are seemed to be considered less significant as advantages.

- Respondents earning between 250,000 ISK and 399,999 ISK list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as convenience in urban transport, noise reduction and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

- Respondents earning between 400,000 ISK and 600,000 ISK list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as convenience in urban transport, noise reduction and performance & durability, listed in their order of preferences, are seemed to be considered less significant as advantages.

- Respondents earning more than 600,000 ISK list their preferences in the following order:
  Lower price of electricity vs. oil price is seen as the most important criteria, followed by the use of domestic renewable energy resources and then greenhouse gases reduction. The three last factors such as performance & durability, noise reduction and convenience in urban transport, listed in their order of preferences, are seemed to be considered less significant as advantages.

As an overall conclusion, once again three advantages (Lower price of electricity vs. oil price, the use of domestic renewable energy resources and greenhouse gases) stand out compared to the other when dealing with population range of salary.
5.3. Disadvantages

This part describes what are the main barriers of an EV according to characteristics of the respondents.

By confronting on one hand the main disadvantages according to the sample population and on the other hand the population sample age some conclusions can be drawn.

Judging by the graph the preferences in terms of electric vehicle disadvantages vary according to the age group:

- From 18 to 25 years old, the population sample lists its barriers in the following order: The factor charging time is seen as the most important criteria, then the price followed by the driving distance. The three next criteria such as limited charging infrastructure, high insurance costs and car speed are preferred in this specific order and are considered less significant. The last elements such as safety, Aesthetic are seen as less important barriers in the eyes of most of the respondents. The size item has not been mentioned by this age group.

- From 26 years old to 45, the population sample lists its barriers in the following order: The factor price is seen as the most important criteria, then the driving distance followed by the charging time. The three next criteria such as limited charging infrastructure, car speed and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as size, aesthetic and safety are seen as less important barriers in the eyes of most of the respondents.

- From 46 years old to 65, the population sample lists its barriers in the following order: The factor price is seen as the most important criteria, then the driving distance followed by the charging time. The three next criteria such as car speed, size and limited charging infrastructure are preferred in this specific order and are considered less significant. The last elements such as high insurance costs and aesthetic are seen as less important barriers in the eyes of most of the respondents. The safety item has not been mentioned by this age group.
Considering that the age group from 65 years old and more only regarded two respondents, there was no point of commenting on it.

As an overall conclusion, it is clearly possible to distinguish three stages of disadvantages according to respondents’ mindset. Nevertheless, the three disadvantages considered as the most significant and stand out compared to the others are always the price, the charging time and the driving distance when dealing with age population sample.

![Figure 39. Electric Vehicle main disadvantages vs. Gender](image)

*Source: own work*

By confronting on one hand the main disadvantages according to the sample population and on the other hand the population sample gender some conclusions can be drawn. Judging by the graph the preferences in terms of electric vehicle disadvantages vary according to the gender of the group:

- **Female** list their barriers in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, car speed and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as safety, size and aesthetic are seen as less important barriers in the eyes of most of the respondents.

- **Male** list their barriers in the following order:
  Price is seen as the most important criteria, followed by driving distance and then charging time. The three next criteria such as limited charging infrastructure, car speed and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as size, aesthetic and safety are seen as less important barriers in the eyes of most of the respondents.

As an overall conclusion, it is clearly possible to distinguish three stages of disadvantages according to respondents’ mindset. Nevertheless, the three disadvantages considered as the most significant and stand out compared to the others are always the price, the charging time and the driving distance when dealing with age population sample.
Figure 40. Electric Vehicle main disadvantages vs. Education

Source: own work

By confronting on one hand the main disadvantages according to the sample population and on the other hand the population sample level of education some conclusions can be drawn.

Judging by the graph the preferences in terms of electric vehicle disadvantages vary according to the group level of education:

- Respondents with Compulsory school or lower as their level of education list their barriers in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, safety and car speed are preferred in this specific order and are considered less significant. The last elements such as size, aesthetic are not cited by the population sample and the factor high insurance costs is seen as a less important barrier in the eyes of most of the respondents.

- Respondents with Upper secondary school as their level of education list their barriers in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as car speed, limited charging infrastructure, and high insurance costs are preferred in this specific order and are considered less significant. The last elements such as safety and size are seen as less important barriers in the eyes of most of the respondents. The aesthetic item has not been mentioned by this age group.

- Respondents with Bachelor as their level of education list their barriers in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, car speed and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as aesthetic, safety and size are seen as less important barriers in the eyes of most of the respondents.
- Respondents with Master or higher as their level of education list their barriers in the following order:
  Driving distance is seen as the most important criteria, followed by the price and then charging time. The three next criteria such as limited charging infrastructure, car speed and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as size, safety and aesthetic are seen as less important barriers in the eyes of most of the respondents.

