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# How Does Electric Vehicle Help an Average Person In Iceland?

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**Abstract**

Automobile technology has been around for over a century and has allowed civilization the ability to become extremely mobile. Unfortunately, the technological advancement comes at an extreme cost with the emissions of various waste products such as carbon dioxide and carbon monoxide. Thus, many countries are looking to transition their carbon based transportation system to a carbon neutral with the use of electricity. Iceland is a country that depends on renewable resources such as geothermal and hydroelectric power and recently there have been implementing electric vehicles in some towns. The usage of hydroelectric and geothermal power makes it durable to implement the usage of electric vehicles. This paper will explore the advantages and disadvantages of implementing electric vehicles (EV) in Iceland and the gain the perceptions of the average commuter.

The researcher used the methodology of ethnography where lot of average Icelanders were interviewed to get their view on EV's and other experts from the University of Iceland. Some of the finding were the following: Icelanders have recently started implementing the usage of EV, Icelanders are finding it useful to use it in shorter commutes due to the fact that charging stations are less and they need to be charged frequently to travel longer distances. Mostly they are being implemented in cities like Akuyeri and Reykjavic. The researcher hasn't seen much of Electric Vehicles around the town due to the fact that it's been recently implemented. It can be concluded that it is feasible to implement EV in Iceland and people will find it useful provided that they are ways to resolve the disadvantages in the features of EV.

## Introduction

Over a century ago, Karl Benz invented the first automobile and technological advances have been made to improve upon the design to increase safety and efficiency. However the usage of fossil fuels are causing emissions of various waste products such as carbon dioxide and carbon monoxide. In addition to this, various human activities such as deforestation is also increasing the release of carbon dioxide onto the atmosphere. This is causing climate change due to global warming which is defined as increase of the earth's surface temperature. The increase in global temperatures could have wide ranging effects such the possible extinction of polar bears due to the melting of ice in Arctic or direct impacts on human life. Therefore, societies are looking at ways to become carbon neutral within their energy and transportation sectors.

Interest in the usage of electric vehicles within transportation infrastructure is growing high due to the fear of decreasing oil reserves and the environmental impact of petroleum based vehicles (DOMM, 2018). Electric vehicles obtain their power by storing energy which are produced by renewable and nonrenewable power sources. This stored energy is transferred over to electrical DC/AC motors who use the energy to rotate wheels to move the car forward. Furthermore, many EV have regenerative braking systems to recover energy lost in braking of the vehicles in motion (CarBikeTech, 2018).

Iceland is a country that depends on renewable resources such as geothermal and hydroelectric power and emitted 6.29 tons of carbon dioxide greenhouse gases per capita in 2009 (International Energy Agency, 2018). Iceland also has filling stations which dispenses hydrogen fuel for the cars which are powered by fuel cells. Due to the availability of renewable resources, Iceland produces hydrogen in adequate amounts for the country's usage. In 2010, Iceland was in the Guinness World Record for its achievement as the greenest country (International Energy

Agency, 2018). All of these factors show how Iceland is environmentally conservative and how they are working to reduce global warming. Iceland has a unique ability to generate renewable green energy as 90 percent of Iceland's power comes from renewables, but only 14.1 percentage of population uses EV (EAFO, 2018). From this it can be seen that even though EV can be implemented in Iceland, it isn't being much used. This paper will explore the advantages and disadvantage of implementing EV in Iceland and gain the perceptions of the average commuter on whether or not implementing EV helps them.

## Literature Review

To gain a better understanding of the topic, the researcher conducted a literature review using governmental websites, scientific journals, and news articles. After reviewing the relevant literature, three distinct themes formed: comparing costs of EV versus petro vehicles, Point source pollution, and EV travel range. These themes will be explored in greater detail in the proceeding section.

