Regional status-quo assessment and potential analysis on e-mobility in eight countries of the Baltic Sea Region

In cooperation with

HeiVäl Consulting

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Tartu

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1 Abstract

The project BSR Electric aims to enhance the utilization of e-mobility in urban transport systems around the Baltic Sea Region by demonstrating potential applications of various types of urban e-mobility such as electric city logistics, e-Bikes, e-Buses, e-Scooters and e-Ferries. This report is prepared as one of tasks within BSR Electric project. The aim of this report is to assess the current status of the implementation of e-mobility solutions in BSR (Baltic Sea Region) in specific partner regions and cities in order to keep track of crucial bottlenecks and also successful methods how to build e-mobility solutions. In addition to the BSR electric themes (electric city logistics aka e-logistics in this report, e-buses, e-scooters and e-ferries/water taxis), the inclusion of e-cars was added in order to have an extensive overview of the current situation in e-mobility sector. Furthermore, e-cars are the forerunners in e-mobility and are the most popular e-vehicles.[1]

Information about status-quo and potentials in e-mobility was acquired through a questionnaire and partner input. The questionnaire was conducted in the Baltic Sea Region by the corresponding partner. The regions were Tartu Region; Riga Metropolitan area; Tricity Metropolitan area in Poland consisting of Gdynia, Gdansk and Sopot; Hamburg Metropolitan Region; Rostock regiopolis; Metropolitan Copenhagen; Greater Oslo Region; Metropolitan Gothenburg; City Region of Turku and Greater Helsinki Region. The countries, in which the questionnaire was carried out are Estonia, Latvia, Poland, Germany, Denmark, Norway, Sweden and Finland. Partner input consisted of the corresponding country's policies and infrastructures, also of potential plans in e-mobility and key ideas from the corresponding country. From the questionnaire answers descriptive statistics for every country was brought up. The data consisted of quantitative and qualitative data. From quantitative data either frequency or mean of different e-mobility user patterns was calculated and presented. Quantitative data was condensed in tables.

The current situation of the respondents is that e-cars are the most used and popular e-vehicle. However, the use of other e-vehicles is on a rise. The main limiting factors at the moment in e-mobility for the respondents are limiting range/performance of current batteries, lack of infrastructure in the city/region/country, lack of financial means/support, lack of motivation among consumers, low cost efficiency compared to internal combustion engine vehicles (ICE) and lack

[1] 2017.10.18 BSR electric - Final Application submitted13.01.17.pdf

of suitable e-vehicle models. The most important aspects that could accelerate the e-mobility related activities for the respondents, were the availability of financial incentives from the local/regional/state authorities, availability of efficient and low-cost information sharing and knowledge access/transfer mechanisms, cross-disciplinary/-industrial cooperation, conditions for fair competition regarding service/technology providers and improvement of local/regional/national legislations. Regarding e-mobility the following suggestions were elaborated by area:

e-cars – countrywide charging network is needed together with suitable car models and promotion campaigns. Also, different actions could support the use of electric vehicles like free parking or the use of bus lanes.

e-buses – electrical drive is still competing with CNG and hydrogen solutions. Similarly charging question should be solved either in depot or in end of each line. Availability of models and delivery time are still limited, but choice is enlarging over time.

e-bikes – with emergence of large variety of e-bikes need for 230V charging points emerges in cities although typical owner charges them mostly at home. City rental bikes are the best form of promoting e-mobility and chargers are as a rule integrated in stands.

e-logistics – no suitable vehicles available so far, but choice is developing fast. City centres could get rid of polluting and noisy delivery cars which is one challenge for inhabitants specially during the mornings.

e-scooters – four wheeled e-scooters have significant potential for usage by elderly and handicapped people in hospitals and cemeteries.

e- ferries – electrical drive could be used effectively when travelling distance is comparatively short compared to charging time. Finland and Norway have in this area more experience than other countries.

According to various transport vehicles producers predictions we will have a lot of electrical means of transport available from 2019 onwards. Current report helps to prepare all stakeholders for this unprecedented and quick development.

2 Abbreviations used

BSR – Baltic Sea Region, also geographical region for BSR Electric project.

CHAdeMO – "CHAdeMO is a DC charging protocol currently enabling EV charging with power from 6kW to 200kW with 350-400kW in preparation".[2]

CCS – "The Combined Charging System is a standardized charging environment based on numerous standards which describe the necessary components for standardized, safe and reliable charging of electric vehicles. This charging environment encompasses charging couplers, charging communication, charging stations, the electric vehicle and various functions for the charging process as e.g. load balancing and charge authorization.".[3]

MaaS – "Mobility as a Service (MaaS) is the integration of various forms of transport services into a single mobility service accessible on demand. To meet a customer's request, a MaaS operator facilitates a diverse menu of transport options, be they public transport, ride-, car- or bike-sharing, taxi or car rental/lease, or a combination thereof. For the user, MaaS can offer added value through use of a single application to provide access to mobility, with a single payment channel instead of multiple ticketing and payment operations. For its users, MaaS should be the best value proposition, by helping them meet their mobility needs and solve the inconvenient parts of individual journeys as well as the entire system of mobility services."[4]

230 VAC standard – Alternating Current voltage standard, which is a compromise between 220V in most countries and 240V used in UK. Used in electromobility area to charge most of smaller accumulators in e-bikes, e-scooters etc.

PTA - Public Transport Authority

ICE – Internal Combustion Engine

[2] http://www.chademo.com/technology/technology-overview/, 08.09.18
[3] https://en.wikipedia.org/wiki/Combined_Charging_System, 08.09.18
[4] https://maas-alliance.eu/homepage/what-is-maas/, 27.09.18

3 Introduction

The following report is mostly compiled from the answers of the questionnaire and the results can not be generalized to whole countries and regions. The only exceptions are the questions about the relevant policies related to promotion of e-mobility in a country and the specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented. The current state of e-mobility has been described in this report by a corresponding country's representatives.

The common challenge of all partner countries are the EU's ambitious targets for the reduction of transport sector emissions and the aim to phase out ICEs in urban transport by 2050. E-vehicles produce locally significantly less CO_2 and noise emissions and are therefore the ideal means of transport in an urban context given the relatively short distances and possibilities for recharging.

While national promotion strategies for e-mobility have primarily focused on individual car use, other potential applications have received less attention. These include:

E-buses to make public transport even more environmentally friendly if routes, charging infrastructure and operational routines are planned and designed effectively.

E-bikes (rented/owned) that can be used by commuters travel the last mile to their workplace or for business trips in inner cities or replacing faimily's second car.

E-scooters to increase the accessibility of public places such as cemeteries and hospitals for people with impaired mobility, thereby strengthening social inclusion.

Electric delivery vans and trucks that could greatly reduce the CO_2 and noise emissions of the urban logistics sector. Urban companies and public authorities operating large fleets of cars, e.g. for maintenance workers, that could be replaced by e-vehicles. In this report, electric delivery vans and trucks are categorized under e-logistics.

Electric ferries and water taxis to complement public transport systems in the many coastal cities of the Baltic Sea Region.

This focus was implemented in a project BSR Electric. Current paper is the first stakeholder study in this project and aims to find out current state and further development potential in 8 participating countries and 10 regions. Goal is to map valuable experience of e-mobility application and structure it so that other interested cities or various stakeholders could benefit and learn from it.

Experience with practical implementation of these multiple applications of e-mobility solutions in BSR cities is still limited. The project partners will first explore the technical state-of-the-art, status quo and potentials of e-mobility in the partner regions. In order to map potential of all 10 regions, a questionnaire approach was worked out. Task leader for this exercise is Institute of Baltic Studies from Estonia, who has also involved some questionnaire specific know-how from local cooperation partner HeiVäl Consulting. Task leader has coordinated identification of local stakeholders, interviews and compilation of report. Local partners in other countries and regions have independently carried out interviews and participated in preparation of report. Stakeholder study focused on different types of e-mobility actors starting from legislative functions in government, in municipal level and ending with various NPO-s, e-vehicle operators and producers. Institute of Baltic Studies worked out the questionnaire and all partners were interviewing relevant local stakeholders from April until August 2018. Average number of answers per country was about 9. Interviews were made partly as a face-to-face meetings and partly as telephone interviews. Some interviews were answered remotely by stakeholders themselves. The following document gives overview about main findings of this e-mobility stakeholder survey and partners own local knowledge.

4 Description of the sample

The questionnaire was answered by 74 organisations dealing with some aspect of e-mobility from 8 countries. The 8 countries are Estonia, Latvia, Poland, Germany, Denmark, Norway, Sweden and Finland. They are listed on all graphs in the same order to ease understanding and following presentation of results. Order of countries is based on their geographical position on the coast of the Baltic Sea.

Figure 1 BSR Electric project partner regions[5]

[5] https://www.lindholmen.se/en/project-examples/bsr-electric

Number of respondents is illustrated by the following graph.