As an overall conclusion, it is clearly possible to distinguish three stages of disadvantages according to respondents’ mindset. Nevertheless, the three disadvantages considered as the most significant and stand out compared to the others are always the price, the charging time and the driving distance when dealing with age population sample.

![Figure 41. Electric Vehicle main disadvantages vs. Occupational group work](source: own work)

By confronting on one hand the main disadvantages according to the sample population and on the other hand the population sample occupational group work some conclusions can be drawn. Judging by the graph the preferences in terms of electric vehicle disadvantages vary according to the respondent’s occupational group work:

- Craftsman, traders and entrepreneurs list their barriers in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, high insurance costs and car speed are preferred in this specific order and are considered less significant. The last elements such as size and aesthetic are seen as less important barriers in the eyes of most of the respondents. The item safety has not been mentioned by this age group.

- Employees list their barriers in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, car speed and size are preferred in this specific order and are considered less significant. The last elements such as aesthetic and high insurance costs are seen as less important
barriers in the eyes of most of the respondents. The safety item has not been mentioned by this age group.

- Executives and Intellectuals list their barriers in the following order:
  Respondents working in Intermediate occupations list their preferences in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as car speed, limited charging infrastructure and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as aesthetic, size and safety are seen as less important barriers in the eyes of most of the respondents.

- Respondents working in Intermediate occupations list their barriers in the following order:
  Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, car speed and high insurance costs are preferred in this specific order and are considered less significant. The last elements such as aesthetic and size are not cited by the sample. The safety item is seen as a less important barrier in the eyes of most of the respondents.

- Others (primary sector, retired and unemployed) list their barriers in the following order:
  Driving distance is seen as the most important criteria, followed by charging time and then price. The three next criteria such as car speed, high insurance costs and limited charging infrastructure are preferred in this specific order and are considered less significant. The last elements such as safety and size are seen as less important barriers in the eyes of most of the respondents. The aesthetic item has not been mentioned by this age group.

As an overall conclusion, it is clearly possible to distinguish three stages of disadvantages according to respondents’ mindset. Nevertheless, the three disadvantages considered as the most significant and stand out compared to the others are always the price, the charging time and the driving distance when dealing with age population sample.
By confronting on one hand the main disadvantages according to the sample population and on the other hand the population sample range of salary some conclusions can be drawn. Judging by the graph the preferences in terms of electric vehicle disadvantages vary according to the respondent’s range of salary:

- Respondents earning less than 250.000 ISK list their barriers in the following order: Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, car speed, and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as safety, size and aesthetic are seen as less important barriers in the eyes of most of the respondents.

- Respondents earning between 250.000 ISK and 399.999ISK list their barriers in the following order: Price is seen as the most important criteria, followed by driving distance and then charging time. The three next criteria such as limited charging infrastructure, car speed, and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as aesthetic, size and safety are seen as less important barriers in the eyes of most of the respondents.

- Respondents earning between 400.000 ISK and 600.000 ISK list their barriers in the following order: Price is seen as the most important criteria, followed by charging time and then driving distance. The three next criteria such as limited charging infrastructure, car speed, and high insurance costs are preferred in this specific order and are considered less significant. The last three elements such as size, aesthetic and safety are seen as less important barriers in the eyes of most of the respondents.

- Respondents earning more than 600.000 ISK list their barriers in the following order:
Driving distance is seen as the most important criteria, followed by charging time and then price. The three next criteria such as high insurance costs, car speed and limited charging infrastructure are preferred in this specific order and are considered less significant. The last three elements such as aesthetic, size and safety are not cited by the sample.

As an overall conclusion, it is clearly possible to distinguish three stages of disadvantages according to respondents’ mindset. Nevertheless, the three disadvantages considered as the most significant and stand out compared to the others are always the price, the charging time and the driving distance when dealing with age population sample.
6. Discussion

Before starting to discuss on the results few questions need to be answered in order to outline the different areas that need to be taken into account in the case of Electric Vehicle implementation, as follow:

- Are Icelanders ready for electric car implementation?
- Is the actual potential demand big enough?
- Are still innovators and early adopters the main target?
- How to manage to target the mass market?
- Who will buy the electric vehicle?

The following discussion will be structured regarding three fundamentals pillars:

- The first stage will deal with the Icelandic market forces through which will be emphasized the different influential factors and the correlated characteristics.
- The second stage will lead to the customers targeting process where profile of adopters and non-adopters are going to be highlighting.
- Then, as the third step, social and economic barriers to adoption will be presented and a focus will be operated on the main advantages and disadvantages in the case of electric vehicle implementation in Iceland.

