An Analysis of EV Charging Markets and EV User Needs in Finland

Capabilities of Implementing Private Charging Network for Public Use

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Tämän opinnäytetyön tarkoituksena on kerätä perustietoa sähköautojen latauksen nykytilasta Suomessa toimeksiantajayhtiön ChargeBnB:n kansainvälistymisprosessia varten. Kerätyn perustiedon ja markkinatiedon avulla yritys voi tehdä strategisia päätöksiä tulevaa markkinoille tuloa varten Suomessa. ChargeBnB on norjalainen startup-yritys, ja se on kerännyt tunnustusta erilaisissa startup-kilpailuissa innovaatiollaan laturinjakokonseptista. ChargeBnB etsii järjestelmällisesti uusia markkina-alueita laajentaakseen liiketoimintansa kansainväliseksi.

Opinnäytetyön teoreettiseen viitekehykseen sisältyy olemassa olevan kirjallisuuden tutkimus ja tutkimuksia sähköajoneuvojen nykytilanteesta ja latauskapasiteetista Suomessa, Euroopassa ja Yhdysvalloissa. Tämän tutkimuksen suorittamiseksi valittiin kolme keskeistä liiketoiminnan kansainvälistymisen teoriaa ja kaksi teoriaa kuluttajakäyttäytymisen mittaamiseksi. Tutkimus keskittyy sähköautojen käyttäjien lataustottumusten ja mielipiteiden tutkimiseen nykyisistä palveluista ja heidän tulevista tarpeistaan.

Tarvittavien tietojen keräämiseen on käytetty sekatekniikkamenetelmää ja kolmea analyysiä, joissa tietoja hinta-analyysiä ja Gap-analyysiä varten kerättiin toissijaisista tietolähteistä. Kyselyllä, joka oli suunnattu nykyisille sähköautokäyttäjille, kerättiin primääritutkimustietoa määrällisellä ja laadullisella menetelmällä. Kysely keräsi tietoja 319 vastaajan väestötaustasta, heidän lataustottumuksistaan, mielipiteistään ja tarpeistaan, sekä heidän vastauksistaan avoimiin kysymyksiin, joilla selvitettiin sähköautoilun positiivisia puolia ja koettuja ongelmia.

Kolmen tehdyn analyysin keskeiset havainnot on esitetty tämän opinnäytetyön pohdintaosiossa. Kirjoittaja on antanut tämän tutkimuksen tulosten pohjalta suosituksia toimeksiantajayritykselle tulevista päätöksistä Suomen markkinoille tulon strategiasta, sekä suosituksia jatkotutkimukselle tulevaisuudessa.

Avainsanat Sähköauto, julkinen lataus, kotilataus, EV latausinfra

Sivut 62 sivua ja liitteitä 6 sivua

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International Business Abstract
Author Teemu Tuiskula Year 2022
Subject An Analysis of EV Charging Markets and EV user Needs in Finland: Capabilities of Implementing Private Charging Network for Public Use.
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This thesis is created with a purpose to collect base information about the current state of electric vehicle charging in Finland for the internationalization process of the commissioning company ChargeBnB. With the collected base knowledge and market information the company can make strategic decisions for their future market entry in Finland. ChargeBnB is a startup company from Norway, and it has gathered recognition in different startup competitions with its innovation of charger sharing concept. ChargeBnb seeks systematically new market areas for expanding its business internationally.

The theoretical framework of this thesis includes research from existing literature and preconditional studies about the current situation of electric vehicles and charging capacity in Finland, Europe, and The U.S. For accomplishing this study, three main theories of business internationalization and two theories of measuring the consumer behavior were chosen. The research is focused on studying the charging habits of electric vehicle users and their opinions about current services and their future needs.

For gathering the needed information, this study used a mixed research method and three analyses where information for price analysis and a gap analysis were collected from secondary data sources. Moreover, the survey for existing electric vehicle users collected primary research data with quantitative and qualitative methods. The survey collected data from 319 respondents' demographical background, charging habits, their opinions and needs, and their responses in open-ended questions, where they were asked about their opinions regarding the positive sides and obstacles of electric motoring.

The key findings of three analyses are presented in the discussion section of this thesis. The author provided recommendations for the commissioning company´s future decisions concerning the Finnish market entry strategy and for further research based on the results of this study.

Keywords Electric vehicle, public charging, home charging, EV charging infrastructure
Pages 62 pages and appendices 6 pages

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1 Introduction

The number of electric vehicles (EV)[1] has started growing rapidly in Finland in the recent years. Today, the number of battery electric vehicles (BEV)[2] among yearly first–time registered cars is higher than diesel-powered cars. The speed of growth shows that the popularity of EVs has passed the popularity of diesel cars and is closing the popularity of petrol cars in first time registrations.

The European Commission's 2050 long–term strategy aims at climate neutrality by 2050 and has settled objectives in the European Green Deal and the strategy of sustainable and smart mobility. The member countries of the European Union must reduce carbon dioxides and other greenhouse gas emissions and those are obliged to take actions in their transportation policies. The governments of European countries have started taking legislative actions towards environmental goals. Private car users have a significant role in achieving these goals, especially in Finland where distances between big cities are quite long, and where the public transportation is not always the best possible solution for commuting. (European Commission, COM/2020/789)

The Government of Finland has announced the country´s roadmap to turn transport to fossil-free by 2045 and a goal for reducing the emissions of domestic transport by at least 50 percent compared the level of 2005 by 2030. The roadmap also states that in Finland there should be at least one rapid charging point per 100 BEVs (1:100) and all of those should have a charging point for overnight charging (1:1) by 2030 (Ministry of Transport and Communications, 2021). This gives an urgent need for building a wide EV charging infrastructure to cover all areas and

[1] **EV (Electric vehicle):** Broader category which concerns all electric motor operated and rechargeable vehicles (BEV & PHEV)
[2] **BEV (Battery-Electric Vehicle):** A vehicle that uses electric motor as its only power source and can be recharged

renewing the car fleet in Finland where it is the oldest among the Nordic countries and also relatively old at a European level.

All big car manufacturers have started to shift their focus to the EVs, and quite many of them have stated that they will stop manufacturing their combustion-powered cars. For example, Jaguar announced that it will shift fully to EVs by 2025 and almost right after Volvo announced that they are fully BEV manufacturer by 2030 (Taylor, 2021). It can be seen at the moment, that all the car manufacturers are in a competition where everybody is trying to be the first in line and win the biggest share in the EV markets.

1.1 Objectives of the research

The objectives of this research are in the internationalization of the commissioning company in the context of Finnish market. To support this the author focuses this research on current state of EV charging networks and EV users in Finland. The commissioning company settled thesis targets from company needs on researching potential market areas, the current pricing of service operators, and EV users needs for charger sharing which became the primary target of this study.

Main focus of this study is to get knowledge of EV users charging habits and collect their individual opinions, public opinions that effect on individual, and common willingness to implement new technologies in use. Research of the EV users´ needs identifies their value atmosphere, EV charging habits and opinions about current charging infrastructure, and their needs in Finland. To identify this, the author is conducting a survey to measure these values and to identify the consumer needs for charger sharing for the future use of commissioning company.

To answer on the target of pricing the author collect base information about pricing of the current services. This target is researched with a price analysis of four biggest service providers. To answer on the target to find areal locations for commission companys marketing an author is conducting a gap analysis from current charging locations in Finland and evaluate the charging infrastructure. Collected data includes the results of EV charging infrastructure, pricing and what are participants personal interests and opinions regarding this new technology. With collected data, the author is forming recommendations for commissioning company to find possible marketing areas, customer segments, and entry to market opportunities.

This study studies commissioning company´s possibilities for internationalization, and bringing its Software as a Service (SaaS)[3] -offering for the privately owned EV chargers of municipalities, hotels, housing companies, and individual owners. Through a chained network, all of these could start to administrate, share, and monetize their chargers when those are not in their own use. Charger sharing can be used to widen the existing charging network and to support the prevalence of electric motoring in transport and thus reducing CO_2 emissions in Finland.

1.2 Commissioning company

The commissioning company of this thesis is ChargeBnB AS. It is a Norwegian startup and quite a new actor in the industry of EV charging which itself is also new and rapidly growing. The company is founded in October 2020, and its main business area is to work with SaaS -solutions to provide a platform for its customers which are enterprises, hotels, municipalities, commercial buildings, and private homes. The ChargeBnB business idea relies on its innovation on the charger sharing and bringing convenience into EV charging. ChargeBnB is offering a mobile app platform, where end users can pre-book a timeslot for charging their EVs. With ChargeBnB´s mobile app, the charger-owner customers can manage their chargers and set up the availability of those for sharing them in use to other EV owners. This solution also offers a possibility to monetize and administrate the private owned chargers and the pricing can be adjusted in the system. (ChargeBnB, 2022)

[3] **SaaS (Software as a Service):** A software licensing model where the administrator of the platform allows users to use its applications over the internet as a service without having the need of physically install the software.

1.3 Concept of charger sharing

The EV fleet across Europe is growing rapidly and EV charging operators are constantly building new infrastructure to meet the current demand. In the future when the number of EVs reach the state where public charging points are not enough for consumers demands alone, the EV charger sharing could fill the gap. At the moment, for example in the UK, installed private chargers in workplaces and households are unused 95% of the time (Dodona Analytics, 2021). If these chargers can be utilized, those offer more covered charging network for EV owners who cannot install their own home chargers.

Charger sharing allows charge point owners like workplaces, households, municipalities, and private entities to join on the charger network and monetize their chargers. With a charger sharing the charger owner can start renting the charger for other EV users and administrate the system via app. This app allows the charger owner to set the rules for example the availability, user groups, and pricing of the charger.

The EV fleet is increasing, and even though most users are charging their cars at home, this brings up the problem when all car owners do not have possibilities to charge their cars in off-street parking spots. With the charger sharing the charger owners could join on the green transition and do their part towards the development of electric motoring. With privately owned chargers on the network, the obstacles of EV charging can be reduced, and growing demands of charging possibilities can be fulfilled. (Hyde, 2022)

1.4 Research questions

The main research question, which is supported by the 1) European Union and the Finnish government legislation guidelines and roadmaps, 2) public opinions and atmosphere towards greener policies, and 3) the author´s research aim, is: How can electric vehicle charging possibilities be increased with the help of private-owned charger networks in Finland?

The second research question of the study is: How can the pricing of the public charging effect on the consumers charging habits and feeling of convenient service?

The third research question of the study is: How can the areal charging network effect on consumers' willingness to buy an electric vehicle?

1.5 Significance of the study

Currently, the charging networks´ concentration in bigger built-up areas limits the generalization of EVs. In the future, it will also affect the purchase habits of people's housing. It is already seen that residential areas offering charging facilities are significantly more sought after than areas where infrastructure does not allow EV charging. According to survey, which was launched for EV users on Facebook, 89% of the 633 respondents said that the charging possibility is crucial if they are considering of buying an apartment. The same question was presented for renting an apartment and responses show that 82% of 246 respondents considered charging possibility crucial for renting an apartment. The results of these surveys indicate that expanding the use of municipal and privately owned charging stations for general use will add convenience to the development of electric motoring and could also effect on the consumers purchase decision of EV. (Autotie.fi, 2022)

The concept of charger sharing is easing the journey towards achieving the UN sustainable development goals 7,9, and 11 (UNDP, 2022). Utilizing the privately owned chargers as a part of public charging infrastructure the effect towards achieving previously mentioned UN-sustainable goals is following:

- 7 – Affordable and clean energy: Charger sharing offers the possibility of charging for those who cannot install their own home charging station and speed up a transition towards cleaner transportation.

- 9 – Industry, Innovation, and Infrastructure: Charger sharing offers more options for EV owners when they charge their cars in different destinations. It eases when they are planning journeys and with wider charging infrastructure, removes a feeling of threats´ in charging an EV.

- 11 – Sustainable cities and communities: Charger sharing is increasing the efficiency and speeding up the transition towards pollution free electrified transportation in cities and reducing CO_2 emissions.

2 Theoretical framework

The number of Plug-In Hybrid vehicles (PHEV)[4], and BEVs have increased for past years in Finland and the nation could not fast enough answer the constantly growing demand of charger capacity. This evolvement towards preferring EVs over combustion engine cars is mostly due to the highly increased price of fossil-based fuels (Figure 1),(Statistic Finland, 2022). This rapid increase of fuel-prices is partly consequence of Act on the Promotion of the Use of Biofuels in Transport, which is guiding the percentage of bio-based fuels that has to be mixed on fossil-based fuels and ascends in yearly steps (30% in 2030) (Act on the Promotion of the Use of Biofuels in Transport (446/2007)). The other factor for high fuel, and energy prices in 2022 is the Russian war in Ukraine, which has affected widely in costs of fuels, gas, and electricity all over Europe. (Ottens, 2022)

[4] **PHEV (Plug-In Hybrid vehicle)**: A vehicle that have combustion engine and electric motor as a power source and can be recharged.

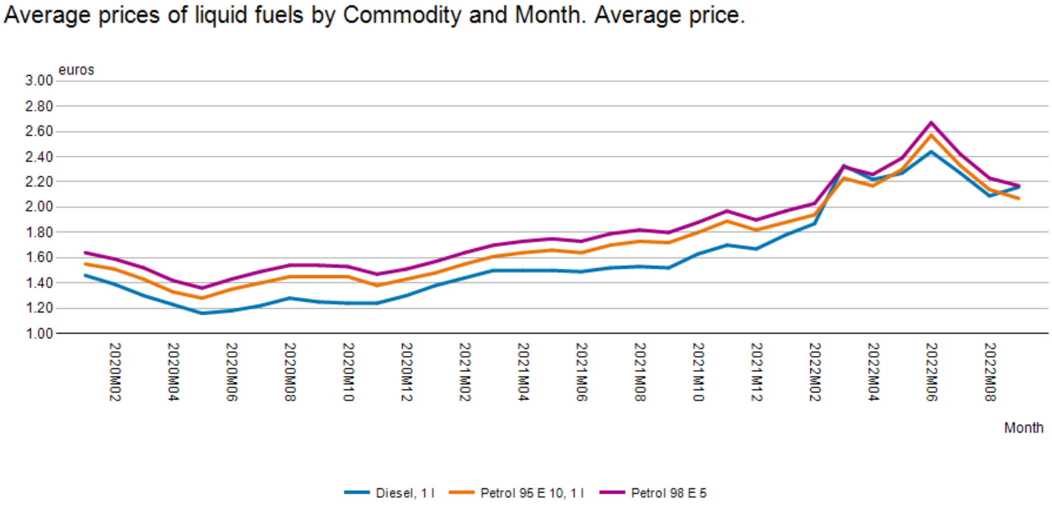

Figure 1 – Price of fuels 2020-8/2022. (Statistics Finland, 2022)

In addition, the general atmosphere has been changing towards greener thinking, thus reducing the usage of fossil-based fuels. The long continued stable pricing of electricity, the improved choice of new EVs from different manufacturers, and the increased network of charging points in past years have made electric transportation a more tempting option compared to fossil-based transportation.