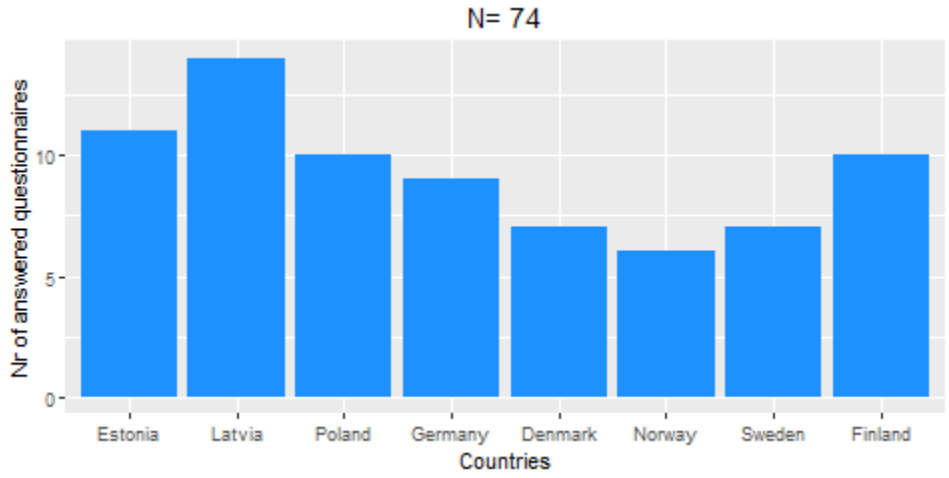


Figure 2: Number of respondents from countries

The questionnaire was answered by 5 main types of organisations and the rest were classified as other. The types were the following: local municipality, private enterprise, public enterprise, ministry or other national authority, national NGO and other. The most answers came from local municipalities, which was also the primary target group. There were 36 answered questionnaires by local municipalities. The numbers of respondents from the rest of the organisations were: private enterprises - 17, public enterprises - 8, ministries or other national authorities - 6, national NGOs - 2 and other types - 5.

Respondent organisations are illustrated by the following graph.

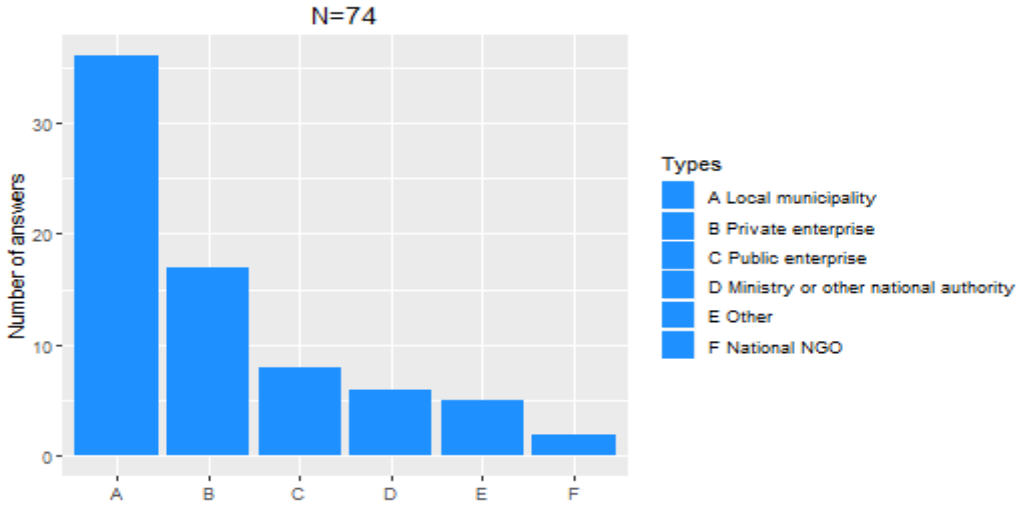


Figure 3 The number of organisation types answered

Local municipalities also indicated their size. The options were: large city (with tram, rail, bus, subway etc transport); middle sized town (with some bus lines) and small town (with no regular public transport lines). Among the respondents there were 13 large cities, 16 medium towns and 7 small towns. This is illustrated by the graph below. Different sizes of cities were chosen to identify possible differences between organisation of e-logistics in larger and smaller municipalities.

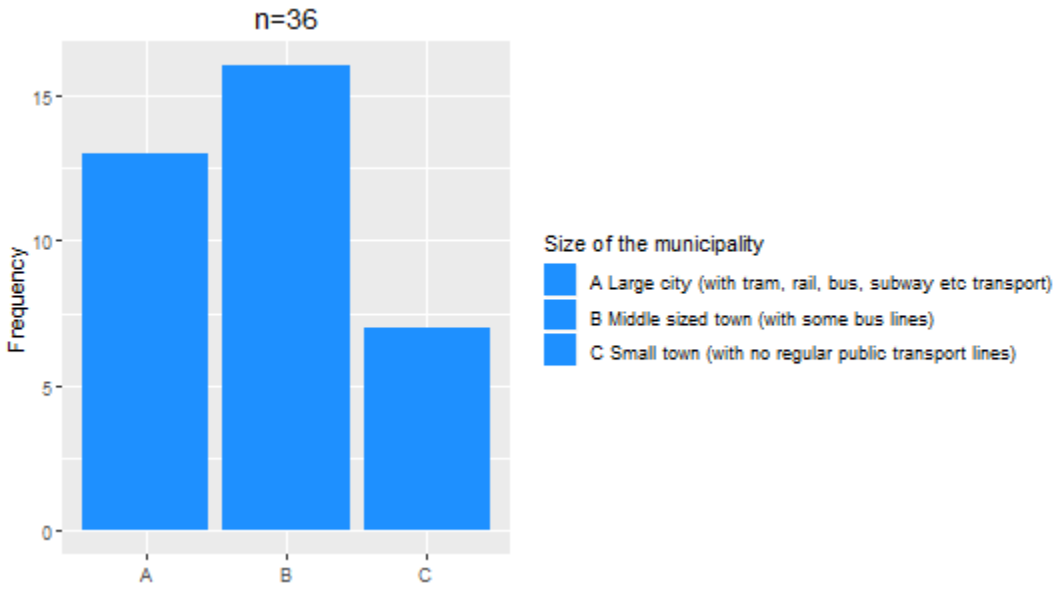


Figure 4 The number of respondents from different sized cities

Stakeholders were asked about the length of their experience in e-mobility field. The most frequent answer was 6-10 years with 29 respondents. The next most popular answer was 3-5 years, which was chosen by 22 organisations. Other categories had less answers. The following graph illustrates length of experience with e-mobility.

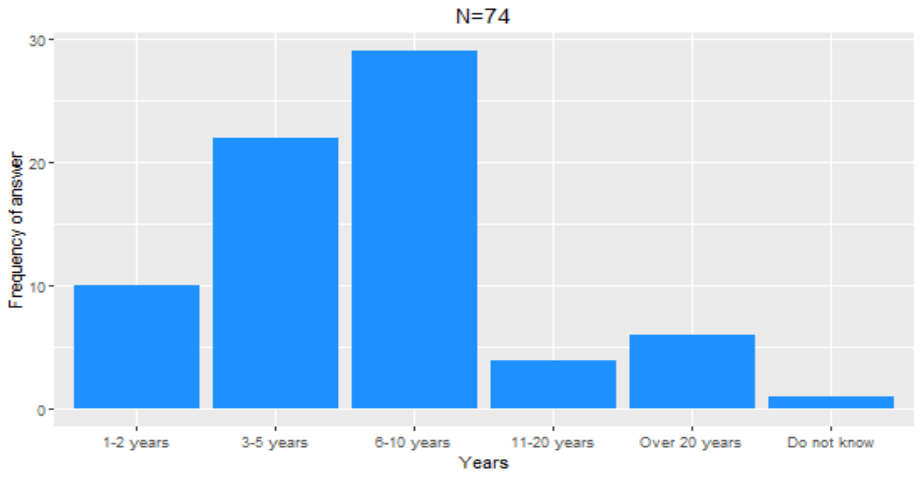


Figure 5 Experience in years among the respondents

As seen from the graph, there is a rise in the number of organisations, that have experience in e-mobility for less than ten years, but the number of organisations plummets when involvement exceeds ten year mark. It means that history and experience in e-mobility application has not been very long and majority of stakeholders have been involved in e-mobility for less than 10 years.

The number of employees involved in activities related to e-mobility was also mapped. The answers of the questionnaires are described on the following graph.

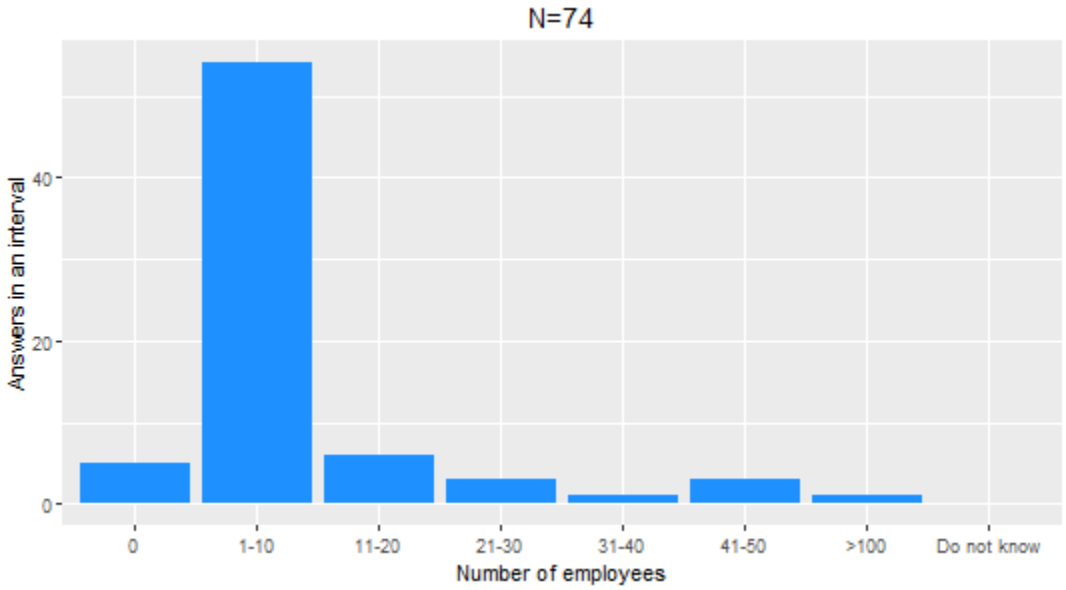


Figure 6 Number of employees involved in e-mobility among the respondents

The majority, 54 out of 74 respondents have 10 or less employees working in area of e-mobility. One organisation has more than 100 employees involved in e-mobility related work. That organization is Elektritakso OÜ (Electric taxi private limited company) in Estonia with 160 employees. In several organisations e-mobility is just one function and nobody is permanently employed in this particular area.