The model presented below, illustrate the different steps that would intervene during Icelanders adoption process.

![Figure 43. Icelanders adoption process based on survey results](source: own work)

The made up model based on conducted survey illustrates the roadmap of the potential demand. As it is presented above, 67% of the respondents already thought of replacing their actual car by an EV. Meaning that the electric vehicle is already considered as a real alternative to the internal combustion engine during the buying process. For comparison, the German survey has demonstrated that only 5% of the respondents were ready to buy an EV.
This group includes not only early adopters, innovators and environmental friendly people but also a large part of the mass market that have the sufficient knowledge (Fig. 18) to visualize the actual benefits that can represent the purchase of an electric vehicle.

Their final decision in order to become whether or not an adopter depends on lower price of electricity vs. oil, increase of use of domestic renewable energy resources and greenhouse gases reduction (App. XIV.). On the opposite, the reasons why they shall reject the adoption are the price, the driving distance and charging time (App. XV).

As observed in the model above, 28% of the respondents have never thought of replacing their car by an electric one. Two cases can be underlined. The first group lacks information about EVs but can further become later adopters or non-adopters. The second group regards people with no particular interest for EV, associated with the non-ability to change.

Their final decision in order to become whether or not an adopter depends on lower price of electricity vs. oil, increase of use of domestic renewable energy resources and greenhouse gases reduction (App. XIV.). On the opposite, the reasons why they shall reject the adoption are the charging time, price and car speed (App. XV).

As seen in the model above, 5% of the respondents have not thought of replacing their actual car by an EV until they answered the survey. In this case, this group enters the learning process to get acquainted with the electric vehicle. Two possibilities are considered: to become or not an adopter.

Their final decision in order to become whether or not an adopter depends on lower price of electricity vs. oil, increase of use of domestic renewable energy resources and greenhouse gases reduction (App. XIV.). On the opposite, the reasons why they shall reject the adoption are the price, charging time and limited infrastructure (App. XV).

**Market forces**

The first influencing factor when looking at EV opportunities is the role that the government must play in order to attract the mass market during the first phase of the implementation process. It can be operated through several situations:

- Incentives such as tax reduction as it was done in Ireland
- Federal loans as also mentioned in the Irish survey
- Higher greenhouse gases tax
- Improvement of the fast charging infrastructure
- Free parking for electric vehicles
- Favorable tax interest rate

However, in the Icelandic context, the government has limited possibilities to support EV market development due to the recent financial crisis presented in the chapter relating the political and financial situation in Iceland. Additionally, the financial crisis has led to the reduction of car sales the past few years. Therefore, as soon as the recovery after crisis is operated the number of car sales could rise again which gives a good opportunity for the EV to step up in the market.

The second influencing factor is the energy market in which Iceland has a huge potential. As cited in the chapter Energy market in Iceland, the country has increased its utilization of renewable energy resources over the last years. Nevertheless, Iceland still uses small percentage of available resources which could be changed by switching fossil fuels for
electricity generated from domestic energy resources. On top of that, Iceland benefits from the lowest price of electricity in comparison to the other European countries.

The third market force regards the technology and innovation through which constant advancements are achieved. As a matter of fact, the reluctance towards EV came from its own characteristics. As mentioned in most of the survey presented in the theoretical framework (Germany survey, Ireland survey and the beyond batteries survey), criteria such as charging time, available infrastructure, driving distance, car speed, safety need to be improved in order to fulfill high expectations of customers in the transportation sector.

**Target market**

According to the first two questions of the conducted survey, the majority of respondents show proof of strong knowledge about alternative energy in transportation (Fig.18, App. XVI).

As illustrated in both survey regarding hydrogen and electricity in transportation, the interest showed by potential customers was bigger than expected and therefore the mass market was considered as a viable target and not only early adopters and innovators.

Consequently, in the case of the conducted survey the question of whether or not targeting only early-adopters and innovators seems to be answered. As a matter of fact, due to high already existing interest and knowledge in alternative, environmental friendly technologies in transportation the mass market should be targeted. Therefore, it is more likely to conclude that the demand of potential EV users and buyers is big enough.

Following this discussion, the profile of adopter and non-adopter can be drawn thanks to obtained results.

The adopter profile can be characterized as a single, divorced or widowed male aged from 46 to 65 years old, working as craftsman, traders and entrepreneurs and earning from 250.000 to 399.999 ISK or more than 600.000 ISK. His level of education regards the upper secondary school.