The first-time registrations of cars in Finland have turned past years to showing that EVs have increased their market share and BEVs popularity has passed the popularity of diesel cars and altogether PHEVs and BEVs have passed the popularity of petrol cars in Finland in the year 2021. The latest report 8/2022 of first-time registered cars in Finland shows that PHEVs, and BEVs has together 30.76% market share in 2021, and in September 2022, the market share is 34.79% of first-time registrations (Figure 2). (Autoalan tiedotuskeskus, 2022–a)

	Diesel	Gasoline	HEV, MHEV	PHEV	BEV	CNG
2015	35,70 %	60,90 %	2,60 %	0,40 %	0,20 %	0,10 %
2016	33,20 %	61,60 %	3,90 %	1,00 %	0,20 %	0,10 %
2017	30,40 %	59,50 %	7,20 %	2,20 %	0,40 %	0,40 %
2018	23,80 %	60,60 %	9,80 %	4,10 %	0,60 %	1,00 %
2019	18,30 %	59,30 %	13,60 %	5,20 %	1,70 %	1,90 %
2020	13,25 %	47,29 %	19,42 %	13,72 %	4,40 %	1,91 %
2021	8,53 %	31,23 %	28,54 %	20,45 %	10,31 %	0,92 %
1-8/2022	6,84 %	25,52 %	32,28 %	19,82 %	14,97 %	0,54 %

Figure 2 – Shares of first–time registrations by fuel types in Finland 2015–8/2022. (Autoalan Tiedotuskeskus, 2022–a)

2.1 Challenges in the development of electric motoring

Elevated electricity prices in 2022 have posed a threat over the development of electric motoring, as consumers are skeptical about the future cost of electricity (Yle, 2022.–a). Finnish government made a temporary change to the obligation to distribute mixed bio-based fuel liquids in late summer 2022 and that has momentarily lowered the price of fuel (Act on the Promotion of the Use of Biofuels in Transport (446/2007)). Earlier, when electricity prices have been lower, the benefits of electric motoring have been easier to see from the consumer's point of view, and this artificial situation where fuel prices are lower due to a temporary change in the law the clearest advantage, the cheaper operating cost of EV is narrowed in comparison with combustion engine powered vehicles. So far this threat of rising electricity costs is not visible in the sales of EVs, and the market is running. Electric cars are trading at full power and importers sell all the cars they have. At the moment, a purchaser of the new or used EV should be prepared for the fact that they may have to queue for the most popular car models from six to twelve months because of the high demand. (Yle, 2022.–b)

In August 2022, the Geological Survey of Finland released a study summary from the report made by Associate Research Professor Simon Michaux, where it is stated that the currently known global mineral reserves for producing the EV batteries are not enough to build worldwide fossil-free transition (Geological Survey of Finland, 2022), (Michaux, 2021). This study summary has risen a lot of discussion about global mineral reserves and the threat is real that the needed materials for electric transport batteries are not enough. Discussion around this topic has also raised different points of view, and many have already called for responsibility on painting threats and highlighting the fact that the report deals with already known mineral reserves and new reserves will be discovered when new areas are mapped. Discussions have also highlighted the fact that the development of battery technologies and battery recycling is a priority for converting traffic to electric and the emerging technology will enable completely new types of batteries to be used in electric motoring in the future. (Cooley, 2022)

2.2 Literature review

Area of EV charging markets, which the author is researching is quite new in Finland. The literature that is directly handling this thesis topic from Finnish perspective is few, because EVs have been on the market so little time. For general knowledge, Motiva Oy offers a great start package for all people who are thinking of buying an EV and their website includes great amount of basic knowledge what to consider regarding electric motoring. (Motiva, 2022–a)

The Ministry of Transport and Communications follows the development of electric charging infrastructure in Finland and has released a memorandum of the current state and future expectations of national charging network development for electric cars. The memorandum states that at the moment public charging points are not equally divided, and most of those are built in bigger cities. In 2019, 48% of public charging points were located in Helsinki, Tampere, and Turku area. The Ministry of Transport and Communications has ordered two forecast scenarios from Technical Research Centre of Finland and those give predictions of the future EV fleet. The first prediction results that in 2030 there is all together 620,000 EVs (BEV, PHEV, Hydrogen car) in Finland from which BEVs count is 287,000. If this scenario happens, there is a need for 2,870 (1:100) public rapid charging points and 287,000 (1:1) charging points for overnight charging (Ministry of Transport and Communications, 2022), (Pihlatie et al., 2019). Great efforts will be required to reach this result of charging points, as not all EV users have the option of charging at home and still those need a reliable charging location near home for their EVs.

In 2020, The Finnish Information Centre of Automobile Sector conducted a survey of habits and thoughts for 5000 Finnish PHEV and BEV users and got a response rate of 44%. In the survey report, they present the latest condition of the charging network and peoples´ believes and behavior. This survey report does not consider the subject through privately owned non-public chargers and it is listing and concentrating mostly on the existing public network but provides a great summary of the advantages and disadvantages of common condition. (The Finnish Information Centre of Automobile Sector, 2020)

In Finland, the organization Sähköinen Liikenne ry together with Finnish Transport and Communications Agency - Traficom follows the increase of electric motoring and announces its report four times a year. The report lists the figures of the current EV fleet and available public charging network (Sähköinen Liikenne ry, 2022), (Traficom, 2022). Also, this report has its limitations. Even though it gives a good summary of the current state of the EV fleet and public charging possibilities, it does not cover all aspects of EV charging possibilities in total and does not follow the privately owned charging network.

The city of Helsinki has been highly active in the development of the charging network and in city area there are altogether over 500 public charging points and over 100 On-street public charging points. The city has a general development plan for public charging, and it leases city´s street space for the use of operators which provide charging services. (Helsingin ilmastoteot, 2022)

2.3 Situation of EVs and public charging capacity in Finland

According to the latest report of Sähköinen Liikenne ry, at the end of Q2/2022, there was total 125,084 EVs in Finland from which 32,981 are BEVs, and 92,103 are PHEVs. The increase of Finnish EV fleet in BEVs comparing the figures of Q2/2021 with Q2/2022 has been +125% (+18,299), and PHEVs +47% (+29,317) (Sähköinen Liikenne ry, 2022). Autoalan Tiedotuskeskus offers even more precise statistics in their service which is updated monthly and those show that the count of EV´s has been risen steadily during the year 2022 (Figure 3). (Autoalan Tiedotuskeskus, 2022–b)

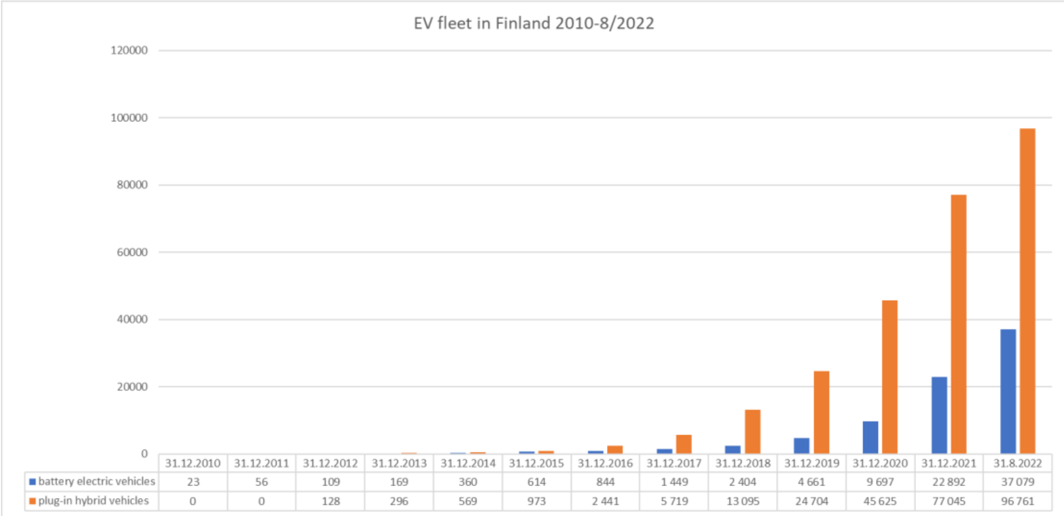

Figure 3 – Increase of EV fleet in Finland 2010–8/2022. (Autoalan Tiedotuskeskus, 2022)

According to the latest report Q2/2022 of Sähköinen Liikenne ry, there are altogether 7,264 public charging points in Finland. The total ratio between charger capacity and EVs in numbers of basic charging (type2) points for BEVs, and PHEVs is 20 per one of 6,306, and fast and rapid charging points for BEV´s are 34 per one of 958 (Figure 4). (Sähköinen Liikenne ry, 2022)

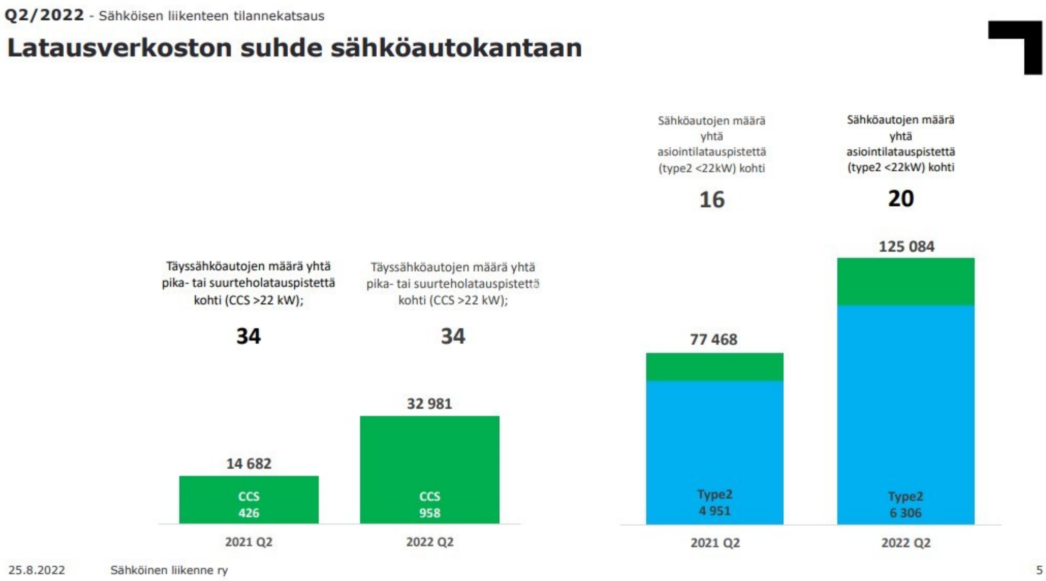

Figure 4 – Charging point ratio – EV fleet/charging points in Finland 2021–2022.
(Sähköinen Liikenne tilannekatsaus, Q2/2022)

In Finland, even that EV charging possibilities increase rapidly when new charging stations are built, in rural areas there are still difficulties to buy an EV because the electrical wiring in buildings is often old-aged and the building of efficient (11–22 kW) charging station is costly. In rural areas, quite many EV owners still charge their cars at home with household outlet sockets (~8 A fuse+1,85 kW) and in old buildings even if they use 16 A fuses the electric wires are often old and their long-term charging durability is not lasting over this 8 A charging. This 8 A limitation to charging from household outlet has been settled as a standard regulation SFS–EN 62752 in Finland and it is limiting the charging speed in home use and being meant for temporary charging if the actual EV charging point is not available. (Sesko, 2021)

An efficient 11–22 kW charging station for home use costs around 1,100–1,600 euro with installation costs included. If the station needs more than 15 meters wiring, those installations costs extra. These charging stations come with a type2 cable and in the higher end of the price range those include more options for the user, for example charging timing and app for controlling the station remotely. In Finland where the main fuses of a household are mostly 3*25 A and people have saunas, the efficient charging station needs a load management system, or the charging timing has to be monitored manually. For 11–22 kW home charging stations these load management systems are offered as an option from the higher end of price range of charging stations. (Lataus.net)

The Housing Finance and Development Centre of Finland announced the governmental funding for building a charging infrastructure in 2022. This funding is limited in maximum 35% of actual costs and maximum 90,000€. There are also limitations that could be slowing the development of charging infrastructure. The regulation to get a funding is in the minimum number of chargers, where example a housing company is forced to build at least five chargers per time. (ARA, 2022)

2.4 Public charging capacity in Europe

According to European alternative fuels observatory statistics released (Figures 5,6), in EU there are 306,864 public recharging points, which is counted in both, normal- (<22 kW), and high-power (>22 kW) chargers. Count of public high-power recharging points (>22 kW) is 41,747. Top three countries, which represent 60% of EUs charging infrastructure with the number of public charging points are: Netherlands (90,284), Germany (59,410), and France (37,128) (European alternative fuels observatory, 2022). European Court of Auditors has stated in their report that the building of new charging stations is increased, but still uneven deployment of those does travelling difficult across Europe. (European Court of Auditors, 2021)

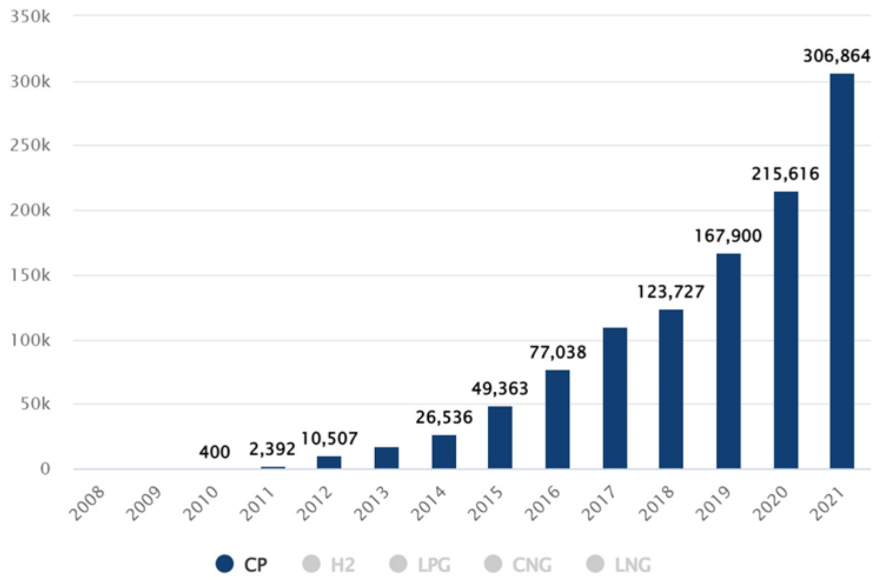

Figure 5 – Total number of recharging connectors in Europe (CP).

(European alternative fuels observatory, 2022)

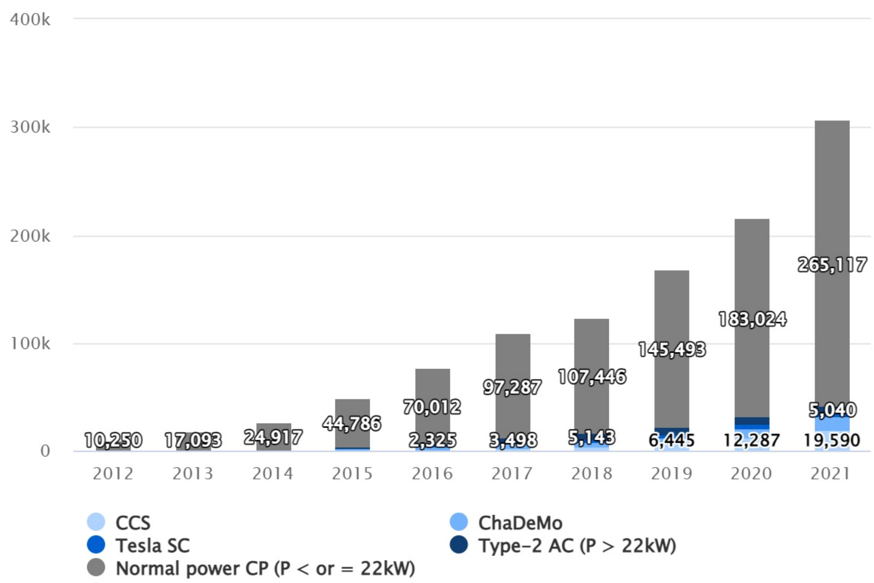

Figure 6 – Total number of recharging connectors by type.