In the following part, general overview about e-mobility planning and potential is given about each country involved.

5 General analysis

Under this section the core ideas and the most mentioned suggestions/challenges/solutions/aspects from the answers of the questions have been taken and combined into a more compact version. The mentioned questions are:

- If you would start the e-mobility initiative/development again, what would you do differently?
- What kind of challenges/obstacles have you faced in the e-mobility application area? What was (were) the solution(s) to each obstacle/challenge?
- Please evaluate the limiting factors in your country/region related to application of e-mobility products/services.
- What are the 5 most important aspects that could help the development of activities related to e-mobility in your organisation?
- What would it take to manage a complete shift from fossil to electric vehicles? Please describe the actions and expected results.

The compact lists/tables/answers are following the order of the questions mentioned above.

If there are organisations, that do not have any experience in e-mobility, but they want to start, it would be beneficial for them to see what other organisations have suggested to do right from the start. This reduces possible mistakes and inefficient approaches that could be avoided.

The following list contains suggestions/ideas what the respondents from all countries would do differently if they could start with e-mobility initiative or development again:

- More promotion for every e-vehicle on a national, regional and municipal levels. Focus on corporations and enterpises more, because their use of e-vehicles will have greater impact on the environment and society. Also, their use of e-vehicles will promote the e-vehicles as well. Electric cars start to be cost effective, if they would be in intensive daily use. For example, e-taxi or e-logistics.
- Spend more time in planning phase.
- Researching the market (what are the viable options)/doing one's research on the interested e-vehicle and the necessities that come with it (e.g. charging network)

- The beginning of introducing e-mobility should be more aggressive. Too passive start and people/enterprises will loose interest. Also, when the leading organisation does not believe in the project, others do not have a reason as well.
- Consider, that there will be an amount of time where people and enterprises are getting used to e-vehicles.
- Create full network coverage of infrastructure on national scale. Fund the charging station network (cooperation with organisations, investors, Euro projects etc). Also, standardised or variety of outputs should be implemented on any given charging station. Example outputs: CCS, CHAdeMO, other standard outputs, output for 220-250V. Furthermore, plan public charging stations for e-vehicles that require less electrical current (e.g. e-scooters, e-bikes).
- Also, municipalities should include e-mobility into their transport strategies.
- Would strive in city planning for a more condensed structure and land-use, which would enable shorter distances. For example the city of Naantali is very dispersed and has a large archipelago area, which requires the use of private cars.
- A complete plan for building charging infrastructure, which takes into consideration, where people live, work and travel.
- Political and financial instruments should be planned to support the promotion of e-mobility.
- A national office for sustainable information and knowledge; one central organisation/national office to manage it at the beginning.
- More beneficial tax regulations and legislation for e-vehicles (Dutch model, free parking in city center or near it, only e-vehicles allowed in city center, e-vehicles can use bus lanes). When the percentages of e-vehicles have risen to a certain point, start reducing the benefits.
- Create a broad policy tool kit for each transport mode.
- Clear directives internally in the organisation directly from the start. Having clear and structured plan makes implementation easier.
- A more favourable electricity tariff scheme for fast chargers in rural areas.
- Involve different industries and enterprises to start building all-inclusive infrastructure (cooperation between different organisations).
- Build technology competence within public procurers.

- Test e-mobility areas before fully implementing.
- Would not focus on e-cars and would rather take smaller vehicles for social employees.
- Would work on the image of e-bikes. They could become a real alternative to fossil-fuelled mopeds, scooters and microcars.
- Monitoring use of public support for purchase of e-cars should be proper in order to avoid criminal activity and court cases later.
- Get involved in e-mobility related Euro projects, that could help to kickstart e-mobility movement in the region.

Those who are new in e-mobility area would like to know what are typical problems or challenges of application of e-mobility and how to solve them. Therefore such questions were included in questionnaire for experienced users of e-mobility.

The following table describes the challenges and obstacles the respondents of the questionnaire have had in the e-mobility application area. Also, suggested solutions have brought out if there were any.

In the table in the left column is the challenge or obstacle and on the right is the suggested solution.

Challenge or obstacle	**Suggested solutions**
Lack of infrastructure, partial infrastructure	Governmental support and funding. Planning charging network that covers the whole country. Take into consideration the pros and cons of fast and slow charging stations.
Charging infrastructure should be made more visible to citizens	An app which gives real-time data on where there are free charging points. As charging takes time it should also predict how much time is left to fully charge.
Approval process for establishing infrastructure in the municipalities	Create 1 pager – guides for the process. Make clear and interesting arguments, so that officials in the municipalities start taking interest.

Although the public charging network is there, the number of charging points isn't enough	Increasing the number of charging points, making sure that the charging points are being serviced regularly and are working properly. Also, think about different outlet options for e-cars, e-bikes, e-scooters etc.
No clear strategy how to implement e-mobility	Ask help from other organisations that already have experience in the that particular field. Then thought out plan, that can be somewhat flexible if needed.
Roaming of infrastructure providers	Bringing the parties together – create solution like in Telecom industry.
Difficulties in mileage planning, hard to reach further destinations	Use e-vehicles only in the nearby area and in the immediate vicinity. Other option is to combine different modes of transport or even e-transport to form an intermodal chain to reach wanted destination.
High cost of energy distribution	Favourable price of electricity for charging stations is needed
Low number of sold e-vehicles	Implementing tax benefits for e-vehicles. Futhermore, at first implement additional benefits to encourage e-vehicles purchase, such as usage of bus lanes, financial support when purchasing e-vehicles, free parking in city center.
Having no variety in e-vehicle, few e-car models	Investigating different country's solutions/options/OEM's and taking the most suitable model for local conditions.
Range of e-vehicles	Dense charging infrastructure. Combining parking lots and charging stations. Public charging stations for lower current electricity consuming e-vehicles like e-bikes, e-scooters etc.

Fear from limited range offered by EVs	Suggest performing mileage monitoring and check how often EV can drive daily planned range.
There have been cases when the electric car has more sophisticated technical problems and even the official retailer doesn't know how to fix it. They don't have much experience with electric cars.	Need to find the solution by yourself (usually Google helps) which means that sometimes the driver knows more about the e-car than the retailer. Think about sending few employees to get in-service training.
Lack of competence about instruction for use/benefits	Electric vehicles training course for employees
E-vehicles perform poorly in winter and on rougher roads.	With each model / year it is improving
Some e-bus models have been too tall to drive under bridges with traffic signs. Trucks and caravan cars have crashed into pantograph charging stations.	Give preference to e-vehicles that can drive around in the city without any hindrance.
Early worries about quiet e-buses	Test and see how people react. Ask others with experience.
Cultural change / people's mindset	Promote e-mobility in the region and start implementing e-vehicles in the area, so users have the possibility to get used to them (e-taxi, e-vehicle rent).
Lack of belief into the e-technology. For example banks don't want to give loans as they don't believe in it.	No quick solutions. Talk to people, be as a role-model. Promoting e-mobility with e.g. e-taxi, e-vehicle rent.
From the consumers point of view, a major obstacle is the lack of information and opportunities to test e-vehicles.	Low-treshold opportunities to test different e-vehicles. E.g. when getting a replacement car during the time your car is in the repair shop you could try out an e-car. General e-mobility promotion.

E-mobility readiness among private citizens/businesses	Campaining, knowledge sharing, promoting e-mobility.
People used ordinary electrical sockets for recharging e-vehicles not meant for high current outputs and overloaded them creating fire hazards	Promote separate chargers, spread general awareness on charging safety.
Misuse of special parking places for e-vehicles by other owners of cars	Fining for incorrect parking on e-infrastructure parking lots
Missing support in legislation	Communication with political parties, ministries and parliament commissions.
Decentralized procurement of cars in different departments	Establish a car technology forum in the municipality for sharing competence on EVs and charging. Procurement should ideally be administrated centrally to ensure updated knowledge.
The business & service models: who is responsible for which part of the system?	Exchange experiences with others /Cooperation

What might be of interest for the organisations new to e-mobility are the limiting factors in e-mobility. The following graph describes how much a factor limits e-mobility on average. The answers were coded from 1 to 5, where:

1. this is not a problem;
2. this is a small problem;
3. this is moderate problem;
4. this is significant problem;
5. this is a major problem.