The non-adopter profile can be characterized as a married or cohabiting female aged from 18 to 25 years old, working as an employee and earning less than 250.000 ISK. Her level of education regards the compulsory school or lower education.

In parallel, the question of use or type of the car chosen previously illustrated in the German study need to be set.

According to the survey results, 45 % of the respondents declared willing to use their electric vehicle as a family car and 39% of the sample surveyed would use their EV as a first car.

According to the survey results, 59% of the respondents declared willing to buy a mid-sized electric vehicle and 24% as a compact car.

**EV key success factors marketing campaign**

According to the obtained results, it is possible to highlight in the first place the three main advantages that respondents chose regarding their characteristics (age, gender, education, range of salary and occupational group work).
As correctly mentioned in the analysis, the main advantages are presented as followed. Lower price of electricity vs. Oil, greenhouse gases reduction and use of domestic renewable energy resources.

According to the obtained results, it is also possible to highlight the three main disadvantages that respondents chose regarding their characteristics (age, gender, education, range of salary and occupational group work).

As correctly mentioned in the analysis, the main advantages are presented as followed. The price, the charging time and the driving distance.

Besides, as it is presented in the empirical data through primary data, the same high amount of respondents (approximately 29%) are willing to pay up to 20% and up to 10% more for an electric vehicle than for a traditional car.
7. Conclusion

Currently, there are already 45 electric cars sold in Iceland, which makes this small society the leading market of EVs per capita. This situation is not only due to the number of inhabitants, but also regarding the low cost of electricity generated on the basis of renewable energy resources. Moreover, not exploited high level of low polluting energy resources is to be an evident aspect that will help fulfilling needs of future electric transportation market. As a matter of fact, two thirds of the population sample already thought of purchasing an EV instead of currently owned car. This offers a good market opportunity to most of the car manufacturers that already launched commercially available EV cars onto the automotive industry.

The conducted survey proved that Icelandic population is very positive about EV implementation. Indeed, this society is much more enthusiastic in comparison to other countries worldwide. Icelanders have already high knowledge about EV and include this technology as real alternative in their car buying process decision. If a company or government is to take into account the most important advantages and barriers from the respondents perspective, it would increase the effectiveness of the future campaign. Those most significant advantages are as follows: lower price of electricity versus oil, greenhouse gases reduction and use of domestic renewable energy resources. However, the most significant barriers are the price, the charging time and the driving distance. In fact, the use of those barriers might help marketers to better apprehend the behavior of potential customers. Additionally, by using the most important advantages, marketers will be able to bound and maintain the relationship with customers.

Most of the respondents agreed to pay more for EV than for ICE, because they see the chance of cost and emission reduction. The future campaign should present possible transportation cost reduction in using an EV and then, potential buyers would be capable of spending more. Those are effectively main reasons why it is necessary to target the mass market instead of small group of early adopters because it seems to be a more profitable decision for car manufacturers.

Actual financial situation of Iceland mitigates government initiatives to support electric market development. However, because of the higher price of imported petroleum and oil that occurred after the banks’ collapsed in 2008, car users have started to look for cheaper alternative. In that case, electric vehicles seem to be the perfect solution that will enable the reduction of individuals’ transportation expenses. Besides, it will help to support the country’s economy by decreasing cash flow outside the country. Consequently, it might create “green jobs” all over Iceland and decrease unemployment caused by the crisis.

To conclude, this research proves that Iceland is an attractive place to start implementation of EV not only because of technical and environmental advantages, but also thanks to inclined population mindset.
8. Possibility of future work

The results from conducted survey gives possibility to analyze EVs market from many others perspectives that can be used for different purposes. Thus, it can be considered as a future work.

Additionally, to understand better customers’ preferences, companies need to focus on following developed issues:

- Research on branding
- People with different opinion about EV in different part of Iceland
- Conducting the same survey in others regions of Iceland and compare the results with ours
- EV market forecast to develop market evolution, growing demand, innovation and technology
- Conducting a survey on current EV users in Iceland
- Acceptance of the charging time and driving range
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## Appendix I