(European alternative fuels observatory, 2022)

2.5 Public charging capacity in the U.S.

(Greene et. al, 2020) have released a report where they researched public charging infrastructure of EVs in California in 2017. Research addressed human behavior of how the lack in charging infrastructure effects the buying habits of EV users and how to improve a common thinking of EVs range disadvantages and building confidence of potential car buyers. The report is focusing on a value of existing charging infrastructure and how it effects on peoples´ decisions to buy an EV. In the U.S., the gap that slows their EV market is the lack of chargers and that they are divided unequally. In the U.S. there is 43,000 public charging stations and 120,000 charging points in total, where in California there is the highest number of EV chargers in the U.S., which is almost the same amount as 39 other states with the lowest count combined. (Bellon, Lienert, 2021)

2.6 Norway, the European leader of market share in EVs

In Norway, where government has given more eases to EV owners, example lower taxation and free parking in larger cities, the number of EVs has been increasing very strongly and subject is researched more. (Figenbaum, Kolbenstvedt, 2016) have conducted research that is one of the most referenced research studies of this area in past years and these report-based surveys that measure peoples´ habits are followed and arranged yearly. There is almost 17,000 public charging stations in Norway with over 3,000 fast chargers and those are installed in every main road. In main road network the nearest rapid charger can be find in less than 50 kilometers (Mer, 2022). In Norway where the EVs market share is the largest in Europe, with the amount of 556,700 of BEVs and 66,713 in the year 2022 (EV-stats 7/2022), still they are struggling with the same problem as other countries, the infrastructure does still not support enough of owing an EV in rural areas. (Lorenzen et al., 2017)

2.7 Theories regarding company internationalization

There is no universally adopted model of company internationalization yet, despite that several theories have been developed in past decades to research company´s market entry process. The most widely adopted and used theories to conduct a company´s international market entry and strategy research are stage theory, network theory, and international entrepreneurship theory. These three main theories combined support each other for explaining and understanding company´s strategic decision-making when the firm is looking opportunities for widening its business abroad. (Reuwer et al., 2013)

2.7.1 Stage theory

Uppsala model

The Uppsala model from 1977 is the most common and widely adopted stage theory approach in international business when company is measuring its capabilities and seek opportunities to widen its business into foreign markets. The Uppsala model was originally published Johansson and Vahlne in 1977, and it states that company´s business internationalization follows pattern of learning and commitment stages, based on company´s knowledge of foreign target country (Figure 7). (Johansson & Vahlne, 2009)

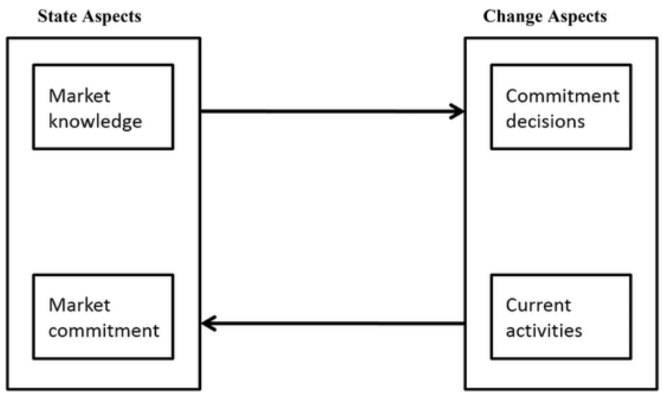

Figure 7 – The basic 1977 mechanism of internationalization: state and change aspects (Johanson and Vahlne 2009, pp 1411–1431)

Each of model stages bring more knowledge for the company and create a path to follow from stage to stage when the goal is to internationalize company´s business into other country. These stages can also be seen as a measure of company´s commitment and dedication in foreign markets and what decisions are taken to go international. Core stages of the Uppsala model are:

- Stage-1: The company has no regular export of its product and business is concentrated markets in home country.

- Stage-2: Product exports are made via independent agent representatives.
- Stage-3: Company´s product export is systematic, but intermediaries are still used in promotion of company´s products.
- Stage-4: The company has established a subsidiary company for production and sales in the target country.

Business network internationalization process model (Revised Uppsala Model)

Johanson & Vahlne revised Uppsala model in 2009 to serve better modern-day markets which consist of concepts and insights that were not taken into consideration in the original model. The progress of networks and internet has degreased the importance of company´s geographical distance in the globalized world and increased the importance of knowledge of the business environment as well as building relationships and trust between businesses. The revised Uppsala model highlights the importance of identifying and developing the opportunities between network insiders, and added the recognition of opportunities, as one of the key concepts of the revised model (Figure 8). (Johansson & Vahlne, 2009)

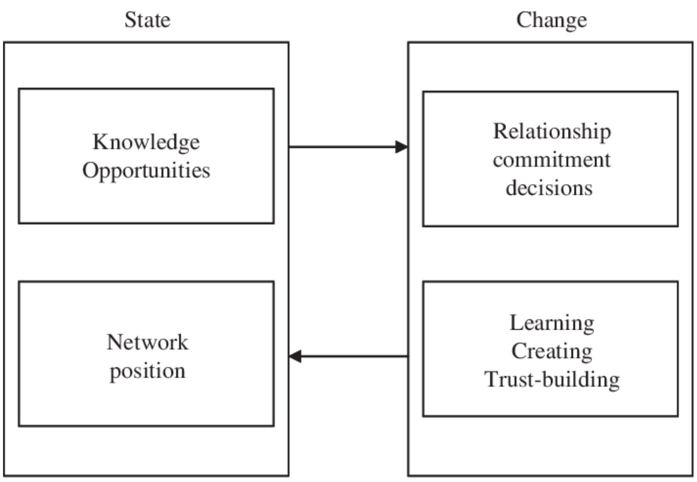

Figure 8 – The business network internationalization process model (the 2009 version)
(Johanson and Vahlne 2009, pp 1411–1431)

Limitations of Uppsala model

The original Uppsala model has four core stages which are built to serve mostly production companies and the model does not fully cover researched subjects and it is not fully applicable to conclude the subject of internalization of the commissioning company´s business. Combined with the revised 2009 business network internationalization process model, Network theory, International entrepreneurship theory, and chosen theories for measuring the consumer habits, the revised Uppsala model is well suited to carry out this study and give accurate information about commissioning company´s capabilities to internationalize its business operations.

2.7.2 Network theory

The network theory fits well on the internationalization process of Small to medium-sized Enterprise (SME), which have limited resources to expand its business. Theory is stating that interaction with customers, partners, and other market actors in company´s network is crucial for small business, and all firms are considered a part of one, or more of these ecosystems. These business networks and their connections play a major role in the company´s internationalization process and effect on company´s choice of market areas and market entry mode as well as expansion and development plans. (Reuwer et al., 2013)

These business networks are often considered as company´s bridges into international markets, and they speed up the processes with a help of the experience and resources of its member partners. In the case of commissioning company that can be considered as a near future Born Global company which seeks fast expansion and competitive advantage in emerging markets of EV charging service internationally, the network theory takes its place on the research of current active players in the Finnish markets.

2.7.3 International Entrepreneurship theory

Based on international entrepreneurship theory (IET) the company´s entrepreneurial and individuals' behavior are forming the base of company´s market entry. Theory is focusing on the value and the role of an entrepreneur as the most important value of SMEs internationalization process and states that international entrepreneurship is a process of discovering and exploiting new opportunities outside company´s home markets and to find the increase of company´s competitive advantage. (Reuwer et al., 2013)

The commissioning company´s future target to expand its business internationally and the needed decisions will be highly influenced by its entrepreneurs and the demands of markets. One of the influencing factors for company´s internationalizing process is the type of the company and its industry. The Commissioning company works with SaaS-technologies and its location is not so dependent to its markets when all business actions are internet based. These rapidly growing companies are referred as Born Global´s and typically those are SMEs which are seeking opportunities to widen their business to abroad within a few years of founding and reach international sales for over 25% of their yearly revenues. (London Business School, 2008)

2.8 Theories for measuring the consumer habits

The author has based this part of research on two theories that help to evaluate the results of questionnaire, give answers to two aspects of research and support Uppsala model, Network theory, and International Entrepreneurship theory when analyzing data. First one is Maslow´s Hierarchy of Needs that gives an answer to participants personal needs, fears, expectations, knowledge, and thoughts about owing an EV and charging capabilities.

Second used theory is Ajzen´s Theory of Planned Behavior what the author is using to evaluate participants personal behavior of adopting new technologies, influence of external values and how perceived knowledge and information has influenced on individual´s behavior and motivation to get an EV.

Questionnaire evaluates the subject based on research questions, where these theories take their place for researching the common atmosphere and values for the possibilities of installing EV charging station in the joint use of wider population, instead of the need individually buying own.

2.8.1 Maslow´s hierarchy of needs

The author has decided to conclude a part of this study to research human behavior and psychological motivation what comes to increasing knowledge of EV charging and convenience of using an EV.

In Maslow´s Hierarchy of Needs it is stated that human´s basic needs must be fulfilled first, in this case learning and gaining information about convenience of charging a vehicle at home, or near home and the knowledge of the easiness for how to do it.

Now when humans feel the inconvenience of high gas prices and settled climate goals the Maslow´s theory takes its place where people look answer for one of their needs to find out easy, affordable, and convenient way of moving from one place to another. Even that transportation is arranged now, people feel uncomfortable because of the changing environment of transportation, and they do not have enough knowledge of the future and how to solve settled climate goals and targets as an individual´s.

In Maslow´s Hierarchy of Needs there is explained that people would not need to be fully satisfied in one need to go on the next stage, but in given time the most people´s tend to have those needs at least partly fulfilled. Gaining some knowledge for better understanding of EVs, gives a feeling of safety and contributing on people´s self-actualization. (Hopper, 2020)

2.8.2 Ajzen´s Theory of Planned Behavior (TPB)

As a part of this study, the author has decided to evaluate human behavior in based of Ajzen´s Theory of Planned Behavior and how the understanding of the adopting new technology and different factors of thinking effect on people´s intentions to get an EV and their engagement towards climate goals.

In Ajzen´s theory it is explained that people´s intentions are determined by three variable classes where first one is human´s personal attitudes that affect individual´s behavior. Now it can be seen that because the lack of knowledge some people resist the movement toward fossil-free transportation and take a strong stand against EVs.

Second variable in Ajzen´s theory is the subjective norms where it is considered how individual humans view the ideas of other people. Nowadays it can be seen how the resisting of development and delivering of unfavorable information effect on the public thinking what it comes to EVs. Because the lack of knowledge it is easy for resistants´ to spread harmful information for example arguing about the environmental friendliness of EVs on the social media platforms.

Third variable in Ajzen´s theory considers perceived behavioral control and how humans think that they can control their own behavior. Human´s behavior depends on ability to understand new technologies and individual´s own determination. With correctly delivered information about the technology of EVs and charging capabilities people could gain their own knowledge and this effect on the public opinions and that way in a perception of individual´s own ability to understand the importance of climate goals that government has settled in Finland. (Brookes, 2021)

3 Methodology

As part of the research, the author collects data from primary sources and conducts a survey for already existing EV owners. For collecting the knowledge about the subject, the author is conducting a survey in two existing Facebook groups, Latausverkosto - Nyt! and Sähköautot - Nyt! which are the most active EV user groups in Finland. In June 2022, Latausverkosto - Nyt! - group had 10,400 members, and Sähköautot - Nyt! - group had 26,500 members. By the high number of potential respondents, the author expects to collect a representative amount of survey data to be evaluated.

The secondary data is collected via existing literature and other valid sources from the internet and mobile App´s. With the secondary data, the author is conducting a price analysis of current pricing of public EV charging and comparing it with average price of home charging to collect knowledge about the current state of the prices in Finnish markets. With the secondary data the author is also conducting a gap analysis of the coverage of the current available public charging network. These analyses from secondary data sources are used for researching areal business locations for commissioning company´s future use and validating their pricing model.

3.1 Mixed methods research explanation

Mixed methods research is a combination of quantitative research and qualitative research, and it is used to gather deeper knowledge from researched subject. This research method is commonly used in behavioral and social sciences, and it helps to understand the correlation between numerical and written data. Mixed methods research can be used when quantitative or qualitative data alone does not give deeper knowledge for the settled research question. This research method is allowing the researcher to collect both data types and find correlations which support the collected generalizable quantitative data and contextualize that with collected qualitative data to get a better knowledge about the subject. Mixed methods research is bringing more credibility and validity in results when the results are supporting the conclusion of the study. (George, 2022)

3.2 Justification of the selected research method

To accomplishing this study, the author has selected the mixed research method. This method is used for gathering deeper knowledge of the subject and public opinions about EVs, charger sharing possibilities, and how survey participants feel about EVs. Purpose of using this mixed method research in this thesis is to find correlations between numerical data and open-ended responses. This method was chosen because the survey is collecting both types of research data and measures people behavior and opinions with open-ended questions and collecting numerical data from their opinions and habits. Qualitative research is used in this thesis for the collecting of non-numerical data and to understand EV users' opinions and habits concerning EV charging. With qualitative data, which is collected from the open-ended questions of the survey, the author is gathering deeper knowledge on how EV users experience the current state of electric motoring. The quantitative research method is used in the survey to find comparable data about the user behavior and highlight the changes compared with previous studies about the subject. (George, 2022)

With the settled main research question of "How can electric vehicle charging possibilities be increased with the help of private-owned charger networks in Finland?" and chosen theories related, the mixed qualitative and quantitative research method is the right choice to carry out this study. With the data that is collected from the survey, where participants´ opinions and values are heard and listed, the author is evaluating consumer behavior and habits. Evaluation concerns the commissioning company´s chances to bring its EV charger sharing solution into Finnish markets.

3.3 Research design

Primary research of this thesis is designed to gather qualitative data with open-ended questions on a targeted survey for existing EV owners and also quantitative data that is pre-defined with findings from the secondary research. The survey contains open-ended questions for this focus group to gather insights about the current state of EV charging infrastructure and how people see the state of EV charging. Purpose of this study is to make the subject better known and increase the participants´ knowledge about the subject of research and then evaluate the questionnaire responses and measure participant´s habits, opinions, knowledge of the subject, values, and personal interest of EVs and EV charging.

The secondary research of this thesis is designed to evaluate the existing information from valid sources from internet and mobile apps. The purpose of the secondary research is to find charging point coverage and pricing of the services and conduct analyses from those for the commissioning company´s future use.

3.4 Survey questions

The survey for EV users is created with Webropol-program which is a part of HAMK´s student toolbox, and it was offered for respondents with two language options, English and Finnish (Appendix 1). The survey was launched in two Facebook groups Latausverkosto.Nyt! and Sähköautot.Nyt!. Survey was open in a selected time from 18.8.2022 to 24.8.2022, and in the middle of that time the author sent a reminder to those Facebook groups to collect more responses in 21.8.2022. Data is collected and stored in Webropol servers, and it is a password protected by the author. The data management plan is presented in Appendix 2.

4 Results

4.1 Price analysis

Price analysis was conducted with the purpose to evaluate and to gather deeper knowledge about the current pricing models of EV charging in Finland and answering on the following research question “How can the pricing of the public charging effect on the consumers charging habits and feeling of convenient service?”. The key findings of price analysis are presented in discussion section 4.4.1. of this thesis.

4.1.1 Public EV charging operators and their charging costs in Finland

There are four big operators in Finland: Virta, Recharge, K-Lataus, and ABC-Lataus. There are also few minor operators that offering their services, but quite many of these are collaborating with the big ones. For accomplish this study, the author has gathered the number of the four biggest operators´ chargers, and average costs of charging per kWh. These charging costs vary quite much, depending on the electricity prices, the pricing model, and the location of chargers.