The following factors were evaluated to be the most limiting on average: limited range/performance of currently available batteries, limited availability of charging infra-structure, lack of financial means, lack of motivation of consumers to engage with e-mobility, low cost efficiency of the technology compared to gasoline/diesel engines and lack of suitable e-vehicle models. On average, none of the limiting factors were evaluated as a minor problem.

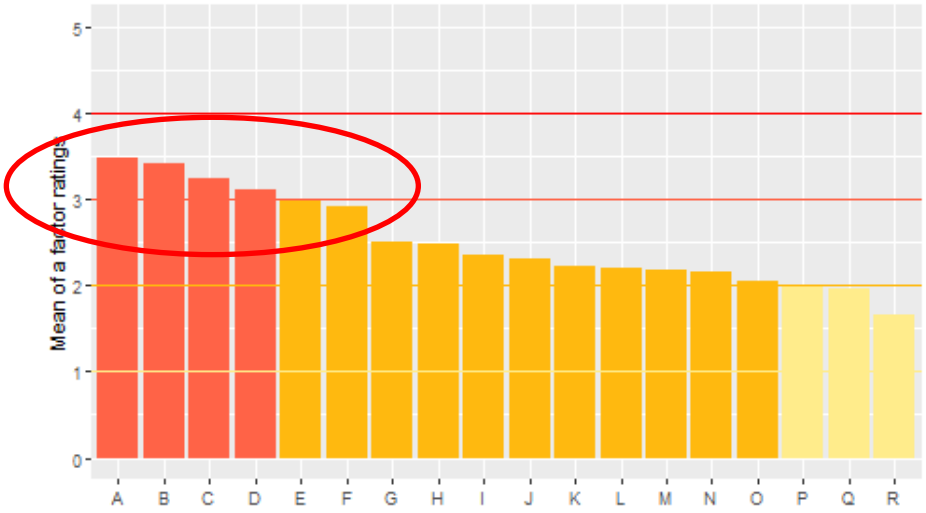


Figure 7 The mean ratings of the limiting factors of e-mobility

In the questionnaire there were given the following limiting factors to choose from:

- A - Limited range/performance of currently available batteries
- B - Limited availability of charging infra-structure
- C - Lack of financial means
- D - Lack of motivation of consumers to engage with e-mobility
- E - Low cost efficiency of the technology compared to gasoline/diesel engines
- F - Lack of suitable e-vehicle models
- G - Low technology readiness level (TRL) of solutions
- H - Problems related to laws/regulations in our country
- I - Limited availability of skilled local professionals and competence
- J - Limits in production capability for markets with big demand
- K - Lack of consistence and coherence in our R&D work
- L - Lack of the most up-to-date technology in our use

- M - Conservative credit policies in banks
- N - Lack of skills/competence among our employees (please specify missing skill)
- O - Internal problems in our organisation
- P - Barriers for hiring skilled international specialists
- Q - High costs associated with accessing and transferring knowledge
- R - Lack of foreign contacts.

Figure 7 describes the mean problem size of each factor rated by the respondents of the questionnaire. The bar is light yellow when the rating is between 1-2, dark yellow when the rating is between 2 – 3 and light red between 3 - 4. Bar is red when the rating exceeds the 4 mark. On the graph group of most important 6 limiting factors are marked with red oval. The graph has been calculated in the following way: code the answers from the questionnaire to a numeric value, sum values of each factor and divide each sum with the number of the respondents, who evaluated that corresponding factor.

The top 6 most limiting factors among the respondents are interdependent. The limiting factors are viewed from the perspective of e-car, but the same logic applies to other areas as well, such as e-ferries, e-buses. Knowing that one can travel only so far until one has to recharge e-vehicle again is disheartening, especially knowing that the range is limited and charging takes more time than filling up a fuel tank. Also in wintertime low temperatures reduce available energy significantly. Fuel stations network has already been established and available almost everywhere. The charging station network is not as complete and dispersed as fuel station network. Limited range, long charging time combined with high purchase price of vehicle support lack of motivation among consumers to engage with e-mobility and e-vehicles. If there would be more financial means, e.g. governmental support, then there are the possibilities to finance the charging network, private and corporate e-vehicle purchase. This would increase private citizens or enterprises interest to get involved with e-mobility. At the moment, one demotivating aspect about e-vehicles is that e-vehicles are cost efficient only when the mileage of the vehicle is large. This applies more to larger e-vehicles such as e-cars, e-buses and e-ferries.

Barriers for hiring skilled international specialists, costs associated with accessing and transferring knowledge and lack of foreign contacts – are the not very important limiting factors for respondents.

On the following chart we analysed difference in limiting factors by countries.

The top 6 limiting factors are mostly seen as moderate, significant or major problems by the country's respondents.

	Limiting factors	Means	Estonia	Latvia	Poland	Germany	Denmark	Norway	Sweden	Finland
14	Limited range/performance of currently available batteries	3.48	3.40	3.54	4.33	3.78	2.25	3.33	3.57	2.67
13	Limited availability of charging infra-structure	3.42	3.55	3.85	4.60	2.67	2.40	3.67	3.14	2.33
3	Lack of financial means	3.24	4.09	4.00	4.10	2.22	1.86	2.83	3.00	2.50
16	Lack of motivation of consumers to engage with e-mobility	3.10	3.00	3.15	4.60	3.22	1.50	2.00	2.57	2.50
15	Low cost efficiency of the technology compared to gasoline/diesel engines	2.98	1.90	3.75	4.00	3.11	4.00	2.50	2.78	1.83
17	Lack of suitable e-vehicle models	2.91	2.64	2.92	3.44	2.88	2.50	4.00	2.67	2.33
18	Low technology readiness level (TRL) of solutions	2.50	1.50	3.33	3.22	2.14	1.00	2.50	3.00	2.00
1	Problems related to laws/regulations in our country	2.47	1.30	2.80	4.00	2.50	2.00	2.67	1.43	2.83
8	Limited availability of skilled local professionals and competence	2.35	2.18	2.20	3.10	2.33	2.00	2.60	2.14	2.17
10	Limits in production capability for markets with big demand	2.31	1.71	2.00	2.00	2.29	2.71	3.80	3.00	1.83
12	Lack of consistence and coherence in our R&D work	2.23	1.00	2.88	3.00	1.83	3.00	2.33	1.75	1.40
11	Lack of the most up-to-date technology in our use	2.20	1.70	2.25	2.88	1.83	3.43	2.20	1.60	1.50
2	Conservative credit policies in banks	2.18	2.67	2.00	3.56	1.50	1.43	2.00	2.00	1.20
5	Lack of skills/competence among our employees (please specify missing skill)	2.16	1.73	2.00	3.00	2.11	1.86	2.00	2.00	2.67
4	Internal problems in our organisation	2.05	1.27	1.55	3.12	2.56	2.14	2.33	2.12	1.67
9	Barriers for hiring skilled international specialists	1.98	1.00	2.56	2.00	1.83	2.86	1.75	1.75	1.50
6	High costs associated with accessing and transferring knowledge	1.95	1.11	2.22	3.22	1.78	2.00	2.00	1.17	1.80
7	Lack of foreign contacts	1.65	1.22	1.82	2.22	1.22	2.14	2.00	1.14	1.40

Figure 8 The mean ratings of the limiting factors of each countries respondents

Figure 8 describes the mean problem size of each factor rated by the respondents. The criteria for cell colours are the same as the bar colour criteria on figure 7.

As seen from the graph, Estonia's, Latvia's and Poland's respondents see the top limiting factors as larger problems than Germany's, Denmark's, Norway's, Sweden's and Finland's respondents. If these countries are grouped into Eastern and Western Europe correspondingly and looking at their countries experience in e-mobility, then there might be the answer. The following graph describes the number of organizations with certain amount of experience in e-mobility among Eastern and Western Europe's respondents.

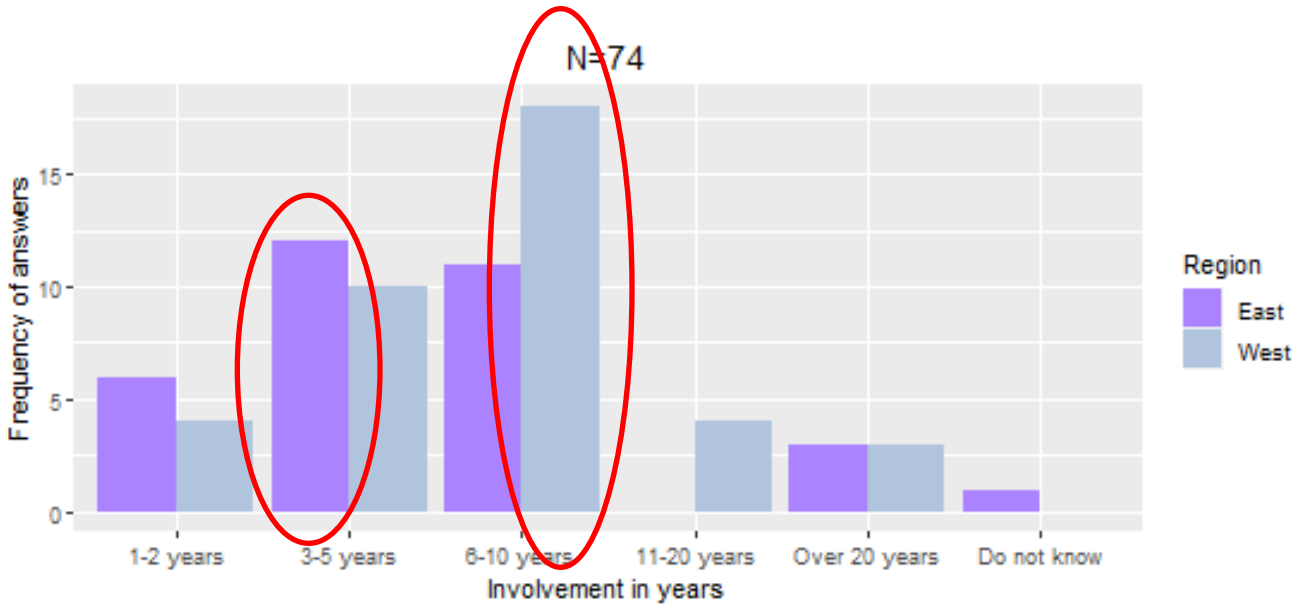


Figure 9 Eastern vs Western Europe's respondents experience in e-mobility in years