Current situation on electric vehicles market

### Availability of Plug-in Hybrid, and All-Electric Vehicles\(^2\)

<table>
<thead>
<tr>
<th>Plug-in Hybrid</th>
<th>Electriv vehicles</th>
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<td><strong>Light</strong></td>
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<td>- Chevrolet Volt (2011)</td>
<td>- Nissan leaf (2011)</td>
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<tr>
<td><strong>Medium &amp; Heavy</strong></td>
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<td>- CNG (Design Line Corporation-Eco Saver IV)</td>
<td>- Smith Electric vehicles- SEV Newton</td>
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<td>- Diesel (Eldorado National-Axess)</td>
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<td>- Balgon – Mule MI5O- Nautilus E20/E30</td>
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<td>- Gasoline (Eldorado National- EZ Rider II BRT)</td>
<td>- Boulder Electric Vehicle - Delivery Truck</td>
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<td>- Hybrid propulsion (Eaton-Hybrid Drive System)</td>
<td>- Electric Vehicles International - Model</td>
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<td>- Navistar-Modec EV Alliance - eStar</td>
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</tr>
<tr>
<td>- Revolution EV USA –Candi (2009)</td>
<td></td>
</tr>
<tr>
<td>- Revolution EV USA –Spark (2009)</td>
<td></td>
</tr>
<tr>
<td>- Cruise Car, Inc. - Utility (2009)</td>
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</tr>
<tr>
<td>- Electric Mini Truck Deluxe (2009)</td>
<td></td>
</tr>
<tr>
<td>- Electric Cargo Mini Van Deluxe (2009)</td>
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</tr>
<tr>
<td>- Miles Automotive - ZX40S Advanced Design (2009)</td>
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<tr>
<td>- Star Electric Vehicles - Star-BN48-4-Deluxe (2009)</td>
<td></td>
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<tr>
<td>- ZENN Motor Company - ZENN 2.2 (2009)</td>
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\(^2\) [www.afdc.energy.gov](http://www.afdc.energy.gov)
Appendix II

Pollutant emissions during morning peak hour in road traffic in Dijon.

<table>
<thead>
<tr>
<th>Emissions (kg/h)</th>
<th>CO</th>
<th>NOx</th>
<th>HC</th>
<th>SO2</th>
<th>PM10</th>
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<tbody>
<tr>
<td>All traffic</td>
<td>1124</td>
<td>312</td>
<td>166</td>
<td>9</td>
<td>15</td>
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<tr>
<td>Private cars</td>
<td>894</td>
<td>173</td>
<td>122</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Urban freight transport (UFT)</td>
<td>225</td>
<td>113</td>
<td>41</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Freight in transit</td>
<td>5</td>
<td>26</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Proportion of UFT</td>
<td>20%</td>
<td>36%</td>
<td>25%</td>
<td>44%</td>
<td>60%</td>
</tr>
<tr>
<td>Proportion UFT + transit</td>
<td>20%</td>
<td>45%</td>
<td>27%</td>
<td>56%</td>
<td>67%</td>
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</table>

Source: Dablan, 2008
Appendix III

Questionnaire in Icelandic

Þessi spurningalisti inniheldur opnar spurningar, spurningar með einum valkosti, spurningar þar sem velja má hámark þrjá valkosti og almennar spurningar.

OPNAR SPURNINGAR

Vinsamlegast skrifaðu niður svarið við eftirfarandi spurningu.
1) Hvaða orð dettur þér fyrst í hug þegar þú sérði „Rafknúið ökutæki” á prenti:

…………………………………………………………………………………………………………………………………………………………………………………………………………..

EINN VALKOSTUR

Vinsamlegast veldu aðeins EINN valmöguleika í þessum hluta.
1) Hefur þú velt því fyrir þér að skipta bílnum þínnum út fyrir rafknúið ökutæki?
- Já
- Nei
- Ekki þar til núna
2) Hvert er viðhorf þitt á innleiðslu rafknúinna ökutækja á Íslandi?
- Mjög jákvætt
- Jákvætt
- Hlutlaust
- Frekar neikvætt
- Neikvætt
3) Hver yrði helsta ástæðan fyrir kaupum á rafknúnu ökutæki?
- Umhverfisáhrif
- Stuðningur / áhugi á nýsköpunartækni
- Tísk
- Sérstæði
- Orkusjálfræði Íslands
- Verð rafmagns samanborið við verð olíu
- Annað

4) Ef verð rafknúins ökutækis væri hærra en annarra ökutækja hversu mikið myndirðu vilja borga?

- Meira en 40%
- Allt að 40% meira
- Allt að 30% meira
- Allt að 20% meira
- Allt að 10% meira
- Einungis sama verð
- Einungis lægra verð

5) Ef þú myndir kaupa rafknúið ökutæki, í hverju fælist nýting þess?