4.1.2 Virta

The biggest company of these public charging service providers is Virta. It has 769 charging stations in Finland. In addition, Virta offers a roaming service in 30 countries for over 170,000 public charging points to its customers to use other companies’ chargers as well (Virta, 2022). The charging costs are depended on location and example costs in Helsinki area for registered customers are following:

- Basic charging 0,15 €/kWh + 2 €/hour, (Kamppi, Helsinki)
- Fast charging 0,22 €/min (Kamppi, Helsinki)
- Rapid charging 0,35 €/kWh + 0,20 €/min after 1 hour (Konala, Helsinki)

Unregistered customers charging fees in same location are following

- Basic charging 0,20 €/kWh + 2,60 €/hour (minimum fee 0,50 €), (Kamppi, Helsinki)
- Fast charging 0,29 €/min (minimum fee 0,50 €), (Kamppi, Helsinki)

- Rapid charging 0,46 €/kWh + 0,26 €/min. after 1 hour (minimum fee 0,50 €) (Konala, Helsinki)

(Virta, mobile App, June 23, 2022)

4.1.3 Recharge

Recharge which was formerly known as Fortum Charge and Drive is providing charging services in Finland, Sweden, and Norway. It has over 2,500 charging points in these three countries. In Finland, the company has 251 charging stations with charging points (Recharge, 2022). The charging costs are depended on location and example costs in Helsinki area for registered customers are following:

- Basic charging 0,33 €/kWh + 0,30 € starting fee (Messukeskus, Helsinki)
- Fast charging 0,25 €/min (Pukinmäki, Helsinki)
- Rapid charging 0,54 €/min (Pukinmäki, Helsinki)

(Fortum Charge & Drive, mobile App, June 23, 2022)

4.1.4 K-Lataus

K-Lataus has 107 charging stations in Finland, and these have 332 slow charging (type2) points, and 149 fast charging points. The company has announced it is going to double its network in 2022 (K-Lataus, 2022). The charging costs for registered customers are following:

- Basic charging 0,20 €/kWh + 0,02 €/min. after 2 hours.
- Fast charging 0,20 €/min.
- Rapid charging 0,30 €/kWh + 0,20 €/min. after 45 minutes.
- For non-registered customers there is also a 1 € starting fee for charging.

(K-Lataus, K-Lataus-asemien hinnasto, June 23, 2022)

4.1.5 ABC-Lataus

ABC-Lataus is the fourth of the big ones and it has 71 charging stations in Finland on its gas-station and grocery store network, and 57 locations with a charging point. ABC-Lataus has announced that it has the most comprehensive charging network in Finland with over 1,000 charging points in Finland by the end of 2024 (ABC-Lataus, 2022). The charging costs are depended on location and in this example costs in Helsinki area (Hok-Elanto) are following:

- Basic charging 0,20 €/kWh
- Fast charging 0,25 €/kWh
- Rapid charging 0,25 €/kWh

(ABC-mobile, App, June 23, 2022)

4.1.6 Comparison of charging costs

Comparison of the charging costs is quite difficult for the consumer in current situation where some service providers are informing their prices on a minute-based and others kWh-based. When using these services, the user has to understand that in minute-based pricing the car model which could take on higher kilowatts have the benefit on that. It has to be noted also that the information of maximum capacity of the charging point does not necessarily being fulfilled. This can happen if there are many charging points in use at the same time and the charging field starts limiting the power with the dynamic load management system (Kempower, 2021). The consumer has to note these or otherwise the ending bill could be unexpected.

When using these services and comparing the pricing of those with home charging, it is important to notice that the price is dependent on person´s energy contract with energy company. The offered price for electricity in year 2022 has varied highly and the author has used the estimated price from June 2022 (0,12 €/kWh), including taxes, and transferring costs. During the year 2022 the price of the electricity has increased highly in Finland and Europe, and forecasts show that the price is going even higher in upcoming heating season. In September, the price of the electricity has been 0,34 €/kWh with VAT in 7–day average price in Nordpool (Sahko.tk, 2022). EV owners who have old fixed-price energy contracts benefit a lot from those at the moment, but for people with new energy contracts it has become cheaper to use public charging services.

In table 1, the author has gathered charging costs in Helsinki area for charging the most popular BEV in Finland 2022, Kia EV6, in these services. (Nordicplug, 2022)

The car of the example is Kia EV6 Long Range 77.4 kWh, with the operating range of 528 kms. and 16.5 kWh/100kms. electricity consumption. (Auto-Data, 2022)

Kia is one of the fastest charging BEVs at the market and could go up to 234 kW charging speed. Despite this, the author has used the maximum power of 150 kW for rapid charging from 20% to 80% of battery power, where the charging speed is the most stable. The average charging time in a rapid charger is around 5 minutes per 100 km with ~150 kW charger, and 30 minutes per 100 km with ~50 kW charger. (Fastned, 2022)

Table 1 – EV charging costs in Helsinki area and costs of home charging – June 2022.

Charger operator	Price/kWh Basic charging 22kW	Price/min. Basic Charging 22kW	Starting fee Basic charging 22Kw	Time 46 kWh - minutes	Price 46 kWh	Range kms/46 kWh	Price/100kms.	Price/15000 kms.
Virta	0,15 €		2€/hour	125,45	9,02 €	278,79	3,24 €	485,54 €
Recharge	0,33 €		Start fee 0,30€	125,45	15,48 €	278,79	5,55 €	832,89 €
K-Lataus	0,20 €		0,02€/min. after 2hours	125,45	9,31 €	278,79	3,34 €	500,87 €
ABC-Lataus	0,20 €			125,45	9,20 €	278,79	3,30 €	495,00 €

Charger operator	Price/kWh Fast charging 50kW	Price/min. Fast Charging 50kW	Starting fee Fast charging 50Kw	Time 46 kWh - minutes	Price 46 kWh	Range kms/46 kWh	Price/100kms.	Price/15000 kms.
Virta		0,22 €		55,20	12,14 €	278,79	4,36 €	653,40 €
Recharge		0,25 €		55,20	13,80 €	278,79	4,95 €	742,50 €
K-Lataus		0,20 €		55,20	11,04 €	278,79	3,96 €	594,00 €
ABC-Lataus	0,25 €			55,20	11,50 €	278,79	4,13 €	618,75 €

Charger operator	Price/kWh Rapid charging 150kW	Price/min. Rapid Charging 150kW	Starting fee Rapid charging 150Kw	Time 46 kWh - minutes	Price 46 kWh	Range kms/46 kWh	Price/100kms.	Price/15000 kms.
Virta	0,35 €		0,20€/min after 1 hour	18,4	16,10 €	278,79	5,78 €	866,25 €
Recharge		0,54 €		18,4	9,94 €	278,79	3,56 €	534,60 €
K-Lataus	0,30 €		0,20€/min. after 45 minutes	18,4	13,80 €	278,79	4,95 €	742,50 €
ABC-Lataus	0,25 €			18,4	11,50 €	278,79	4,13 €	618,75 €

Charging in home	Price/kWh	Home Charger 11kW with installation costs	Depreciation period of charger - Years	Time 46 kWh - minutes	Price 46 kWh	Range kms/46 kWh	Price/100kms.	Price/15000 kms.
Home charger	0,12 €	1 500 €	5	250,909091	6,34 €	278,79	2,27 €	341,22 €

In table 1, the author has calculated the costs of charging in the best conditions, BEV manufacturer informed energy consumption 16,5 kWh/100 kilometers and maximum speed of charger type. In the Nordics, despite these manufacturers given information about consumption figures it has to be noted that the normal energy consumption of BEV is on average of 20 kWh/100kms. (Motiva, 2022–b)

4.2 Gap analysis

A gap analysis was conducted in a purpose to evaluate the Finnish EV charger networks coverage and to point out the areal locations where there is lack of available public EV charging possibilities and answering on the third research question "How can the areal charging network effect on consumers' willingness to buy an electric vehicle?". The key findings of the gap analysis are presented in discussion section 4.4.1. of this thesis.

4.2.1 EV charging operators' coverage mapping in Finland

In Finland there are quite many operators in charging business which provide their services for EV charging. Maps for the charger network can be founded on the internet and the most comprehensive is provided by Google maps, where it is easy to check the locations of the nearest charging stations and charging points. Despite that Google Maps is covering most of the charging points it is quite hard to check locational charging possibilities with that, and there comes service providers in question which are offering maps for finding those chargers. The selected map service providers for this study are Latauskartta.fi, Plugshare.com, and Chargemap.com. All these three maps (Figures 9,10,11) show that there is lack of charging infrastructure in Eastern and Northern parts of Finland. Even though the coverage of charging points is in a good state in Southern and Western parts of Finland there are areas between bigger cities, where there are no possibilities for public EV charging.

4.2.2 Latauskartta.fi

Latauskartta.fi service is provided and updated by Finnish EV association Sähköautoilijat ry, and it provide a good basic knowledge about the charging network for EV owners to plan their routes when charging is needed in longer distances. The service also gives an opportunity for its users to report the usability of chargers and to send pictures of those in the platform. (Latauskartta.fi, 2022)

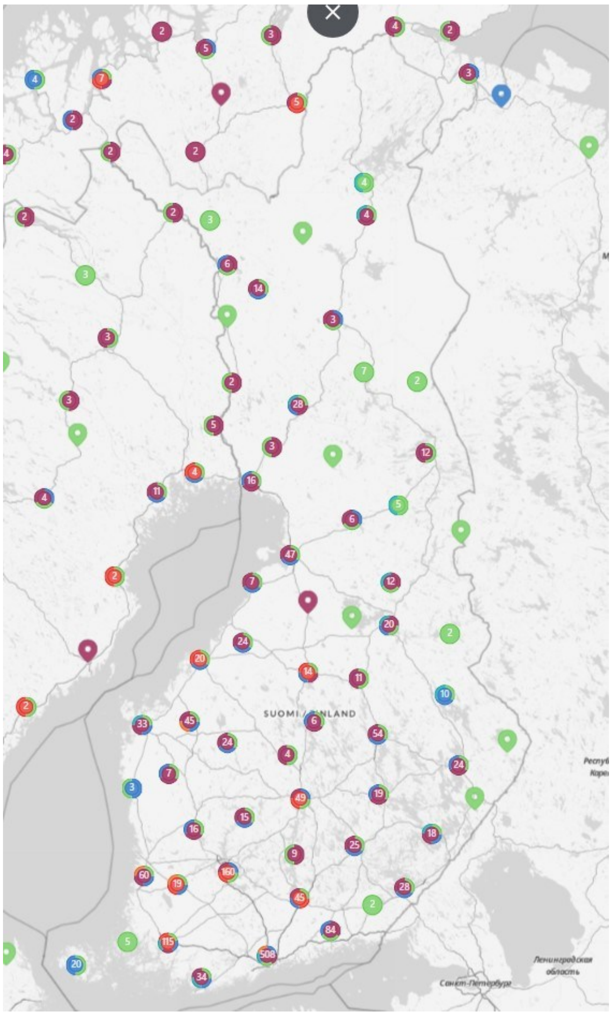

Figure 9 – Charging stations in Finland, June 2022 - All types. (Latauskartta.fi, 2022)

4.2.3 PlugShare.com

PlugShare is an app for EV drivers and has an accurate charger map around the world and it offers a map for charging points and availability data. PlugShare offers its users' a possibility to add privately owned charging stations on the map and report the functionality of those with scoring. This option for charger sharing is quite similar to commissioner company's business model, but it does not allow to set the pricing for charging. With PlugShare app, the EV charger owner could control and set availability times for their chargers. The App is very user-friendly, and it includes features example route planning, and it is compatible with Google maps. (PlugShare, 2022)

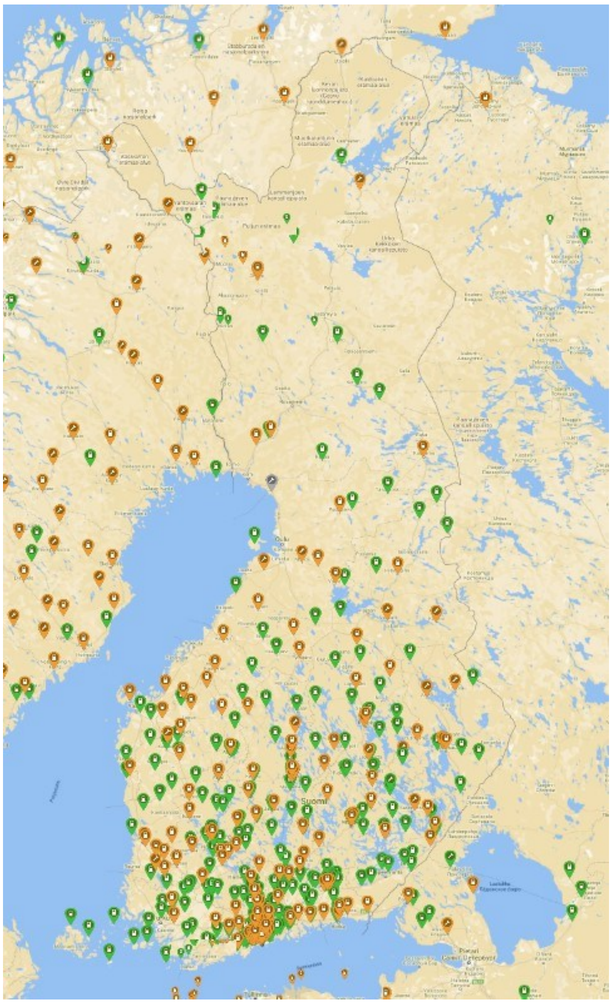

Figure 10 – Charging stations in Finland – All types, June 2022. (PlugShare, 2022)

4.2.4 Chargemap.com

Chargemap´s functionality is basically at the same level as PlugShare, and it also gives an opportunity for its users to set their chargers to be seen and control the availability of those. However, their website does not allow to see the availability of the EV chargers without registering in their service. (Chargemap, 2022)

Figure 11 – Charging stations in Finland - All types, June 2022. (Chargemap, 2022)

4.3 Survey analysis

The survey for EV users collected a total of 319 responses and contained answers from 295 (92.5%) EV owners and 24 (7.5%) non-EV owners. During the one-week response time, the survey was opened 416 times and 365 participants started answering on the survey. This resulted that the completion percentage of the survey was 87% and showed that it was felt as interesting, and the respondents felt it important to complete. The survey analysis is divided into four categories and the author has used figures and tables to show the results for the reader and make the following of survey results easier. Categories of survey analysis are Demographic questions, EV users Charging habits, Opinions and needs, and Open-ended questions. The key findings of survey analysis are presented in discussion section 4.4.2. of this thesis.

4.3.1 Demographic questions

The demographic questions resulted that 285 (89.4%) of the respondents were men, and 31 (9.7%) were female. Three respondents answered Other or Prefer not to say. The age division of respondents was quite equally divided, and age groups 35–44 (32%), and 45–54 (31%) were the biggest (Figure 12).