As seen from the graph, country's respondents, that are labelled as West Europe, have mostly 6-10 years of experience in e-mobility, whereas among Eastern Europe's respondents experience is predomonantly 3-5 years. This might indicate, that West European respondents have already found some solutions to the problems and the level of significance of the problems to them is smaller.

Among all the countries respondents, Polish respondents have been the most critical. This might be due to the fact that Polish respondents have predominantly 1-2 years experience in e-mobility and the limiting factors are still a concern. Also, from third row of table on figure 8 could be seen that financial restrictions are more important for Eastern Europe's respondents compared to Western Europe's respondents. Most countries respondents view the limited range/performance of the e-vehicle and the lack of charging station infrastructure as a significant problem.

Among the respondents of the questionnaire, the most important aspect, that could help the development of activities related to e-mobility in the company, is the availability of financial incentives from the local/regional/state authorities.

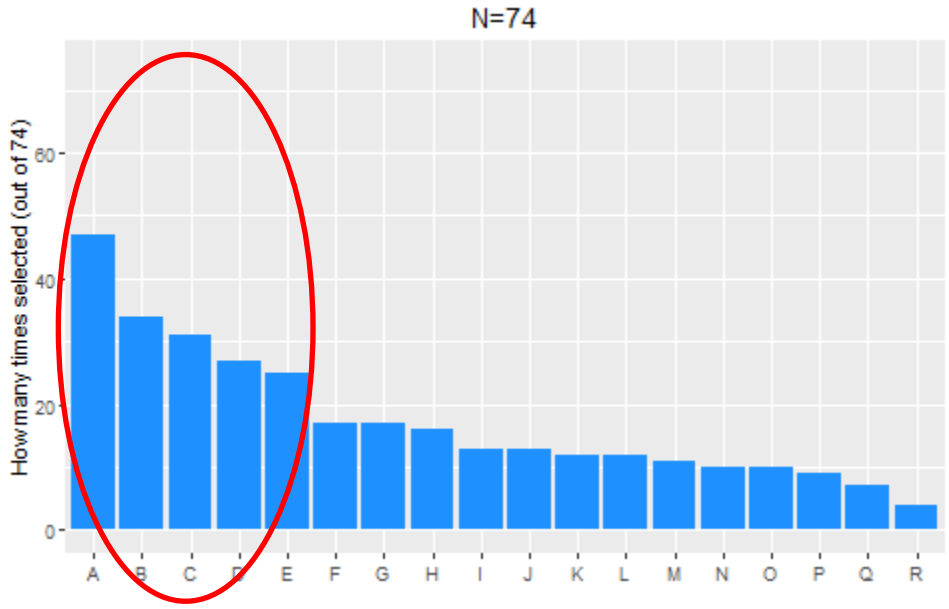


Figure 10 The most important aspects from the overall standpoint

The list of aspects, from which the respondents could choose from:

- A - Availability of financial incentives from the local/regional/state authorities
- B -Availability of efficient and low-cost information sharing and knowledge access/transfer mechanisms
- C - Cross-disciplinary or cross-industrial cooperation
- D - Conditions for fair competition regarding service/technology providers
- E - Improvement of local/regional/national legislation
- F - Clear definition of roles and responsibility areas of organisations involved in the area
- G - Availability of charging network for the batteries
- H - Support and cooperation with (other) public organisations
- I - Cooperation with (other) scientific organisations internationally
- J - Cooperation with (other) private sector organisations internationally
- K - Availability of some unique technology or know-how
- L - Availability of testing services and set levels of standardization
- M - Synchronization/availability of databases between different organisations

- N - Cooperation with (other) private sector organisations in the region
- O - Availability of international skilled professionals and competence
- P - Cooperation with (other) scientific organisations in the region
- Q - Increasing the awareness of local population and/or involving them in using/testing the services/technologies
- R - Availability of local skilled professionals and competence

More than half of the respondents thought, that among the most important aspects is the availability of financial incentives from the local/regional/state authorities. Four other answers were popular as well. They were: availability of efficient and low-cost information sharing and knowledge access/transfer mechanisms, cross-disciplinary or cross-industrial cooperation, conditions for fair competition regarding service/technology providers and improvement of local/regional/national legislation.

The financial incentives from the local/regional/national authorities are important, because building charging station network, purchasing and supporting purchase of e-vehicles, e-mobility promotion all need funding. Private citizen or corporation alone is unable to create necessary infrastructure nor incentives.

The need for know-how and information about e-vehicles are important, because often the e-vehicles are so complex, that even the official retailer does not have the knowledge to fix certain issues. This know-how should be easily accessible for all those, who wish to get involved with e-mobility or e-vehicles. Also role of current BSR project is to alleviate need for know how and information about e-vehicles.

Implementing beneficial legislations for e-vehicles to increase the motivation to use e-vehicles among private citizens and enterprises is necessary step. This however needs the improvement of local/regional/national legislations.

Respondent organisations would like to see higher variety of e-vehicles. This problem disappears over time as market forces regulate supply and demand.

The cooperation between different organisations, private and public, is necessary for implementation of e-mobility in the municipality/region and company.

The following list contains to ideas of the respondents about the ways of combining different modes of transportation into one intermodal (e-mobility) chain.

- For city areas, we foresee the bus, the metro and the commuter train as the major work horses. It is therefore important for us to ensure that these workhorses are not forgotten in public debates, as they are not as sexy to talk about compared with self-driving minibuses or e-scooters. We foresee the self-driving minibus, the bicycle, the scooter, the kickbike, walking and the car as last-mile alternatives between bus/metro/train stations and the customer's home, kindergarten and work place. All these transport modes will be connected through a single-platform trip planning and ticketing solution. The goal is to make the travel experience as seamless and simple for the end customer. This includes a system where the end customer receives only one ticket/price, despite travelling with different transport modes, maybe from different operators, on the same trip. The solution will also be so-called "Handsfree ticketing" or Bibo (Be-in-be-out). This means that the end customer does not have to move a muscle to pay for the trip. Beacons or other near-communication technologies will identify where the customer starts and ends a travel.
- We see a great chance in the software area to realize mobility as service. This means to us one pricing system and application to book and use bikes, carsharing, electric buses, subways and metro.
- Electric trains can transport goods which are delivered by electric ferries, then goods can be moved by electric cars. Moreover, an appropriate solution would be to use electric car-sharing and bike/scooters rental.
- Parking outside of city and electric mini-busses to city center. Car-pools in the city and in apartment house increase intermodality.
- Coordinate train and bus times so, that when the train arrives, there will be a bus that takes people to the city center. E-buses could be used instead of regular buses. In Tartu starting from September 2018, there is one e-bus that drives between railway station and city center.

- E-bikes to e-trains to e-carsharing schemes. Big city hubs with multimodal solutions. Areas with no fixed car parking, only for car or bike sharing operations. Big data collection and easy access mobile app supports intermodality.

- El bikes in intermodal chains. At the nodes there should be charging points. Park and ride system to be used. Incorporate bussiness with charging. For example, in a shopping center there could be charging points, so that when a person is doing his/hers shopping, ones e-vehicle is recharging.

- In the new regional plans there are travel centres which would act as intersections between different mobility chains. For instance charging of e-vehicles and incentive parking have been taken into consideration. Considering e-logistics there should also be a plan for special terminals from where the last mile deliveries could be carried out using cargo bikes.

- Electric MaaS[6]. This transportation service could be implemented in a way, where every mode of transport is electrical.

- A person could travel from the other side of the river to downtown for instance by first crossing the Aura river by the electric city ferry Föri and then taking the electric bus operating route 1 between the harbour and downtown market square. In the future the journey could perhaps be continued by an electric citybike, which also is part of the public transportation system Föli. Turku introduced first citybikes in May 2018. These bicycles are traditional, but perhaps the next citybikes could be electrically assisted.

- Visible mobility points / hubs for changing the means of transport, e.g. in bus stations and train stations there are e-bike, e-scooter etc rent. These e-vehicle rent stations should be spread throughout the city in a strategic locations

- A common mobile app and more cooperation. National government needs to decide and coordinate local/regional transport data in one app[7].