### Comparing Costs of EV Versus Petro Vehicles

When comparing costs of EV and traditional cars it can be complex due to differing factors. Thus to look at the differing costs, a study by Ehsan Shafiei looks at Iceland as a case study. The study compared gasoline price, electric price to charge up EV and EV price. Gasoline prices keep fluctuating due to global markets, but the price of electricity will remain constant due to Iceland's stable renewable energy from geothermal and hydroelectric power (Shafiei, 2012). Thus, the cost to power an EV will be stable with little chance for market shock. Furthermore, the cost of an EV has two possible scenarios, the price can stay constant or decrease due to technological advances. However, it must be said that the price to charge up EV is less than that of gasoline price. If the cost to charge up EV decreases over time, this can be a huge benefit to

the customers. With decrease costs, EV can become Iceland's primary transportation system due to reliable costs to the average Icelander's budget.

**Point Source Pollution**

With regarding to the pollution or emissions that gasoline vehicles generate it can be categorized into two types: direct and life cycle. Direct emissions are the ones that emitted through tailpipe. Such examples include nitrogen oxide gas and other harmful waste gases (Iberdola, 2018). According to a report by Nealer, Reichmuth, and Anair (2015), life cycle emissions are related to vehicle, fuel and vehicle production. Similar to direct emissions, life cycle emissions also include harmful pollutants. Gasoline powered vehicles do produce these emissions, however EV produces less. Gasoline powered vehicles are a point source pollution of $CO_2$ and other greenhouse gases. Thus, to decrease cars point source pollution, EV are becoming more popular. According to the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (n.d.), EVs typically produce fewer life cycle emissions than conventional vehicles because most emissions are lower for electricity generation than it is for burning gasoline or diesel. From this saying, it can be seen that even though they produce few emissions than gasoline vehicles, using more number of electric vehicles in a country could still have an effect on amount of pollutants being released on earth. This is one of the research gap that could be filled in.

**EV Travel Range**

One of the biggest barriers to implementation of EV is the perception of limited travel range and the need to recharge. This is one of the problem that needs to be taken into consideration before implementing electric vehicles and for everyone to embrace the technology. In order to resolve this issue, one can consider constructing and creating more charging stations

along the roads or highways in Iceland. According to Iceland Magazine (2017), Iceland is having an issue with havinsg less charging stations in the highways of Iceland. Considering this factor as a hindrance of electric vehicle being helpful in Iceland this could be one of the theme that could be considered and the research gap that can be filled in.

## Methodology

To conduct this research and collect the appropriate data, the researcher conducted a literature review and interviews with average Icelanders. The literature review provided the researcher with a solid understanding of the topic and the themes informed the type of questions that would be used during the interview process. Due to the limitation of only having one week to conduct research in Iceland, the research felt a semi-structured interview was appropriate and kept a field journal for observations. These interviews allowed for the researcher to ascertain Icelander's perception of EV within the general population. Furthermore, the researcher also conducted interviews with EV users at an EV charging station. Finally, the researcher conducted interviews with Ewa L. Carlson and Hlynur Stefansson from the University of Iceland to obtain experts insights into Iceland EV market. For exact questions please see Appendix I.

## Results

While in Iceland, ten interviews were conducted. The interviewees ranged in age from 20 to 80 and had different occupations. During the period of the study, the researcher visited the electric vehicle charging station, but unfortunately couldn't find anyone using the station. So, the researcher was unable to conduct any interviews in EV charging stations. However for the average Icelanders perspective, the researcher was able to interview people who use EV less frequently. After conducting the interviews, the researcher found the following themes.

**Average Icelander**

- Electric vehicle isn't widely used in Iceland, its only used in few cities like Reykjavik and Akuyeri and EV is being recently implemented 4 years back and slowly becoming a trendsetter.
- They aren't many Charging Stations in Iceland and need to charge more times and EV's can be charged in home as well.
- They aren't many people as of yet who use EV, some use hybrid vehicles.
- Electric vehicles can be used for short distances and average speed is lower than gasoline vehicles.
- Lot of people are impressed with EV due to environmental benefit but some people think they don't need EV due to the low population in Iceland.

**Experts from University of Iceland**

- Electric vehicles are expensive compared to gasoline vehicles due its usage of advanced technology. But electric vehicles cost less to maintain compared to gasoline vehicles.
- People are impressed with less noise pollution.
- Electric Vehicles aren't produced in Iceland, rather they are imported.