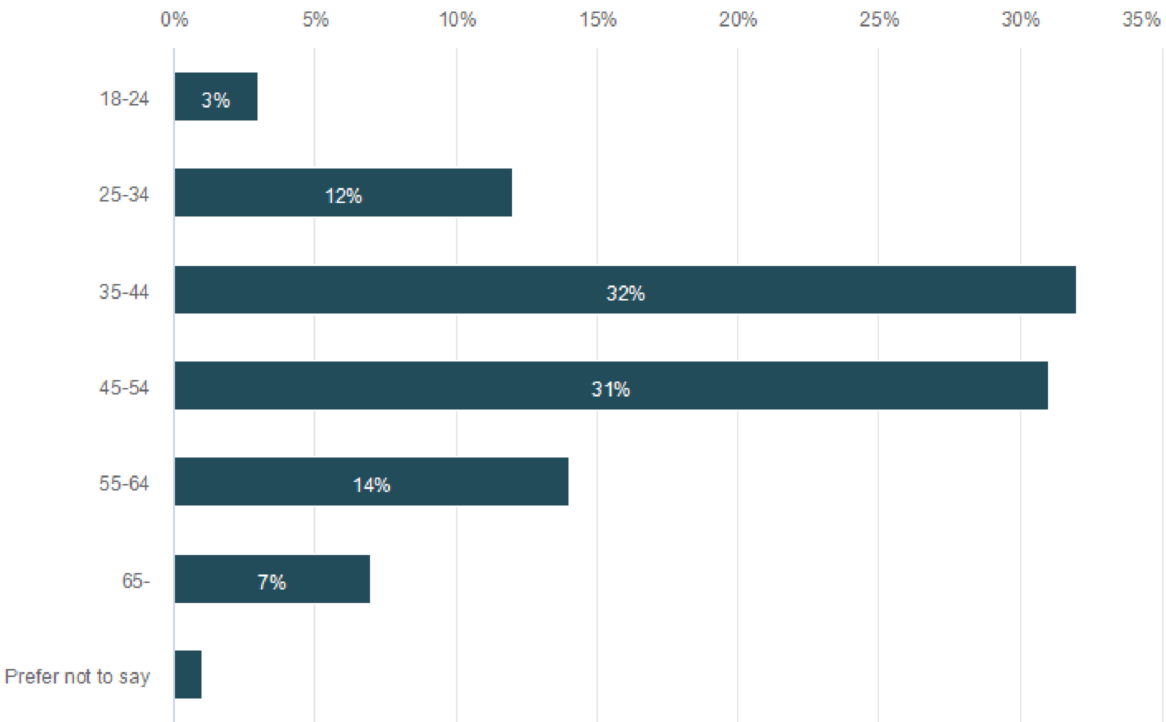

Figure 12 – The age group of the participants

The question of respondents´ yearly income (Figure 13) resulted in answer which showed that most of the EV owners earn over the average Finnish annual income, which was 42,769 €/year in 2020 (Statista, 2022). 130 (41%) of the survey respondents answered that their yearly gross income is 60000€ or greater. The second largest group (18%) was respondents who earn 50000–59999 € per year.

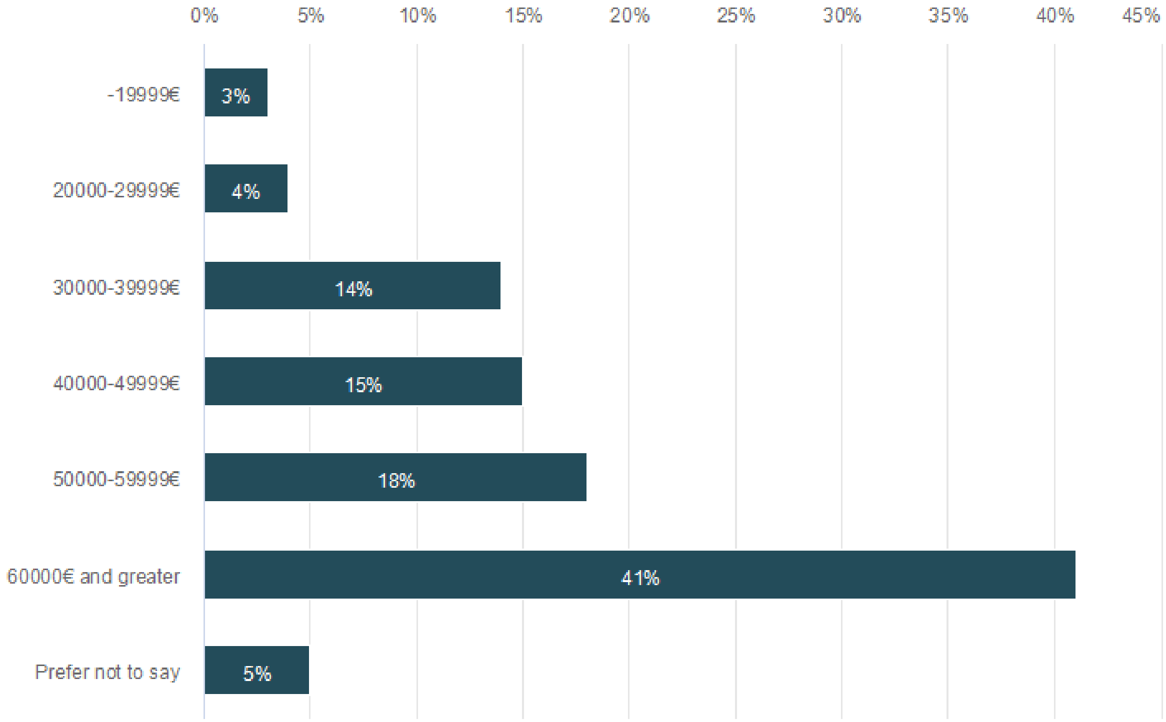

Figure 13 – The respondents' yearly income (Gross) level

The question of respondent´s highest level of education (Figure 14) resulted in a little misunderstanding because of the Finnish translation of the bachelor´s degree which the author has translated as "kandidaattitutkinto". During the response time, the author received a couple of messages where respondents point out that they have answered the option "Other" in the question, because there was misunderstanding in translation and the question did not contain an option: "Amk–tutkinto". For this reason, the answers in the highest level of education are not fully applicable in this study, but those show that at least 47% of the respondents have a higher educational background, and 101 (32%) own a Master´s degree, or higher education.

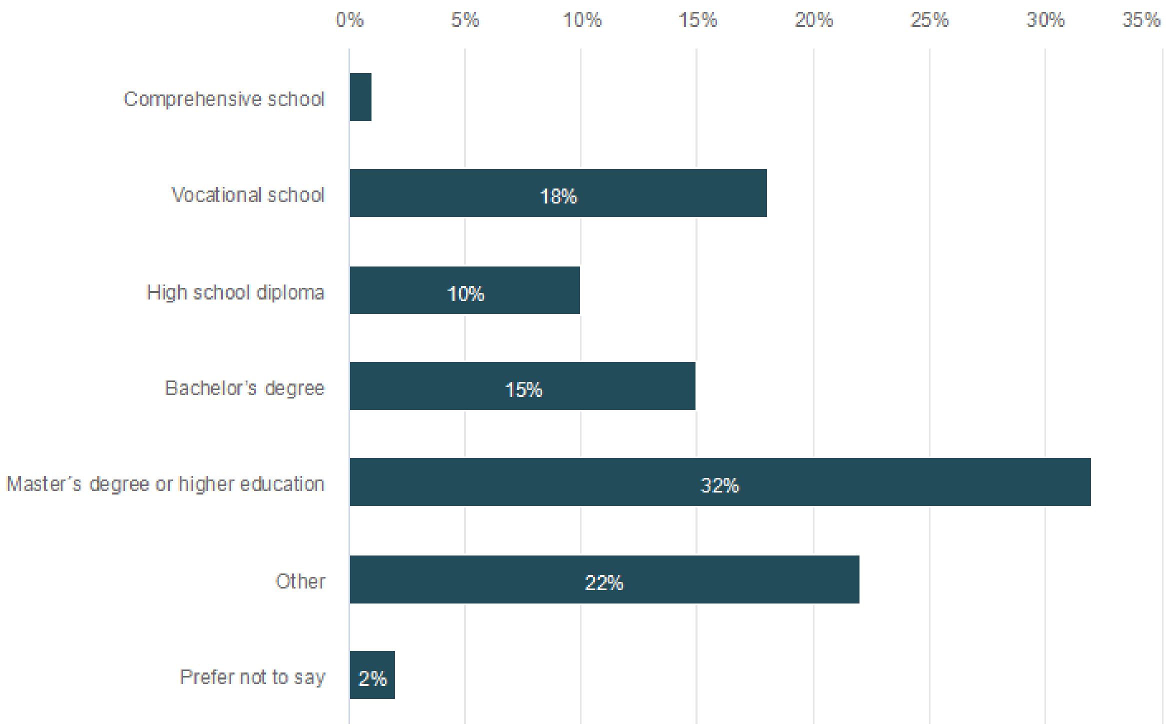

Figure 14 – Respondent´s highest level of education

Question of respondents' current employment status resulted that 253 (79%) are employed full-time and the second largest groups are entrepreneurs and retired people, where both groups represent 7.5% (24 and 24) of the respondents. The most common household size of the respondents is 2 people (33%) and second and the third largest groups are households with 3 or 4 people. These groups represent 243 (76%) of the respondents. The two biggest groups of respondents´ areal location were 51% (Southern Finland) and 31% (Western Finland) (Figure 15). The housing form of most respondents (87%) is ownership dwelling, and the second largest group is people who live in rental apartment (8%). The most common type of respondents housing is a house (58%), and in second row house (20%), and apartment building (18%).

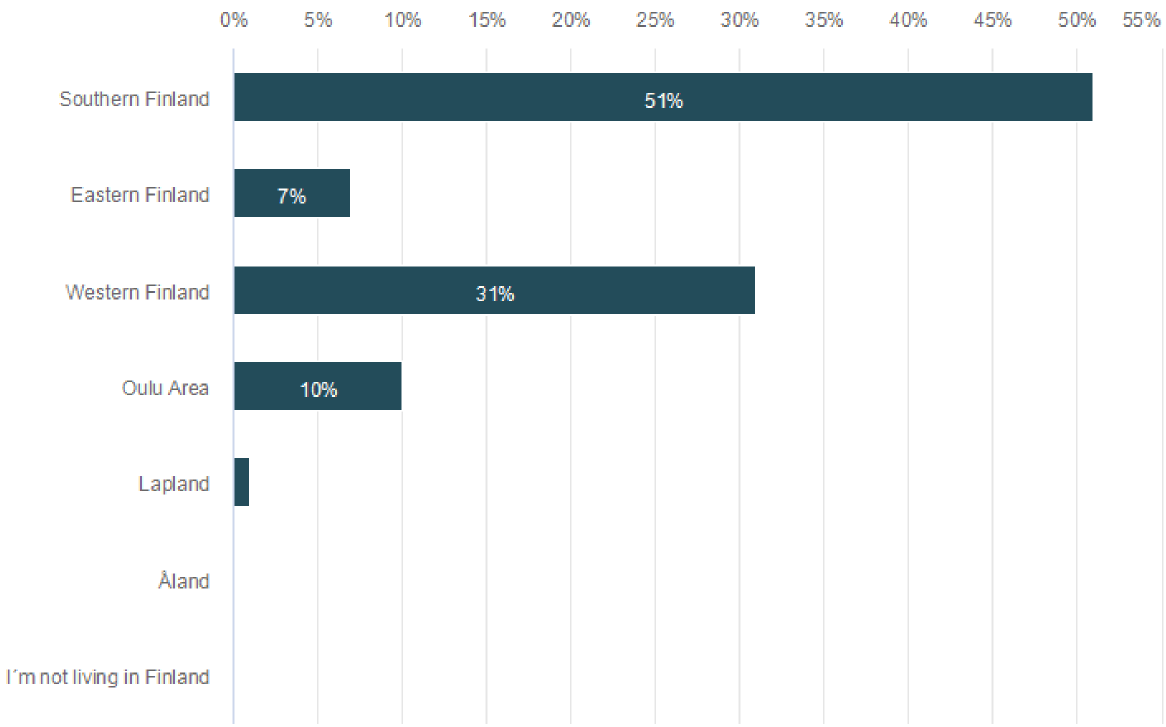

Figure 15 – Areal location of respondent

4.3.2 EV users charging habits

The survey asked respondents their car model and battery size with open-ended question and the question resulted 292 responses. When the raw data was sorted, the results of the three most common car models were following:

- Tesla, 76 cars (average battery size 76 kWh)
- Volkswagen 62 cars (average battery size 59,33 kWh)
- Hyundai 33 cars (average battery size 54,1 kWh)

The number of all reported cars in question responses was 320, with average battery size of 61,6 kWh. The result indicates that some respondents have more than one EV in their household. The respondents was asked their approximate charge amount per session, and it was an average of 31.3 kWh/session (Figure 16).

Number of respondents: 295

Min value	Max value	Average	Median	Sum	Standard Deviation
6,0	100,0	31,3	30,0	9241,0	16,7

Figure 16 – Average charging amount per session

The question of how many kilometers the respondents approximately drive with their EVs in a week resulted an average of 447 kms./week. This indicates that some EV owners drive a high number of kilometers per week and charge their cars daily (Figure 17).

Number of respondents: 295

Min value	Max value	Average	Median	Sum	Standard Deviation
0,0	1000,0	447,0	411,0	131868,0	220,5

Figure 17 – Average driving distance per week

When the charging sessions per week were asked, the survey resulted that 38% of the respondents charge their cars 1–3 times a week, 31% charge their cars daily, and 31% reported that they are charging their cars only when needed. When the author compared these previous responses of charging amount, average count of charging sessions, and average kilometers per week, the calculation resulted that the average energy consumption of respondents' cars is 21 kWh/100kms. For defining this the author used a following calculation formula:

$$\frac{\text{Average charging amount per session} * \text{Charging sessions per week}}{\text{Average driving distance per week}} * 100 = x$$

$$\frac{31.3 * 3}{447} * 100 = 21\ kWh$$

This result correlates with the informed average energy consumption of EVs in Finland, 20 kWh/100kms. (Motiva. 2022–b). The calculated energy consumption of respondents EVs showed that the survey collected quite accurate and comparable results about respondents charging amounts, driving distance, and the count of weekly charging sessions.

The question of where respondents charge their car resulted that 86% are using home charging, 64% uses public charging points, and 27% answered that they are using chargers in workplace (Figure 18).

Number of respondents: 295, selected answers: 530

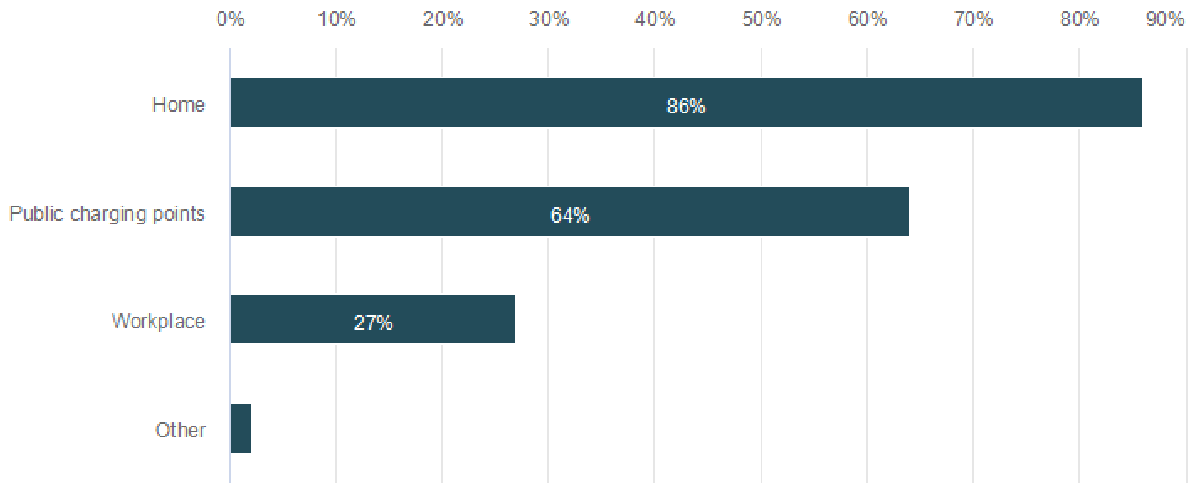

Figure 18 – Where respondents charge their car?

Additive questions were asked based on respondents' answers and for those who answered that they use home charging, the survey asked about their home charger and its capacity with open-ended question. This question collected 247 answers and after the evaluation of data, the three biggest groups based on charger capacity were respondents who charge their cars with 11 kW chargers (118 respondents), slow capacity max. 3,6 kW Schuko–charger (83 respondents), and 22 kW charger users (7 respondents).