[6] See section 2 Abbrevations used
[7] http://www.entur.org/, 19.09.18

The following table contains the actions that the respondents of the questionnaire suggested to take to manage a complete shift from fossil to electric vehicle and the corresponding results, if given.

The table below gives some ideas what to do, in order to switch from fossil fuel powered vehicles to electric vehicles. The idea of the question was what was needed in order to have a complete switch to electric, however mostly only general ideas were brought out. Actions are in the left and results are in the right column.

Action	**Result**
Introduction of significant incentives promoting buying and using of less polluting new technology	Consumers and companies would willingly shift to new technology
Introduction of fines for the users of old technology	Consumers and companies would shift to new technology in order to avoid penalties
Government financial support is required	Would motivate people to buy
Permission to be allowed entry to the city centre only for electric cars	Increase in the e-mobility proportion by 10%
Politicians shift to environmental initiatives	Leading by example
Legal and motivational challenges related to introduction of e-vehicle charging stations at apartment houses should be somehow solved.	More urban people could shift to e-vehicles when they could charge their vehicle at their apartment building's parking lot. Currently making such major changes (investments) in housing is very challenging due to the corporations' own and varying rules and the fact that there always are some flat owners who hinder any major investments when these decisions are being democratically voted upon.
Demanding very low emissions from the public transportation	Changing all buses into e-buses would support the image of zero-emission transportation

Municipalities, public organisations and certain fields of business like taxi companies could be harnessed to lead the way and serve as an example in shifting to e-mobility.	General public would overcome possible prejudices and be more motivated also themselves to make the shift to new technology.
Charging at home would also enable balancing of power consumption. Everybody returns home around 18.00. Consumer could use and supply power to the grid.	Balanced power system also in dwelling houses Owners society could not have right to ban installation of a charger
Dense network of charging points	Network comparable to that of gas stations, possibility for free movement across the country
Lower levies for grid connection and use of electricity	Lower electricity price for e-vehicles
The prices of regular cars should rise and e-vehicle prices should decrease	The amount of e-cars would increase
Price and quality of e-car should be competitive	Determined by the market and producers
Higher prices of fuel	TCO of e-vehicle comparable to combustion engine
Development of better battery technology	Comparable range of travel / operation time
Considerably bigger offer in EV market	More possibilities to purchase EVs
Cost efficient upgrade of the power system, utilizing new technologies like distributed power generation and local energy storage.	Reduced national greenhouse gas emissions, reduced land-use, omitting power bottlenecks in the grid.

6 Theme specific suggestions and recommendations for other cities and regions

Our findings and recommendations are structured based on the e-mobility application areas.

The following suggestions have been compiled using the general analysis section and findings from different country's respondents.

E-mobility in general:

- Legislation: The legislation and incentives need to be clarified and developed towards supporting the transition towards e-mobility
- Business models: There have to be new services and solutions developed for full deployment of e-mobility
- Infrastructure: The development of the infrastructure needs to support the new means of transportation
- Technology: The technical solutions need to be safe, easy to use and affordable. There needs to be variety of different type of solutions to suit different users and their needs.
- Dedicated resources: Cities need dedicated resources (i.e. personnel) for urban e-mobility development. This is currently made with very low resources which slowing down quick application
- End users: E-mobility solutions need to be planned in cooperation with the end-users to encourage uptake. Real-life testing platforms (e.g. e-bike libraries) and possibilities to rent or share e-vehicles may help to encourage a change in mobility habits.

E-cars:

1. When planning the implementation of e-cars in the region, there should be carefully thought through charging station network. Planning the charging station network, the following questions should be thought about: where are the charging stations, what kind of outputs it has, how broad vehicle selection could charge at that station (e.g. only e-cars with CHAdeMO charging inputs or CCS), how is the payment done.
2. When planning the implementation of e-cars in the region, the car model selection should be thought through. Chosen models should be the best suitable vehicle for the environment (e.g. city, country) and climate (e.g. seasons, rain, snow). Also, the model should manage

the intended use (in the sense of battery life and range). The chosen model should appeal to enterprises and the public.

3. Information about e-cars and as well as getting used to them, promoting and spreading awareness about e-cars is necessary to everybody. Debates, rallies, public events are great opportunities to promote e-cars. Also, the primary focus should be on enterprises, because their use of e-cars impacts the environment more than private citizens. Furthermore, enterprises help promoting e-cars in the region. For example, e-taxi services, employees have e-car for their work car.
4. When trying to implement e-cars in the region, different benefits should be implemented to e-cars, so that there would be more motivation to switch from fossil fuelled to electric cars. Often implemented benefits include less taxation/tax benefits on e-cars, free or partially free parking in the city center, possibility to use bus lanes, financial support when purchasing e-car. For example, Norway has already started to lower their e-car benefits, because e-car percentage in the country is already very high. When a certain proportion of e-cars is reached in the country, the benefits should be lessened step-by-step.
   E-cars could be part of or even eventually replace fossil fuelled cars in MaaS.[8]

E-buses:

1. E-buses are competing with CNG and H_2 technologies. A fully functional e-bus line is currently operated in Turku with 6 e-busses. Additional tests are held in Tartu and Hamburg. More comprehensive test results will be available in 2019.
2. Similarly to e-cars, there should be well thought out charging system either based on depot charging or opportunity charging.

E-Bikes:

1. Foldable/carriable e-bikes or kickbikes used for the last mile travel to work. This could alleviate the parking problems in city centers. Companies or organisations could provide the foldable e-bikes to their employees.

[8] See section 2 Abbrevations used

2. Promoting e-bikes, because they are good alternatives to fossil fuelled mopeds, scooters and microcars. The best method is municipal e-bike sharing, which has the highest positive influence for citizens.

E-logistics:

1. There seems to be lack of suitable e-vehicles for e-logistics at the moment. However, several major car producers are coming to market with e-vans and e-trucks. Therefore, the challenge to find suitable vehicle will disappear in the coming years.

E-scooters:

1. The possibility for elderly to use e-scooters in the public spaces. For example, In Riga Latvia, there is a plan to implement four-wheeled e-scooters in cemeteries for elderly people.

E-ferries:

1. In area of e-ferries there is significant experience in Norway and Finland. Other countries do not have much experience in this particular area.
2. E-ferry should be one choice during all procurement processes to determine whether it is competitive solution to replace fossil fuel engines.

   For e-ferry it is critical to look at **usage pattern** of the ferry. If the distance is small and waiting time long, then electrical drive is advisable. For example, in Turku travel distance of e-ferry is less than 100 m. If travel time is 1,5 h and waiting time in harbour 0,5 h like in Estonia on 28 km distance to Hiiumaa island, then currently there is the challenge to keep batteries charged. Batteries improve significantly every year therefore similar solutions should be more interesting in coming years.
3. Due to booming market of e-ferries it creates working places to countries like Poland where e-ferries are built.

7 Overview of the Countries

Under this section each country is looked at separately. Finland has involved Helsinki and Turku regions and Germany has involved Hamburg and Rostock regions, which are described under those two countries. The graphs, tables and bulletpoints are based on the corresponding countries respondents answers in the questionnaire. Also, the partners have given their input in text form under subsections that relates to relevant policies and specific implementation. The order of countries is the following: Estonia, Latvia, Poland, Germany, Denmark, Norway, Sweden and Finland.

7.1 Estonia

From Estonia there were 11 stakeholders interviewed. Among those respondents 5 were private enterprises, 1 ministry or other national authority and 5 were local municipalities. This is illustrated by the following graph.

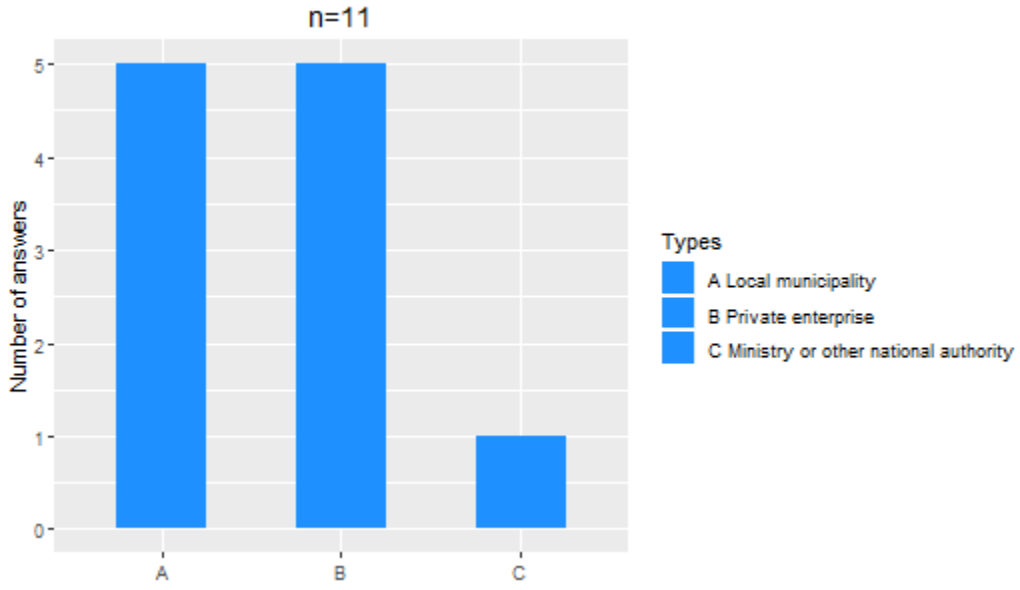


Figure 11 Types of Estonia's respondent

Of the 5 local municipalities, there was 1 large, 2 medium and 2 small cities. The involvement in e-mobility among the respondents were 2 with 1-2 years, 4 with 3-5 years and 5 with 6-10 years of experience. This is illustrated by the following graph.