- Fyrsti bíll
- Annar bíll
- Fyrirtækjabíll (ökutæki sem er notað til að flytja vörur eða farþega. Ökutæki sem er skráð á fyrirtæki)
- Fjölskyldubíll (venjuleg stærð bíls. Geta verið fólksbílar, blæjubílar ...)
- Fristundabíll (bill sem þú kaupir ánægjunnar vegna. Geta verið sportbílar, lúxusbílar, blæjubílar ...)
- Utan vegar bíll (bill sem notaður er til að keyra utan vegar og á ökkunnunum slóðum. Geta verið fjórhjól, stórir pallbílar, trukkar, jeppar, snjósleðar, mótorhjól eða fjallahjól ...)

6) Hvaða tegund rafknúins ökutækis myndir þú kaupa?

- Micro bíl (T.d. Think City, Smart )
- Smábil (T.d. Mitsubishi I-Miev, Volvo C30, Nissan Leaf, )
- Miðstærð af bíl (T.d. Toyota Avensis Corolla, GM Volt)
- Sendiféarlabil (T.d. Nissan NV200, Ford Transporter, Toyota Hiace)
- Sportbíl (T.d. Tesla Roadster, Porsche)
- Sportjeppa (T.d. Chevrolet Equinox, RAV4, Range Rover)
- Lúxusbíl (T.d. Jaguar XF, Mercedes E Class, Royce Rolls)
- Enga

7) Heldur þú að kaup á rafknúnu ökutæki myndi minnka samgöngukostnað þinn?
- Já
- Nei
- Hef ekki skoðun á því

ÞRÍR VALKOSTIR

Vinsamlegast veldu HÁMARK ÞRJÁ valmöguleika í þessum hluta.

8) Vinsamlegast veldu ÞRJÁ mikilvægustu kosti rafknúinna ökutækja, að þínu mati, af eftirfarandi valmöguleikum.
- Lægri kostnaður rafmagns samanbóð við olíu
- Minnkun gróðurhúsaloftegunda
- Hávaðaminnkun
- Afkastageta og ending
- Nýting innlendra orkuauðlinda
- Hentugleiði fyrir þéttbylíssamgöngur

9) Vinsamlegast veldu ÞRJÁ mikilvægustu galla rafknúinna ökutækja, að þínu mati, af eftirfarandi valmöguleikum.
- Verð
- Hár tryggingakostnaður
- Stærð
- Öryggi
- Smekkvisi / fagurfræðilegir eiginleikar
- Hleðslutími
- Hraði bílsins
- Akstursfjarlægð
- Takmörkun á innviðum tengdum hleðslubúnaði ökutækis
ALMENNAR SPURNINGAR

10) Kyn:
  - Karlkyn
  - Kvenkyn

11) Aldur:
  - Undir 18 ára
  - 18 til 25 ára
  - 26 til 45 ára
  - 46 til 65 ára
  - Meira en 65 ára

12) Ertu með bílpróf?
  - Já
  - Nei

13) Hefur þú aðgang að ökutæki?
  - Já
  - Nei

14) Menntun:
  - Skyldunám
  - Framhaldsnám
  - Bachelor
  - Master
  - Doctorate/hærri mentun

15) Starfsflokkur:
  - Frumvinnslugeiri (landbúnaður)
  - Handverksmaður, kaupmaður, frumkvöðlar
  - Stjórnunarstörf, visindastörf
- ðjónustugreinar (preستastörf, skrifstofustörf, vörusala, ðjónusta)
- Starfsmaður
- Verkamaður
- Á eftirlaunum
- Atvinnulaus

16) Hjúskaparstaða:
- Giftur / gift
- Einhleypur /einhleyp
- Skilinn / skilin
- Í sambůð
- Ekkill / ekkja

17) Áttu börn?
- Já
- Nei

18) Launabil þitt:
- Minna en 250.000 ISK
- 250.000 ISK til 399.000 ISK
- 400.000 ISK til 600.000 ISK
- Meira en 600.000 ISK
Appendix IV

Questionnaire in English

This questionnaire includes an open question, one-answer questions and questions with maximum three answers.

OPEN QUESTION

Please write down an answer to the following question.

1) What word comes first to mind when you see “electric vehicle” written:

…………………………………………………………………………………………

ONE ANSWER QUESTION

In this section please pick only ONE answer.

1) Have you already thought of replacing your actual car by an Electric Vehicle?

- Yes
- No
- Not until now

2) What is your opinion about the implementation of Electric Vehicles in Iceland?

- Very positive
- Positive
- Neutral
- Rather negative
- Negative

3) If you decide to buy Electric Vehicle, what would be the main reason?

- Environmental benefits
- Support/Interest for innovative technology
- Trend
- Uniqueness
- Energy independency of Iceland
- Electricity price versus oil price
- Other

4) If the price of Electric Vehicle was to be higher how much more will you be willing to pay?