The survey added additive question for respondents who answered that they are using public charging points and which operators' services they are using. The four biggest service providers were pre-listed and three options with the open field was provided. The most popular public charging services in descending order were ABC-Lataus (76%), K-Lataus (69%), Recharge (62%), and Virta (57%).The option "other" collected many responses and the most common answer for this option was Tesla Supercharger (28 responses) (Figure 19).

Number of respondents: 190, selected answers: 587

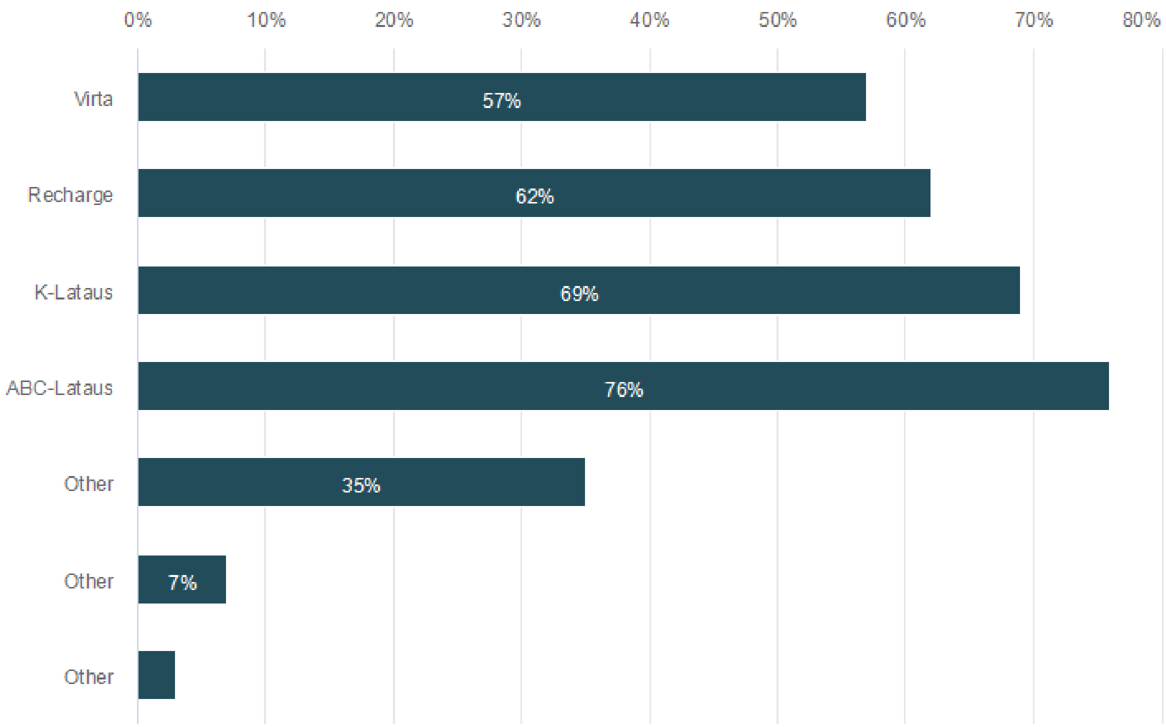

Figure 19 – The most commonly used public charging services

For respondents who answered that they charge their EV in workplace, the additional questions were asked, do they pay for charging in workplace?, and do they have own charging points in work, or can they reserve a time slot for charging?. 73% out of 80 respondents answered they do not pay for charging at work and 75% of them answered that they do not have a personal parking point at work and charging is possible only when the charging point is free.

4.3.3 Opinions and needs

The survey included opinion-based questions to collect knowledge about participants´ opinions and needs from the scale of 0–10, and in some questions marking their preferred choice from pre-defined answering options or add their own answer. When the respondents´ opinion about the current pricing of charging services was asked, it resulted that 64% (188) of the respondents feel extremely satisfied about the current pricing, and 31% (93) felt that the pricing is in a good state. Only 5% (14) of the respondents felt the current pricing of charging services does not totally satisfy them. The average grade from the respondents for the current pricing of public charging services was 8.8 from a scale of 0–10.

For the question of the most preferred pricing method of public charging, the most common answer from 88% (258) of total 295 respondents was kWh-based charging and pricing. This indicates a common situation in charging services where either the EV, or charging field could not get, or give the maximum capacity of power. The lack of power capacity takes its place in a situation, where the charging field is crowded with EVs, and its capacity is not enough to produce maximum power for all attached cars and charger station´s dynamic load management system starts limiting the output power (Kempower, 2021). The situation of this kind result that charging in minute-based pricing is costly for the consumer and explains the answer to the question of the preferred pricing method where people prefer kWh-based pricing and want to know from what they are paying for.

When respondents were asked their opinion about the coverage of the current charging network in their area 60% (177) of 295 respondents think that the coverage is great, or good. Respondents´ experience of finding a free charging point when using public charging services gave an answer where 92% (272) of 295 respondents felt they mostly do not have problems to find a free public charging point and 70% (207) did not feel comprehensive charging network important near their home. For the question about the importance of home charging possibility to owning an EV the survey resulted that 89% (232) respondents think that possibility for home charging is extremely important (66%), or important (23%).

Questions about the respondents' (295) opinions and habits when they are planning a driving route for longer distances and the services they are using, resulted that 81% prefer charging points that are found in hotels, 79% prefer charging points that are found in restaurants, and 82% prefer charging points that are found in roadside cafeterias. 88% of the respondents answered that they are using these services when they are charging their car. 94% of the respondents felt that charging possibility near location when travelling is extremely important (70%), or important (24%).

For the questions about municipalities participation and the utilization of the privately owned EV chargers of those as part of the public charging network, the survey collected answers from a wide range. 61% of the respondents felt important that the municipalities should participate in the development of the public charging network, and 67% of the participants see the so-called “On-Street-charging” important in cities. 58% of the respondents felt important that their municipality should participate in the development of electric motoring and for example arrange city-operated charging points in connection with the municipal services. 53% of the respondents felt the utilization of municipality owned non-public charging points for public use where it is possible as extremely important, or important. For the question about the utilization of charging points owned by private entities, example banks and hotels, the survey resulted that 64% of the respondents felt that extremely important, or important.

The survey asked participant´s personal willingness to share their own charging point as a part of the public charging network when they are not using it by themselves. This question gave the result that 59% are not willing to share their own charger, 22% would be willing to share their charger, and 19% does not own a shareable home charger. Respondents interest to service where the privately owned charging point would be a part of the public charging network, and they could book a timeslot advance from it resulted that 71% do not consider this as their preferred choice. For the question about respondents’ opinion about the importance of utilization of home charging points as a part of the public charging network, the survey resulted that 82% of the respondents do not feel that important. This answer correlates with the respondents answer about their charging habits where 86% answered that they are charging their cars at home.

The survey collected participants´ opinions about why they decided to buy an EV. The most common answer was lower fueling costs from 80% of the respondents and the second largest group 52% answered that they have made their decision because of the environmental reasons (Figure 20). The third largest group, 35% of the respondents chose the option “other” and after this dataset was analysed the results showed that 17% of the respondents in this option felt new technology and technic interesting, 13% felt driving convenient with EV, and 12% pointed out that efficiency and car´s powertrain has affected their decision of buying an EV (Figure 21).

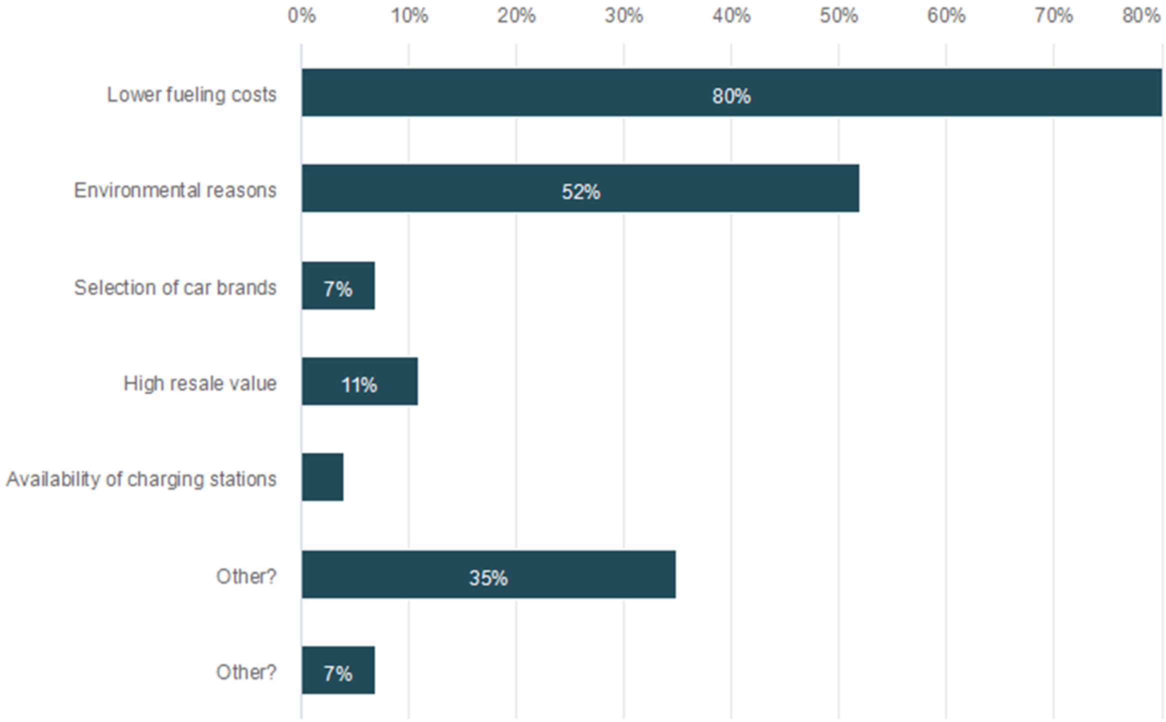

Figure 20 – What were participant´s reasons to buy an EV

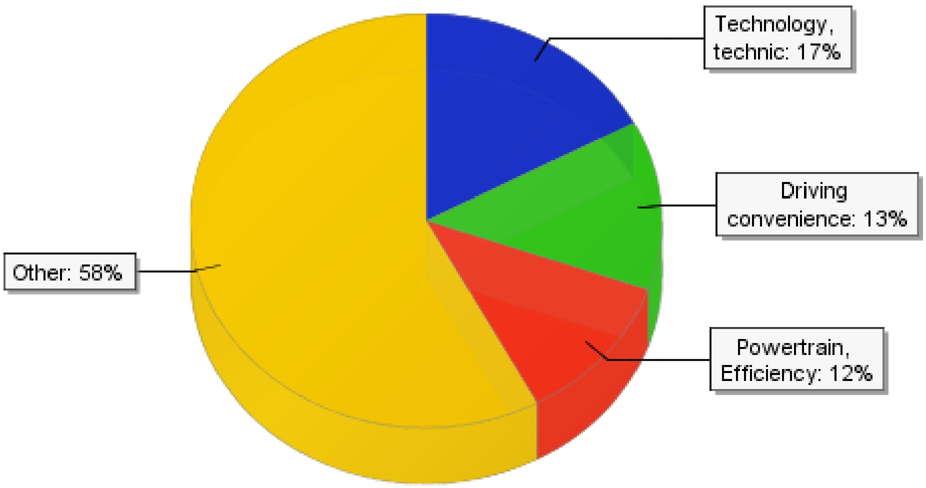

Figure 21 – Most common answers in question: What were the reasons for you to buy an EV? Survey option: Other?

The survey offered a responding possibility for non-EV owners also and for them the author has created two additional questions, before guiding them into thank you page. For respondents who answered that they do not own an EV, there was asked do they have plans to get one and what model they have in mind. The total count of non-EV owners was 24 and both groups, those who have plans to get an EV and those who do not consider buying an EV, the survey asked what concerns them about buying an EV. The most common answer of respondents' concern about buying an EV was long delivery time of the cars (Figure 22).

Number of respondents: 22, selected answers: 33

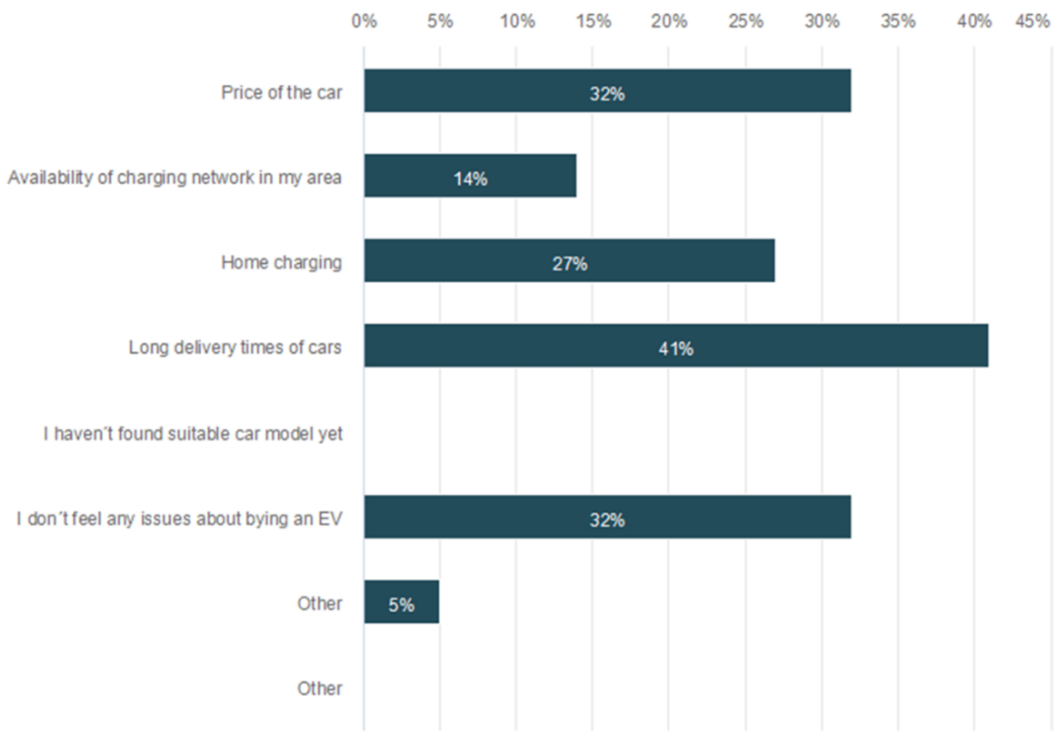

Figure 22 – What concerns non–EV owners´ in buying an EV?

4.3.4 Open-ended questions

The open-ended questions were used in researching respondents' feelings about what they like or do not like about their car and what positive and negative feelings they feel in EV charging. The question "What you like about your car and don´t like about your car?" collected 242 responses and when the data was evaluated the most common positive thing that EV users felt about their car was their car´s powertrain, efficiency, and performance. The second largest group valued the easiness of use of their EV and the third group valued their cars operating costs (Figure 23).