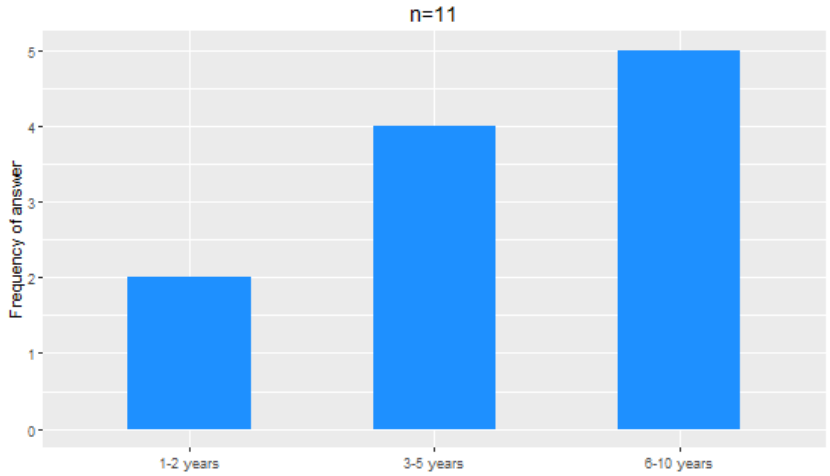


Figure 12 Estonia's respondents involvement in e-mobility in years

Number of employees involved in e-mobility was mostly ten or under, but there were two answers, where number of employees was 30 and 160 respectfully.

The relevant policies related to promotion of e-mobility in Estonia

In Estonia there were four main categories of policies related to promotion of e-mobility. These categories were:

1. parking;
2. road benefits;
3. cars;
4. charging network.

Polices about e-car parking benefits were the most often mentioned policies and they are applied in Tallinn, Tartu and Pärnu.

There are unfortunately no other policies in place at the moment related to focus categories of e-mobility, such as e-bikes, e-ferries etc.

In Tallinn there is free parking for e-vehicles in A-area, the City Center. As for the Old Town and Heart Town, there is no free parking for e-vehicles.

In Tartu one with either e-car or hybrid car can park for free in the whole city. However, starting from January 2019 hybrid cars do not have free parking in Tartu anymore.

In Pärnu parking is free for only electric cars with up to nine seats.

Mentioned policies categorized as road benefits consisted of only the possibility for electric cars to use bus lanes for driving. This policy applies in Tallinn.

In 2011 government organised the purchase of 507 Mitsubishi iMiEV electric cars for social employees. Also, electrical car rent was introduced to promote electrical cars. Furthermore, fast-charging CHAdeMO charging network was built across Estonia with this project. Additionally, regular chargers were installed near local municipalities that used electric cars. This purchase of electric cars and installation of charging stations was related to ELMO project. ELMO project is an excellent example of governmental combined and systematic action to introduce electrical car transport. Similar approach could be used to promote other types of electromobility.

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Estonia

In March 2011 Estonia became the first country in the world that opened nationwide electrical vehicle fast-charging network.[9]

In Estonia there was only one main category of specific technologies, infrastructure, services, know-how related to e-mobility. This category was:

- charging stations for e-cars.

Almost only infrastructure in Estonia related to e-mobility was built during project ELMO. With that project charging network was built across whole Estonia. There are 167 quick chargers in Estonia. 102 quick chargers are in towns and 65 by roads. Out of larger towns, 38 quick chargers are in Tallinn, 11 in Tartu, 5 in Pärnu, 3 in Viljandi and 2 in Narva.[10]

[9] http://elmo.ee/estonia-becomes-the-first-in-the-world-to-open-a-nationwide-ev-fast-charging-network/, 27.08.18

[10] http://elmo.ee/charging-network/, 27.08.18

The following picture shows every ELMO charging station in Estonia.

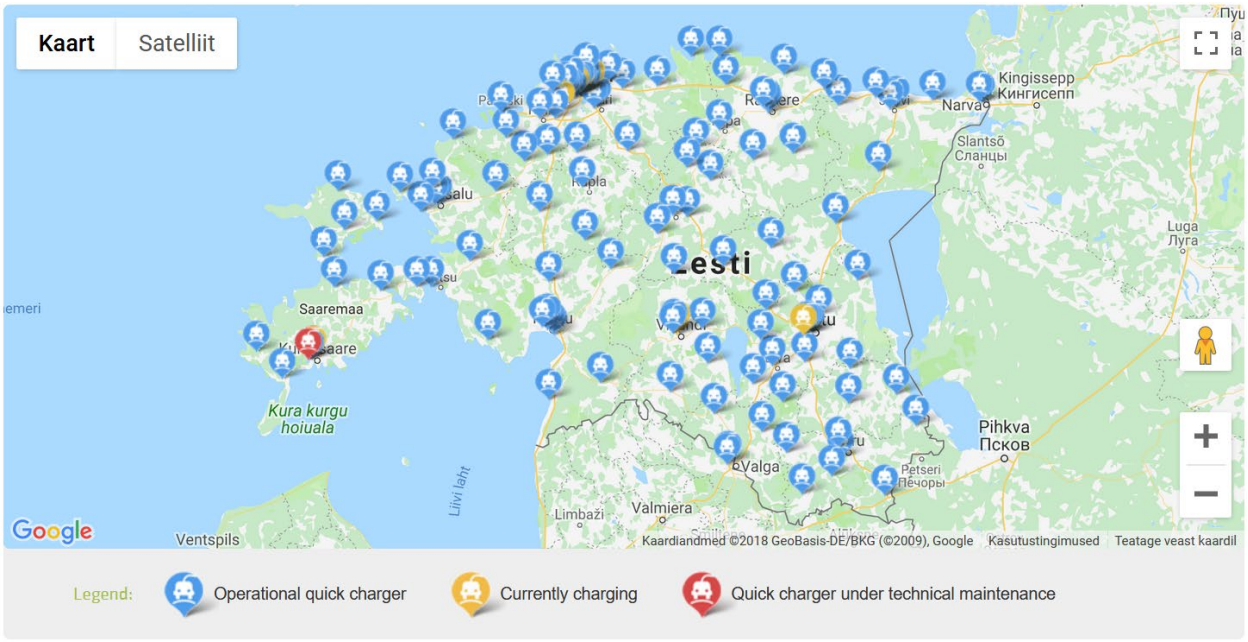


Figure 13: Charging network[4]

However, only cars that support CHAdeMO charging standard can be charged at ELMO charging stations. This is because ELMO charging station only have CHAdeMO chargers.

There are two CCS charging stations in Estonia, one in Tallinn and one in Pärnu.

Quick chargers are designed to quickly charge electrical cars, but there is no outlet for low current users like e-bikes or e-scooters. Other popular modes of electric transport are e-kickbikes, e-hoverboards, monowheels etc. They all need 230V low power chargers, but they are absent from public room at the moment.

In September 2018 there will be an electric bus driving between the railway station and the bus station in Tartu. This pilot is financed by BSR-Electric project. The bus charging will be solved without setting up permanent public infrastructure.

Also, with ELMO project there was an electric car rental service. The reason for that was so people could get more familiar with e-cars.

Another e-car related service in Estonia is provided by companies Elektritakso and Välk. Elektritakso operates in Tallinn, Tartu and Pärnu.[11]

[11] https://www.elektritakso.ee/kontakt.html, 26.09.18

In Estonia there are no policies and infrastructures related to e-logistics, e-bikes, e-scooters, and e-ferries/water taxis. E-bikes and e-scooters can be charged at home from the standard 230VAC power outlet. The need for public charging infrastructures is recognised, however there are no finalised plans to develop it yet.

In Estonia there are no e-ferries/water taxis.

Estonia's respondents have mostly been involved with e-cars.

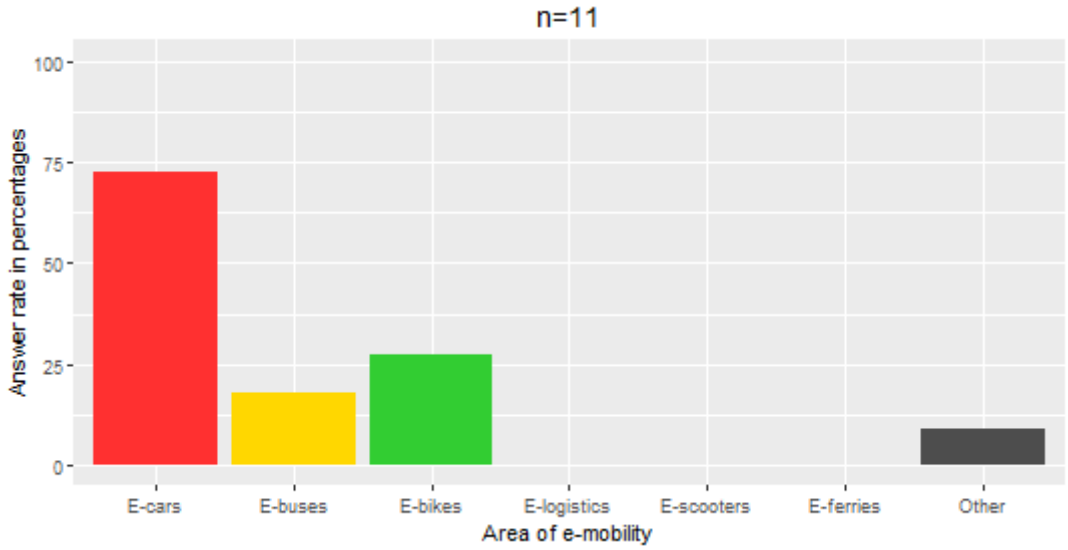


Figure 14 Estonia's respondents involvement in e-mobility areas

Figure 13 describes in percentages how many among Estonia's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents from total indicated certain category of e-mobility.