- More than 40%
- Up to 40% more
- Up to 30% more
- Up to 20% more
- Up to 10% more
- Only the same price
- Only Lower price

5) If you were going to buy an Electric Vehicle what would be the utilization of your future car?

- A First car
- A Second car
- A Commercial car (type of motor vehicle that may be used for transporting goods or passengers. Vehicle registered to a company)
- A Family car (car used to describe normally-sized cars. Relates to hatchbacks, saloons, estates, cabriolets)
- A Leisure car (type of car you buy for your own pleasure. Relates to sport car, luxury car, cabriolet)
- An off road car (term for driving a vehicle on un-surfaced roads or tracks. Relates to ATVs, heavy-duty pick up, trucks, SUVs, snowmobiles, motorcycles or mountain bicycles)

6) What type of Electric Vehicle would like to buy?

- Micro car (ex. Think City, Smart)
- Compact car (ex. Mitsubishi I-Miev, Volvo C30, Nissan Leaf)
- Mid-size car (ex. Toyota Avensis Corolla, GM Volt)
- Van (ex. Nissan NV200, Ford Transporter, Toyota Hiace)
- Sport car (ex Tesla Roadster, Porsche)
- SUV’s (ex. Chevrolet Equinox, RAV4, Range Rover)
- Luxury car (ex. Jaguar XF, Mercedes E Class, Royce Rolls)
- None

7) Do you think that buying an Electric Vehicle will decrease your transportation expenses?
- Yes
- No
- I don’t have an opinion

THREE ANSWERS QUESTIONS
In this section please pick MAXIMUM THREE answers.

8) In your opinion, choose and pick what are the THREE most important advantages regarding EV among the following possibilities?
- Lower price of electricity versus oil
- Greenhouse gases reduction
- Noise reduction
- Performance and durability
- Use of domestic renewable energy resources
- Convenience in urban transportation

9) In your opinion, choose and pick what are the THREE most important disadvantages regarding electric vehicles among the following possibilities?
- Price
- High insurance cost
- Size
- Safety
- Aesthetic
- Charging time
- Car speed
- Driving distance
- Limited charging infrastructure

GENERAL QUESTIONS

10) Gender:
- Male
- Female

11) Age:
- Less than 18 years old
- From 18 to 25 years old
- From 26 to 45 years old
- From 46 to 65 years old
- More than 65 years old

12) Do you have a driving license?
- Yes
- No

13) Do you have access a car?
- Yes
- No

14) Education:
- Compulsory school or lower
- Upper secondary school
- Bachelor
- Master
- Doctorate/higher education

15) Occupational group work:
- Primary sector (agriculture)
- Craftsmen, traders and entrepreneurs
- Executives and intellectuals
- Intermediate occupations (clerical, sales, service)
- Employees
- Workers
- Retired
- Unemployed

16) Marital status:
- Married
- Single
- Divorced
- Cohabitant
- Widowed

17) Do you have children?
- Yes
- No

18) Range of your salary:
- Less than 250,000 ISK
- 250,000 ISK to 399,999 ISK
- 400,000 ISK to 600,000 ISK
- More than 600,000 ISK
Appendix V

Gender

Within the sample there was almost a perfect equity regarding the gender of the people surveyed. As a matter of fact, 53% were male and 47% of female.

Source: Own work
Appendix VI

Age

In this graph, we can see that no minor have answered the questionnaire. Within the sample, 56% were aged from 26 to 45 years old, 30% were aged from 18 to 25 years old and 12% from 46 to 65 years old. Only 2% of the Icelanders surveyed were aged more than 65 years old.

Source: Own work
Appendix VII

Percentage of respondents with driving license

In this graph, the respondents were asked whether or not they had a driving license. 99% of the people answered yes to the question.

Source: Own work
Appendix VIII

Percentage of the respondents with driving license

In this graph, the respondents were asked whether or not they had access to a car. 92% of the people answered yes to the question.

Source: Own work
Appendix IX

Education

The graph above shows the type of education of the Icelandic sample. Compulsory school or lower regards 5% of the respondents. Upper secondary school regroups 32% of the respondents. Bachelor degree concerns 35%. Master degree was achieved by 23%. Only 4% of the respondents possess a Ph.D or higher diploma.

Source: Own work
Appendix X

Occupational group work

The Icelandic sample id divided into 6 occupational group work.
30% are working in Intermediate occupations.
26% are working as Executives and intellectuals.
16% are unemployed.
10% are working as employees.
9% are craftsman, traders and entrepreneurs.
4% of the people surveyed are workers.
3% are being employed in the primary sector.
2% are retired people.