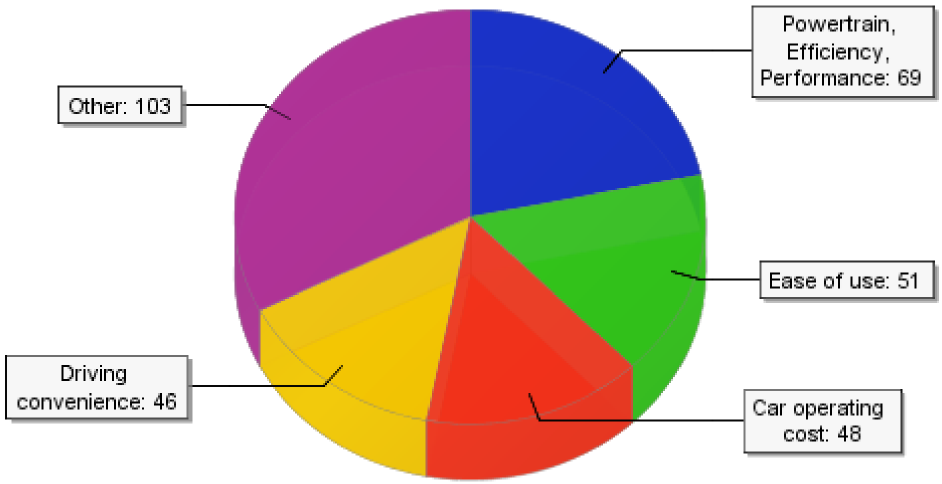

Figure 23 – Positive sides that EV owners feel about their cars

The most common negative feeling that respondents feel is the driving range of their cars and limitation of the battery size and 43 respondents point out this their most inconvenient side of owing an EV. After all, most of the responses include more positive sides of owing an EV and when the author evaluated the answers those showed that EV owners mostly feel comfortable in owing their EV´s.

A question about the positive sides of EV charging what respondents feel collected 217 responses and when the data was sorted 55 respondents´ mention home charging convenience in their responses. 53 respondents´ highlighted the convenience and ease of use in EV charging and 40 respondents´ felt the price is in good condition in both home charging and public charging. The fourth group with 32 responses mentioned they felt positive the public charging and especially the charging speed of public charging stations (Figure 24).

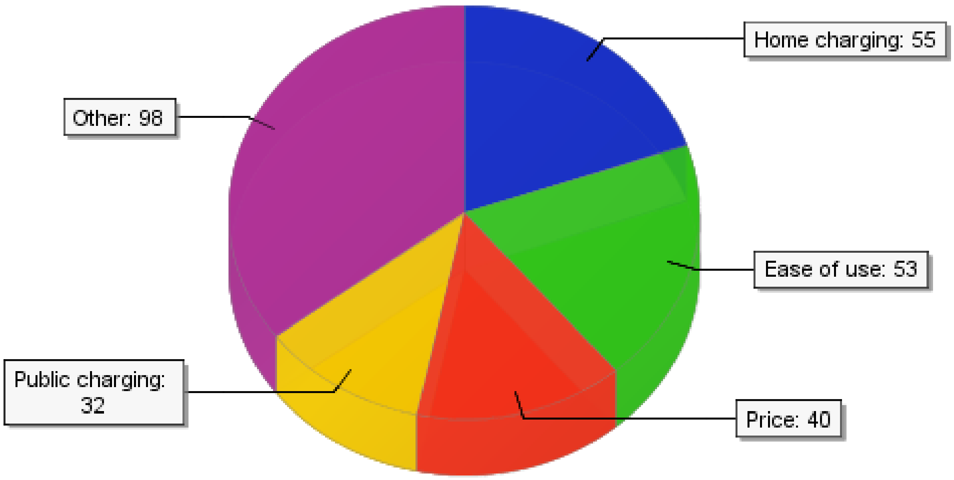

Figure 24 – What positive sides the respondents feel in EV charging

When the respondents were asked about the obstacles they feel in EV charging, the open-ended question collected 242 responses. After the data was sorted it highlighted that the biggest issue that 71 respondents felt is inconvenience in payment methods and mostly they think that there are too many different methods for that. The second largest issue was with the applications and RFID-tags where 67 respondents were mostly highlighted they felt inconvenience with large variety of different apps and tags where all service providers have their own platforms, and those need registrations and user´s understanding what application to use in which charging point. 50 respondents bring up that they feel inconvenience about non-working public chargers and quite many mentioned that operators do not update their non-working chargers fast enough on the charger map systems (Figure 25).

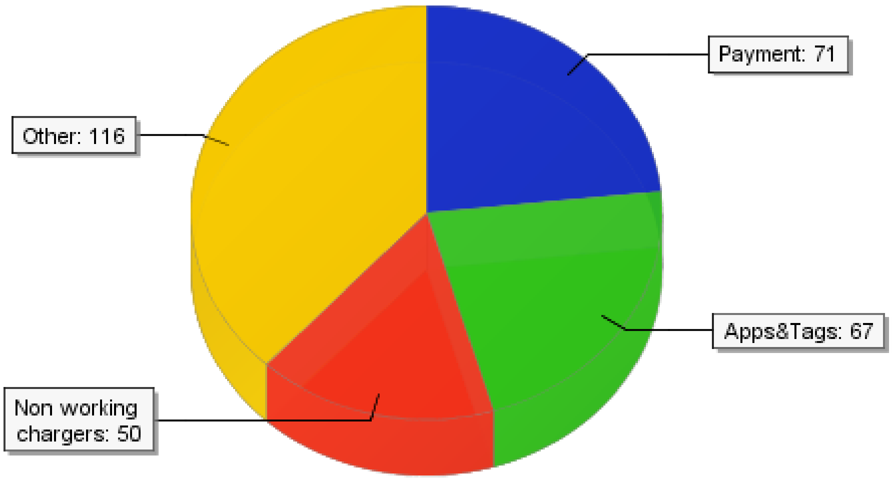

Figure 25 – Obstacles that respondents feel in EV charging

4.4 Discussion

The aim of this research was to study the coverage of EV charging network, EV owners charging habits, and their opinions and needs concerning the current state of provided services in Finland. This study has resulted three analyses where the author is researching the key components of the Finnish EV charging network, the current pricing of public charging services, and the users and consumers charging habits and opinions concerning EV charging and the charging network. The purpose of the research was to create study from the EV owners' point of view and solve the settled research questions, "How can electric vehicle charging possibilities be increased with the help of private-owned charger networks in Finland?", "How can the pricing of the public charging effect on the consumers charging habits and feeling of convenient service?", and "How can the areal charging network effect on consumers' willingness to buy an electric vehicle?". In the discussion section of the results chapter the author is presenting the collected key findings from the gap analysis, price analysis, and survey analysis and comparing these findings with the background information presented in literature review. The author has also brought up own´s personal knowledge about Finnish cultural aspects and behavior when the results are evaluated.

4.4.1 Key findings from the gap analysis and the price analysis of public charging in Finland

The gap analysis of the charging network of Finland resulted that despite the constantly growing public charging network, there is still lack of charging points in rural areas of Eastern, and Northern parts of Finland, and the most charging service providers have focused in building their networks in bigger cities of Southern, and Western Finland. The gap analysis also resulted that at the moment EV user need to install more than one map-program to find out the areal charging points when solving out the areal coverage example charging points of the location, or during a route when travelling.

A price analysis of the four biggest public charging service operators resulted that the pricing of areal charging costs per kWh from these service providers are quite similar. The analysis shown it can be tricky for the users´ to compare the best option for charging their cars when there are operators which are using minute-based charging in their stations, and this could confuse the customers. The comparison between service providers pricing is also difficult because some of these businesses do not present their pricing on their websites and for finding the price, the user has to install an app to check the pricing. This could effect on peoples' purchase decision of an EV when the searching of areal public charging network prices has been made difficult.

When the author compared these results with the 2020 survey results of The Finnish Information Centre of Automobile Sector (The Finnish Information Centre of Automobile Sector, 2020), and the latest report of Sähköinen Liikenne ry (Sähköinen Liikenne ry, 2022), it can be seen that the problems that EV users´ have felt concerning the charging network, the availability of free charging points, and payment methods are still existing, and the number of EVs is growing faster than the network is spreading and new charging stations are built.

4.4.2 Key findings of survey analysis

The survey resulted a great amount of data about EV users charging habits, opinions about charging, and demographical backgrounds. The respondents gender division shown that 90% of the group were men and 10% were female. This indicates that EV users who were reached with the survey on Facebook groups were mostly men. The low responding percentage of females indicate that even though there are quite many female members in those Facebook groups they represent minority there. The biggest age group of EV users are in the age groups 35–54 with an average yearly income of 50000–60000 € and greater. At least 47% of the respondents´ have a higher educational background, and 82% of the respondents are living in Southern and Western part of Finland. The housing form of 87% of the respondents´ is ownership dwelling and 78% of them are living in a house, or row house. The respondents most common EVs are Tesla, Volkswagen, and Hyundai. These results correlate with the latest report Q2/2022 of Sähköinen Liikenne ry, where there is listed the three most popular cars of EV owners (Sähköinen Liikenne ry, 2022). Respondents´ average driving distance in a week is 447 kms., and this correlates with the average yearly driving distance that is presented in the 2020 survey of The Finnish Information Centre of Automobile Sector, where the average yearly driving distance was 21000 kms. (The Finnish Information Centre of Automobile Sector, 2020).

The charging habits of EV users resulted that 86% of them charge their cars at home, 64% are using the public charging points, and 27% use charging points located in their workplace. The three most popular public charging service operators were ABC-Lataus, K-Lataus, and Recharge. When these results are compared with the 2020 survey report of The Finnish Information Centre of Automobile Sector, it shows that the charging habits have changed a bit and the use of public charging points has increased when the EV fleet has grown, and all people do not have possibility for home charging. In 2020 survey report of The Finnish Information Centre of Automobile Sector, 7% of 437 BEV owners told that they do not charge their car at home and in this the EV users’ behavior has changed when this latest survey resulted that percentage has grown to 14% (The Finnish Information Centre of Automobile Sector, 2020). This growing percentage of EV users who does not charge their cars at home indicates that the convenience of owing BEV has increased, and people have made their purchase decision of an EV despite that they do not have possibility to charge their cars at home.

The count of EV users who charge their cars at work was 27% of the total count of 295 respondents and in this count of 80 respondents there was 72% who answered they do not pay for charging at work, and 75% of them answered that they do not have a personal parking point at work, and charging is possible only when the charging point is free. This result shows that offering of EV charging for company employees is still not so commonly adopted in Finnish workplaces, and there is lack of available charging points and charger reservation system for employees in those companies who have installed EV chargers.

Questions about EV users' opinions concerning EV charging resulted that 95% of the respondents feel satisfied in the current price and 87% think that the best pricing method for public charging services is kWh-based pricing. 60% of the respondents feel that the current coverage of the charging network is good, or great and 92% feel that they do not have problems to find a free charging point when they are using public charging services. The question about home charging resulted that 89% of the EV users feel the possibility of charging at home highly important for them. The survey question of EV owners' personal willingness to share their chargers as a part of the public network resulted that 22% could consider charger sharing and 29% could consider using these privately owned shared chargers located peoples' homes if those exist, and they could book a timeslot for charging from those. These results are mirroring the Finnish social behavior where people feel owning their own equipment, example charging devices more comfortable than the loaning of those. Finns are highly respecting the privacy of others and try to avoid going to other man's yard and prefer more using public charging services, where they think that they do not harass others.

The results about EV users' habits in longer driving routes show that around 80% of EV drivers prefer charging points which are located in hotels, restaurants, and roadside cafeterias and 88% answered that they are using these services when travelling. The importance of charging possibility near location when travelling collected an answer where 94% of the respondents feel that extremely important, or important. These responses show that EV users are planning their driving routes based on the available charging possibilities and offering of these services effect on these mentioned businesses customer count increasingly.

EV users' opinion about their municipalities involvement on the developing of the public charging network resulted that 61% of the respondents' feel that municipalities should participate in the development of charging network and 67% feel the chances for On-Street-charging important in cities. 53% of the respondents feel important that their municipality should utilize the municipality owned non-open charging points for public use in the locations where that is possible. These answers of the importance of On-Street-charging and utilization of municipality non-public charging points indicate that the municipalities should take concern the demand for these services and make plans for covering city areas with municipality administered public charging possibilities where home charging is not possible and in this way ease up the growing of the EV fleet and meeting the settled climate targets.

Respondents’ opinions about the positive and negative aspects in owing an EV and charging collected large amount of open-ended responses. EV users are primarily happy from their EVs overall and the most common negative feeling they have concerns the driving range of their cars, which quite many answered is not large enough. Most of the respondents mention home charging convenience and the pricing as a positive side of EV charging. The drawback sides what EV users feel are into the large number of different needed apps, tags, and the large variety of different payment methods from different operators. Non-working public charging points were the third largest group of responses, and they think that the operators do not update those fast enough in charger maps.

Overall, the large number of responses in all open-ended questions gave the author a feeling that this group of existing EV users are extremely active and want effect on the growing of the EV fleet and spread their knowledge about EV motoring in wider audiences. The knowledge that the author collected with the survey helped highly in the research.

5 Recommendations

The author´s recommendations for the commissioning company are based on this study. The recommendations are divided into four main sections. The sections are market entry strategy, areal focus, pricing type of the service, and potential customer segments. With these sections, the author is presenting a market entry model, optimal pricing, areas, and customer segments for commissioning company´s market entry in Finnish markets. After these sectional recommendations, the author is presenting own´s recommendations in a section called where to collect knowledge about EV charging in Finland? In this last section, the author is providing recommendations for actions to consider when commissioning company starts its market entry.

5.1 Recommendations for market entry strategy

Based on chosen theories and this study, the author recommends commissioning company to use a partnering model in company´s internationalization process. Partnering with the existing Finnish charging point operators and charger manufacturers´ is giving an opportunity for commissioning company to entry in the new market with less upfront investments and risks (Rejman, 2022). The revised Uppsala model highlights the importance of collected knowledge of the markets in its first stage. Network theory and International Entrepreneurship theory highlight the importance of business networks as a crucial part of SMEs internationalization. Gathered knowledge of EV users' opinions and needs´ is supporting Maslow´s and Ajzen´s theories of consumer behavior. Partnering is the most widely adopted method in EV charging business where operators and charger manufacturers are joining their forces and use the charging point network of each other's by offering roaming services, or the direct access into charger administration. This study has gathered the base information about the Finnish target market in demographical, locational, and psychological level. Collected data offers tools to commissioning company to identify and build customer profiles concerning Finnish markets and it can be used when the company is negotiating with potential partners and expanding its network.

5.2 Recommendations for areal focusing

The research results of gap analysis and survey analysis show that the most Finnish EV users are located in Southern and Western Finland at the moment, and this is the most competed area of public operators because the markets and EV users are there. The availability of public charging possibilities is the best in Southern Finland and bigger cities of Western Finland but there is lack of charging opportunities between these. EV users are quite convenient about the coverage of the current charging network. Despite this there is potential into offer charging opportunity in locations where EV chargers are not installed yet, or existing chargers are not utilized. The gap analysis shows that there is not so much competition in other parts of Finland and fewer EV owners at the moment, and these can also be potential locations in the future when the commissioning company is looking possible piloting partners from municipalities and private entities. The survey resulted that there is a growing need and demand for municipalities to join on the development of the public charging network and the author sees that there is a potential market area between bigger cities of Southern and Western Finland where the commissioning company could launch a market entry into Finnish markets in a pilot project with municipality, or private entity.

5.3 Recommendations about pricing type of the service

Based on the price analysis and survey analysis of users´ opinions of current public operators, the author recommends that commissioning company should use kWh-based pricing model for the service in Finland. This pricing model is the most preferred by the EV users and easiest to compare between other operators. At the moment, the price of home charging is increasing due to rising electricity prices worldwide and Finland is not an exception. Current public charging operators have priced their services quite low at the moment and there are pressures to increase prices. For the price range of commissioning company´s service in Finland the author recommends that it should be in-line with the price range of home charging and public 11–22 kW Basic-charging. A reasonable price range is between 0.15–0.25 €/kWh and it should follow the pricing of public charging services to tempt EV users to try, test, and get interested in commissioning company´s service.