## Discussion

After conducting interviews and reviewing observations, there was a supersizing lack of EV ownership and encounters with the technology within the field. Based on antidotal evidence, it can be theorized even though there is lack of EV within the market there is still an awareness

by the general public with regarding the benefits of the EV. Balder, an Icelandic tour guide, stated “the Iceland government started encouraging EV due to its renewable energy usage in Iceland and is continuing to do so” (personal communication, March 14, 2018). Some Icelanders were impressed with the implementation of EV because of the positive effects on the environment. Ewa Carson, a professor from the University of Iceland, believes EV cost less to maintain than gasoline vehicles (personal communication, April 13, 2018). Carson’s belief is reaffirmed within the literature that EV are expensive investment, but have lower lifetime maintenance costs compared to traditional vehicles. The advantages of EV from their impact on the environment to lifetime costs still cannot explain the lack of implementation of the technology within the Icelandic market.

Despite all these factors allowing Iceland to implement electric vehicles, people perceive the disadvantages of EV outweighing the good, which is the reason why they prefer gasoline vehicles. After interviewing average Icelanders, two main disadvantages often cited was the need of EV to be charged frequently and high initial costs. These sentiments were supported within the literature. Many Icelanders are finding EV to be more expensive than gasoline vehicles therefore aren’t considering to buy it and not everyone can afford them (Waiter at a restaurant, personal communication, March 11, 2018). Due to the limited number of EVs, the average Icelanders are not seeing how their lives can be improved with the technology. All the Icelanders interviewed stated that they have seen EV in use and advertisements related to EVs (Tiriveedhi, personal communication, March 12, 2018). One Icelander, Balder thinks that Iceland small population leads to small amount of pollution, which decreases the demand of implementation of EV (personal communication, March 14, 2018). Due to Iceland low population, most of the

pollution is centered in Reykjavik. If this city implemented electric helpful to reduce the noise pollution and $CO_2$ emissions in Iceland's biggest city.

One of the limitation in this research, was that the researcher didn't get a chance to meet people who actually drive EV in Iceland and experts who are involved in the design of electric vehicles. These interviews would have given some insight into people who own the vehicle and advantages over traditional cars. Furthermore, this research was conducted in a week's time which did not provide the researcher enough time to meet more experts. Finally, the researcher did not get the time to explore one how the usage of electric cars can generate pollutants by the power plants.

## Conclusion

To conclude, people may start finding electric vehicles helpful over gasoline vehicles if the perceived disadvantages are outweighed by the positive aspects of the technology. These advantages can be with the speed and the distance the EV can travel without being charged frequently. However, electric vehicles do cost less to maintain as compared to gasoline vehicles. EV's can be implemented in Iceland because of the large amount of electrical energy production coming from renewable sources. Based on this study, advantage of implementing EV is that it helps decrease Iceland's carbon footprint and can save the average Icelander costs over the lifetime of the car. Furthermore, future studies could look into Iceland's automotive industry and gain insight into governmental policy concerning future transportation systems for Iceland.

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## Appendix I

I. Interview questions pertaining to an average person.

- Do you see any advertisements regarding Electric Vehicle?
- Have you seen Electric Vehicles around?
- Do you have one and if not, what are your thoughts about buying it?
- Are EV's commonly used and better than Gasoline Vehicles?
- How much is the cost of buying it?
- Your overall impression?

II. Interview questions pertaining to people in electric vehicle charging stations.

- How frequently do you need to charge it?
- Do you see any advertisements regarding Electric Vehicle?
- Do you have one and if not, what are your thoughts about buying it?
- Are EV's commonly used and better than Gasoline Vehicles?
- How much is the cost of buying it?
- Your overall impression?
- How many charging stations do you think exist in the city and is it easier to find them?
- How long does it take to charge the Electric Vehicles?

III.Interview questions pertaining to the experts

- Do you see any advertisements about EV around? Televisions or radio
- Have you seen EV around?
- Does EV cost less compared to gasoline vehicles?
- In what ways can the EV be helpful/what makes it reliable and useful to average Icelanders? (List 2-3 factors/ways)
- In what way does Iceland's economy help in producing/constructing EV? (List 2-3 methods)
- Your overall impression and do you own one or planning to buy one?