Source: Own work
Appendix XI

Marital status

The population sample is divided according to their marital status.
37% of the respondents are cohabiting.
31% of the people surveyed are married.
28% of them are single.
3% are divorced.
1% of the sample is widowed.

Source: Own work
Appendix XII

Number of respondents with children

In this graph, the respondents were asked whether or not they had any children. Over the half of the people surveyed have children.

Source: Own work
Appendix XIII

Range of salary

The population sample is divided according to their range salary:
37% earn less than 250.000 ISK
32% earn from 250.000 ISK to 399.999 ISK
18% earn from 400.000 ISK to 600.000 ISK
9% earn more than 600.000 ISK.

Source: Own work
Appendix XIV

Chart: main advantages vs. willingness to buy EV

Source: Own work
Appendix XV

Chart: willingness of buying EV vs. main disadvantages

Source: Own work
Appendix XVI

Survey results: words related to EV

<table>
<thead>
<tr>
<th>Original words in Icelandic</th>
<th>Translation</th>
<th>Original words in Icelandic</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>veit ekkki</td>
<td>don’t know</td>
<td>Grænn</td>
<td>green</td>
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<tr>
<td>Island</td>
<td>Iceland</td>
<td>Minni mengun</td>
<td>less pollution</td>
</tr>
<tr>
<td>Prius</td>
<td>Prius</td>
<td>dýr startkostnaður en ódýr í rekstri</td>
<td>expensive starting operational costs?</td>
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<td>Sparnabdur</td>
<td>Saving</td>
<td>Framtiðin</td>
<td>future</td>
</tr>
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<td>sjálfbærnir</td>
<td>Sustainability</td>
<td>umhverfisvænt</td>
<td>Environmentally</td>
</tr>
<tr>
<td>Orkusparnabdur</td>
<td>Energy conservation</td>
<td>bill</td>
<td>car</td>
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<tr>
<td>Rafmagnsbill</td>
<td>electric</td>
<td>Bill fyrir einn</td>
<td>car for one</td>
</tr>
<tr>
<td>Rafknúinn bill</td>
<td>electric car</td>
<td>Gáfulegt</td>
<td>smart</td>
</tr>
<tr>
<td>Framtiðin</td>
<td>Future</td>
<td>minni mengun</td>
<td>less pollution</td>
</tr>
<tr>
<td>Háskvæmni</td>
<td>efficiency</td>
<td>Rafmagnsbill</td>
<td>electric car</td>
</tr>
<tr>
<td>Bill</td>
<td>car</td>
<td>Ökutæki sem notar minni orku og aðra en bensín og diselbílar.</td>
<td>Vehicle that uses less energy and other than gasoline and diesel cars.</td>
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<td>Rafmagnsbill</td>
<td>electric</td>
<td>Sparsamt, hljóólaust og umhverfisvænt</td>
<td>Spar Still, silent, environmentally friendly?</td>
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<td>Smábíll</td>
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<td>Hreinlæti (hreint loft)</td>
<td>Hygiene (clean air)</td>
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<td>elecric, saving</td>
<td>tesla</td>
<td>tesla</td>
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<td>Umhverfisvænt</td>
<td>Environmentally</td>
<td>háskvæmri</td>
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<td>Kraftlitill</td>
<td>Powerless</td>
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<td>Rafmagnsbíll</td>
<td>electric</td>
<td>bill</td>
<td>car</td>
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<td>Sparneytinn bill</td>
<td>fuel economy car</td>
<td>Umhverfisvænd</td>
<td>Environmental Protection</td>
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<td>Ökutæki sem ganga ekki fyrir bensíni.</td>
<td>Vehicles that do not go for gas.</td>
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<td>bill</td>
<td>car</td>
<td>sparnaður</td>
<td>saving</td>
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<td>orka</td>
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<td>g-wiz</td>
<td>wow</td>
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<td>general word for all manner of electric transport</td>
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<td>ekkert bensín</td>
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<td>saving</td>
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<td>batteries</td>
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<td>future</td>
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<td>That is what is to come</td>
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<td>cool</td>
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XXX
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<tr>
<th>English</th>
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<td>Environmentally friendly car</td>
<td>Umhverfisvænn bíll</td>
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<td>Sparnaður</td>
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<td>Umhverfisvænt</td>
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<td>Sparnaður</td>
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<td>Snílld</td>
<td>Genius</td>
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<td>Super bike?</td>
<td>OfurMótorhjóll</td>
<td>Super Bike?</td>
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<td>Power available</td>
<td>kraftlaus</td>
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<td>Sparnaður</td>
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