The survey analysis results show that Finnish EV users keep home charging in a great value and are willing to pay for a home charging point and the convenience of charging their cars effectively and with lower costs at home. There is a growing user group, 14% of the survey respondents, who are not charge their EVs at home. The commissioning company´s service could be a solution for them to increase their convenience of owing an EV. The service could also encourage people who have not made their decision of purchase an EV yet, due to the lack of a home charging facility.

5.4 Recommendations for potential customer segments in Finland

According to Network theory it is crucial for the company to note the importance of business networks when it builds connections between different parties of the ecosystem. For SMEs, these business networks and their connections play a major role in the company´s internationalization process and effect on company´s choice of market areas and customer segments. Well-built business network speed up the processes with a help of its partners´

experience and resources. In this chapter, the author has highlighted the four most potential customer segments for commissioning company.

The first group of potential customers for commissioning company are hotels, restaurants, and cafeterias. The gap analysis and the survey analysis resulted that there is lack of charging points outside the big cities of Finland. The survey resulted that around 80% of EV users prefer using the services of restaurants, hotels, and roadside cafeterias when they are charging their EVs, and 94% feel that charging possibility is important for them near location when they are travelling. This gives an opportunity for the commissioning company to market their service for businesses in those areas where there is not fully covering charging network, or home charging is impossible.

The second group of potential customers are workplaces which do not offer their employees a possibility for EV charging, or do offer, but do not have individual parking spaces, or charging points cannot be installed in all parking spaces. The survey resulted that 27% of the respondents charge their cars at work and 75% of those do not have personal parking space and charging is possible only when the parking point is free. Respondents also answered that 72% of them do not pay for charging at work. This uncontrolled division of available charging points could result in a situation, where these chargers are not utilized evenly between employees who have EVs and result inconvenience if someone uses the charging point whole day without actually needing it for charging. At the moment there is temporary tax relief in Income Tax Act in Finland which allows employers to offer EV charging to employees without tax consequences in work benefits for employee (Tuloverolaki, 30.12.1992/1535). This temporary tax act relief is affecting the years 2021–2025 and could rise the interest in workplaces to install charging stations. Also, the increasing price of electricity can effect in workplaces and inspire the employers to change their existing and new charging points and purchase control systems for charging sites. This gives an opportunity for the commissioning company to market their service for workplaces to administrate the charging points and collect usage data from the users.

The third group of potential customers are municipalities around Finland, especially in larger cities, and older areas of those where home charging is impossible. EV users see important that municipalities should participate in the development of the EV charging network and On-

Street-Parking. This gives an excellent opportunity for the commissioning company to market their service for municipalities. The author highlights an article of Autotie.fi (Autotie.fi, 2022) where Facebook survey participants were asked their opinions about the importance of charging possibility when they are considering buying an apartment and 89% of the respondent kept that crucial. In the bigger cities, for example in Helsinki there are not individual parking spaces in parts of older town areas and home charging is impossible. On-Street-Charging is the answer to this situation and with municipality´s active participation and utilization of municipality owned non-public chargers for public use those can join on the development of electric motoring. On-Street-Charging also offers opportunity to achieve the settled climate regulations with building public charging areas on the street side near peoples´ apartments where the citizens of the neighborhood can book a time slot for charging their cars.

The fourth group are individual EV owners and the survey results showed that there is not great demand for commissioning company´s service at the moment but the growing count of EV users who don’t have home charging possibility could grow the need for commissioning company´s service in the future. The survey resulted that 22% of the respondents could consider charger sharing and apply their charger as a part of the public network and 29% who could consider using those if they could book a charging slot in advance. This shows that there is an interest among EV users for the charger sharing services. When the commissioning company´s Finnish market entry has happened, and EV users are more familiar with the service this customer segment is going to be more important when tackling the challenges of EV charging and creating of a widely adopted charger sharing network.

5.5 Where to collect more knowledge about EV charging in Finland?

According to International Entrepreneurship theory, company´s entrepreneurs and individuals’ behavior are forming the base of company´s market entry. Theory highlights that international entrepreneurship is a process of discovering and exploiting new opportunities outside company´s home markets. The commissioning company´s future target is to expand its business internationally and it is highly influenced by the demands and needs of the markets.

During the research, the author collected knowledge about how the different public charging operators work in Finland. One of the most noticeable findings was, that the biggest operators are very active in social media discussions. The author joined in the two biggest EV users Facebook groups in Finland, Latausverkosto.Nyt! and Sähköautot.Nyt!, and noted that the operators´ representers work there almost daily and actively join in the conversations. Those representers are widely known in those groups and quite often they are pinned in conversations when there is some kind of customer feedback. Following the discussions in those Facebook groups gave the author a lot of knowledge about the obstacles of EV charging, and how the EV users sometimes feel the charging network issues when they travel across the country. Those discussions also provide useful information about the common problems of EV chargers and give knowledge and tips how to handle those. The author is highly recommending for commissioning company to join in national Facebook EV user groups to catch the customers on the markets where they are operating. This is in line with the International Entrepreneurship theory. Being virtually present among the users is highly important for company when it wants to give the best customer support and short response times for customer feedback. These Facebook groups are very active and like the survey´s open-ended responses showed, EV users are willing to share their knowledge, support, and opinions. This benefits the company highly when it collects knowledge from the markets and insights´. The survey also showed that it is important for the company to communicate target country´s national language in these different channels. The user survey was offered with two language options Finnish and English, and there was only one respondent who chose to reply in English.

6 Conclusion

This thesis was made in a purpose to investigate and research existing EV charging network and EV users in Finland and to look for the possibilities of commissioning company´s market entry in Finnish markets. This study focused on the research how to increase the current EV charging capacity with the help of privately owned chargers, and it also gathered knowledge about users´ opinions and needs. At starting point the author was searching for the information about the subject from existing literature and found out that this is a quite new area of business and literature from it is still few. The found literature mainly addressed the development of charging networks from a public perspective and the latest found survey which concerned EV users charging habits was released in 2020 and after that a lot has changed. The BEV fleet in Finland has tripled after 2020 and the PHEV fleet has doubled, and when looking the first-time registrations in Finland, the sales of BEVs has already passed the popularity of diesel cars in 2021. To solve the settled research questions, the author searched information from valid sources to collect knowledge about the current state of EV´s and charging infrastructure in Finland, Europe, and the US.

Based on gathered base knowledge about EV´s, the charging infrastructure and commissioning company´s needs the author made three different analyses. The price analysis researched the current pricing of public operators for gathering deeper knowledge to evaluate suitable price range and pricing model for the commissioning company´s service. This analysis resulted that there are some difficulties to find charging prices directly and for finding the four biggest operators current pricing the person has to install phone app´s for getting the information of charging costs. Pricing models are also somewhat misleading in different operators when some operators are informing their charging costs in minute-based pricing and the user is not always aware what the actual costs of their charging are. These different pricing models bring inconvenience to the user and in survey responses most of them answered that they prefer the kWh-based pricing method more.

The gap analysis was done in keeping an eye of the current EV charging network and to find areal locations for the commissioning company´s services. When the gap analysis was conducted, it resulted that the public charging network is in a good state in Southern and Western Finland and there is lack of charging points in other areas. Even though there are public charging networks in the biggest cities there is a problem between those in rural areas and example in Western Finland there is a long distance between public charging points. This brings so-called range-anxiety to EV users, especially when sometimes there are non-working chargers and the car driving range starts to go empty. With bringing the charger sharing services into markets this obstacle can be solved and the utilization of privately owned chargers is removing these gaps between locations and increasing the convenience of electric motoring.

The survey for EV owners resulted that there is a growing user group which do not have possibility for home charging and have confidence in the adequacy of the public charging network and charging possibilities in other places. The survey resulted that EV users are mainly still charging their cars at home and highly value this option. Now when the electricity prices have started rising all over the world the public charging and charging at work have become a more tempting option to save on the energy bill. EV charging in workplace is still not so widely common and the Finnish government has imposed a temporary change in the income taxation law to speed up the development of electric motoring. In 2021–2025, the employer could offer EV charging to employees without benefit taxation, and this could be remarkable and a great offer, when the company thinks about its employee benefits or finding new employees and that could also work as a part of company´s environmental strategy. With a properly adjusted charger sharing system, the company could share installed chargers evenly for its employees without the need for personal charging points and control the usage of those.

When EV users’ opinions and charging habits were asked the responses showed that at the moment most of this group are highly active and own a high knowledge about EVs and charging. The study and following of conversations on social media shown that the EV users´ are interested in this new technology and have a will to share their knowledge to others.

At starting point of this thesis, the author was quite unfamiliar about the EV charging networks and different operators in Finland. During the research, the author collected a lot of knowledge in how to stay in a high-tide of EV revolution. This need constant following on different channels because the industry is new, and the EV fleet is growing all the time.

This thesis gathered the basic knowledge and recognized opportunities concerning the current state of EVs, the charging network, pricing, and EV users’ habits and opinions for commission company to move on the first stage of Uppsala model. For future research, the author recommends gathering knowledge about the competitors of charger sharing business in Finland and charging point providers. This knowledge can be used in partnering and networking with those and implementing a plan towards the second stage of business internationalization. The future research should include a competitor analysis, a marketing plan, and timelines for market entry, which were not in the scope of this study.

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Appendix 1: Questionnaire

1: Gender?

- Male
- Female
- Other
- Prefer not to say

2: Age group?

- 18–24
- 25–34
- 35–44
- 45–54
- 55–64
- 65–
- Prefer not to say

3: Income level?

- –19999€
- 20000–29999€
- 30000–39999€
- 40000–49999€
- 50000–59999€
- 60000€ and greater
- Prefer not to say

4: What is your highest level of education?

- Comprehensive school
- Vocational school
- High school diploma
- Bachelor’s degree
- Master´s degree or higher education
- Other
- Prefer not to say

5: What is your current employment status?

- Employed Full-Time
- Employed Part-Time
- Seeking opportunities
- Entrepreneur
- Retired
- Prefer not to say

6: Including yourself, how many people currently living in your household?

- 1
- 2
- 3
- 4
- More than 4

7: What area of Finland do you live?

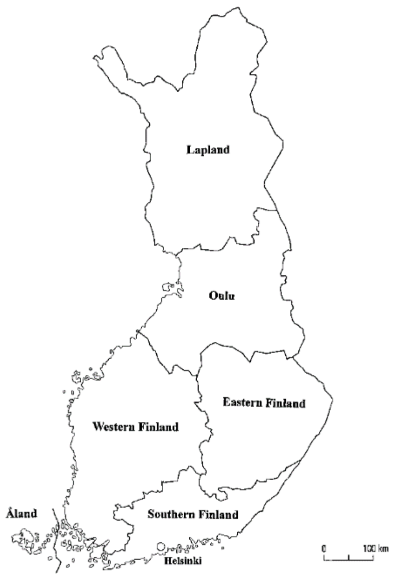

Figure 26 - Map of Finnish provinces. Author: Harri Hemilä. Source:

https://www.researchgate.net/figure/Map-of-Finnish-provinces_fig5_26726017

- Southern Finland
- Eastern Finland
- Western Finland
- Oulu Area
- Lapland
- Åland
- I´m not living in Finland

8: What is your current form of housing?

- Ownership dwelling
- Rental apartment
- Housing licensing
- Part-ownership housing
- Other
- Prefer not to say

9: What is a type of your housing?

- Apartment building
- Row house
- House
- Other?
- Prefer not to say

10: Do you own an electric vehicle (EV)?

- Yes -> What model? -> Battery size -> How much you approximately charge your EV in a session? ->What you like about your car and don't like about your car?
- No -> Have you plans to get one? ->
  YES -> What model you have in mind? -> What concerns you about buying an EV? -> Thank you!
  NO -> What concerns you about buying an EV? -> What is the main reason for you not to own an EV? -> Thank you!

11: What were the reasons for you to buy an EV?

- Lower fueling costs
- Environmental reasons
- Selection of car brands
- High resale value
- Availability of charging stations
- Other?

12: How much you are approximately driving with your EV in a week?

- Open question with slider 0–1000kms.

13: How often do you charge your car?

- Daily
- 1–3 times a week
- When needed

14: How do you charge your car?

- Home -> What is the model of your home charger? -> what is the capacity of you home charger?
- Charging operators charging points -> what are the most common operators that you use? -> Virta, Recharge, K-Lataus, ABC-Lataus, Other what?
- Do you have an opportunity to charge your car in your workplace? -> Do you pay for charging at work? Yes, No. -> Do you have own charging point there, or can you reserve a time slot for chargers at work?

15: What is your opinion about current pricing of charging services?

16: What kind of pricing method you prefer the most when using public charging services?

17: How do you feel about the coverage of current charging network in your residential area?

18: Do you experience problems finding a free charging point when using public charging services?

19: How do you see the importance of a comprehensive charging network near your home?

20: How do you see the importance of home charging possibility to owning an EV?

21: When planning a driving route, do you prefer charging points that are found in hotels?

22: When planning a driving route, do you prefer charging points that are found in restaurants?

23: When planning a driving route, do you prefer charging points that are found in roadside cafeterias?

24: Do you use services above mentioned when you charge your car?

25: How do you see the importance of charging possibilities near your location when travelling?

26: How do you see the importance of your municipality´s participation in the development of the public charging network?

27: How do you see the importance of so-called On-Street charging in cities?

28: How do you see the importance of your municipality´s participation in the development of electric motoring, e.g., by arranging city-operated charging points in connection with municipal services?

29: How important do you see the utilization of non-public charging points owned by your home municipality for public use in places where it is possible?

30: How important do you see the utilization of charging points owned by private entities (e.g., banks, hotels) into the public charging network?

31: Would you be willing to share your own home charging point as part of a public charging network when you do not use it?

32: How likely would you use a service where a privately owned charging point would be as part of a public charging network and could book your own time slot for it in advance?

33: How important do you see the utilization of home charging points as part of a public charging network?

34: What are the positive sides you feel in EV-charging?

35: What are the biggest issues you feel in EV-charging?

Appendix 2. Data management plan

Before and during this thesis process the author has collected knowledge of the guidelines for data collection, processing, and data storage and destruction principles from HAMK´s thesis guide. For completing the thesis and settled research questions the author has gathered data from primary sources and secondary sources. The author of the thesis has been acquainted with the principles of research methods and responsible research. Research methods selected and presented for the thesis have been used for data collection.

Primary data for this thesis is collected from two Finnish EV user groups (Sähköautot.Nyt!) and (Latausverkosto.Nyt!) in Facebook, where the author has launched a survey in one week period (18.08.2022–25.08.2022) for already existing electric vehicle owners. The survey data includes information about respondents' demographical backgrounds, habits, opinions, and responses from open–ended questions. Survey collected responses anonymously and dataset from primary source do not contain any information that can be combined with the data of single respondent.

During thesis process, the primary data collected with a survey is stored in Webropol-program which is provided by HAMK and a part of students' toolbox. Webropol is password protected and widely used in HAMK and considered as a safe platform for storing data. Secondary data for thesis is collected from existing literature and valid sources from the internet and mobile App´s with the aim to gather needed information for this thesis. During the process, the secondary data has been stored in authors personal OneDrive account for school which is provided by HAMK and protected with password and two-factor authentication. With the secondary data the author has conducted following analyses: 1. Price analysis and 2. Gap analysis. The secondary data includes pictures and statistical tables. The sources of these pictures and statistics are mentioned in the text and caption below them in the thesis.

The author is storing all collected data and research material in password protected personal OneDrive account after completion of this thesis. The survey dataset which is collected with Webropol program is kept in that program 1 year (365 days) after the completion of this thesis for further evaluation. After this period, the dataset will be deleted in Webropol. During 1 year after completion of this thesis, all collected data will be handed for the use of commissioning company of this thesis, if requested.