Estonia's respondents have comparatively good experience of introducing e-cars and e-bikes. Also, there are respondents who have been involved with e-buses and other types of e-vehicles. However, noone had been involved with e-scooters nor e-ferries. Estonia's respondents have room to improve in the usage of e-logistics and e-scooters. Those who have been involved with e-bikes could think about the implementation of e-scooters as well. Since there is a lot of involvement related to e-cars, the next step is to help implementing and forwarding this knowledge and experience towards e-logistics. In e-logistics, cars, vans, truck etc are used, meaning the experience gained from e-cars could be implemented in e-logistics.

Estonia's respondents have identified themselves most often in the role of making policies and/or legislations.

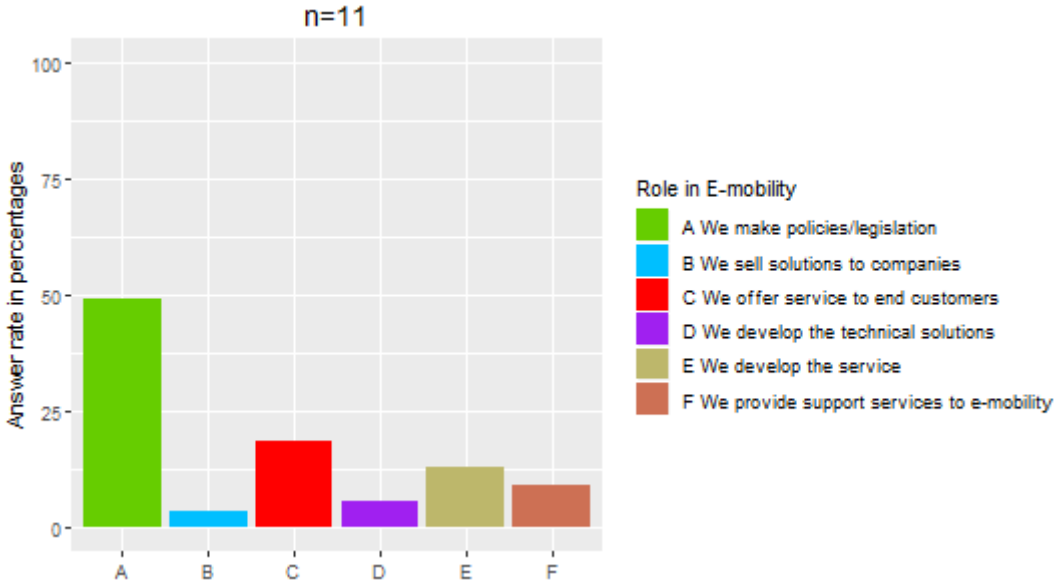


Figure 15 The roles of e-mobility in which Estonia's respondents have been in

Figure 14 describes in percentages how many among Estonia's respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Estonia.

Since half of the respondents in Estonia were either local municipality or ministry (or other NGO), then it is logical, that Estonia's respondents have mostly been involved in making policies and/or legislation. Because Estonia is a small country, then there might not be as many industries/companies that can develop technical solutions and hence there are not many who could sell the solutions to other companies. Since the sample size is not very big, we cannot generalize this to whole Estonia.

The following list contains smart specialization strategies, cluster policies or initiatives, that would be interesting for others to join with regard to e-mobility, brought out by Estonia's respondents.

- Smart City Cluster[12]

[12] http://smartcitylab.eu/en

- SUMP project.

There is a map, that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

- https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Estonia's respondents best practices in the e-mobility application area.

- Public charging network – this is something that private sector is not able to build. In Estonia there was the first charging network in Europe to cover the whole country.[13]
- Free parking for electric cars in larger cities.
- Extensive electrical taxi experience in Tartu and Tallinn. Elektritakso and Välk taxi services are using the older Nissan Leaf model.
- Electrical bicycle rent in Tartu.
- Webpage that offers the possibility to have a real time overview whether the charging point is free or not (the Elmo app). The info refresh rate in that app is about 4-5 minutes, so if one would check from the webpage or the app whether the charging point is free, it might happen that it has already been taken by the time one reaches there. A suggestion – there should be faster refresh rate and the possibility to check how much time already charging vehicle will take to be fully charged. The idea behind this is to get an estimated time when the charging point will be freed, so the client would know which charging point should be that persons destination.
- Quality of the service. The customer service needs to be superb. Also the cars have to be nice and clean. The first ride with electric taxi is usually out of curiosity – people want to ride an electric car. But the next time they order electric taxi is because of the service.
- Social employees use electric car for daily work and commuting.

[13] http://elmo.ee/estonia-becomes-the-first-in-the-world-to-open-a-nationwide-ev-fast-charging-network/, 28.09.18

- Renting the e-vehicles to private citizens. Renting might increase further intrest and start thinking of purchasing an e-vehicle for him-/herself.

The following list is the best practices Estonia's respondents are willing to introduce to others.

- ELMO program is a comprehensive approach to electricity transport introduction in a country
- Car park management from car purchase and service to charging network

The following list contains the Estonia's respondents proposed project ideas, that would be interesting to do in cooperation with.

- E-Car sharing projects.
- MaaS project could be developed together with international partners.
- Exchange experience with other smallers cities outside of Estonia.
- E-bike projects in smaller and larger cities
- How to develop services of municipalities – what kind of technologies to use, how to do procurement, to get new ideas in area of electromobility.
- Developing e-vehicles for garden work and service.
- Develop one international platform/app, where all the payment for e-mobility is done.

Potential and plans in Estonia by e-mobility areas

Respondents could discuss the potential in each area mentioned below and share any plans they know of any e-mobility area.

- **E-cars:** No general policies on governmental level regarding e-cars. Free parking and traffic lane usage are entirely municipal policies. Subsidies to purchase e-car were abolished few years ago, which led to the sales of e-vehicles going almost to zero. E-cars have to become competitive on market, but only few parking and traffic lane usage benefits

are supporting them at the moment. The first local e-car producer announced that they will come to the market with three-wheel car by 2020[14].

Figure 16 My Nobe example

- **E-buses:** Test of one e-bus is going on in Tartu and further steps are based on the results. Other cities have not shown much interest yet.

  In Tallinn the idea of e-buses was tested, but abandoned due to battery problems few years ago. Feedback and first experience can be obtained in 2019 in Tartu.

- **E-Bikes:** There are plans for e-bike circulation in Tartu. This includes 500 electrical bikes and 250 regular bikes with 63 bike racks with integrated charging systems. These parking racks will have separate power supply. In total there will be around 900 power outlets in these racks, in average 10 in each rack.

  The capacity of the e-bike battery is 15Ah and the time for full recharge is 4 hours.

  The founders of foldable e-bike Stigobike[15] are from Estonia, but products are sold worldwide. Stigobike is representative of ultralight foldable e-bike, which could be taken along to shopping mall or office due to low weight and additional wheels to carry it like hand luggage.

[14] www.mynobe.com, 02.10.18
[15] www.stigobike.com, 02.10.18

Figure 17 Stigobike example[16]

Besides this company also several other e-bike producers exist. Some of them convert ordinary bikes to e-bikes for about 1000 EUR investment.

One company Ampler Bikes hides all accumulators to bicycle body providing ordinary bikes look.[17]

Figure 18 Ampler bike example

[16] https://stigobike.com/wp-content/uploads/2017/11/stigo-01.png, 02.10.18
[17] www.amplerbikes.com, 02.10.18

- **E-logistics:** No pilot projects nor any interest found yet.
- **E-scooters:** No pilot projects nor any interest found yet.
- **E-ferries:** No pilot projects nor any interest found yet. There is a potential of e-ferry usage between the main land and islands, if the battery and electric technology have involved to a level, where the short ride and short charging time is not a problem.

7.1.1 Key ideas from Estonia:

1. ELMO project is comprehensive approach, from which countries willing to introduce e-mobility systematically and quickly could take example of. The most important is to combine all aspects like charging infrastructure, vehicles, usage, rent under one management.
2. Unique experience of two large electrical taxi companies, which have worked daily with e-cars.
3. Emerging small producers of e-bikes make difference on market and provide solutions for every taste.

7.2 Latvia

From Latvia there were 14 stakeholders interviewed. Among those respondents 6 were local municipalities, 2 were ministries or other national authorities, 1 was national NGO, 1 was private enterprises, 1 was public enterprise and 3 identified as other. This is illustrated by the following graph.

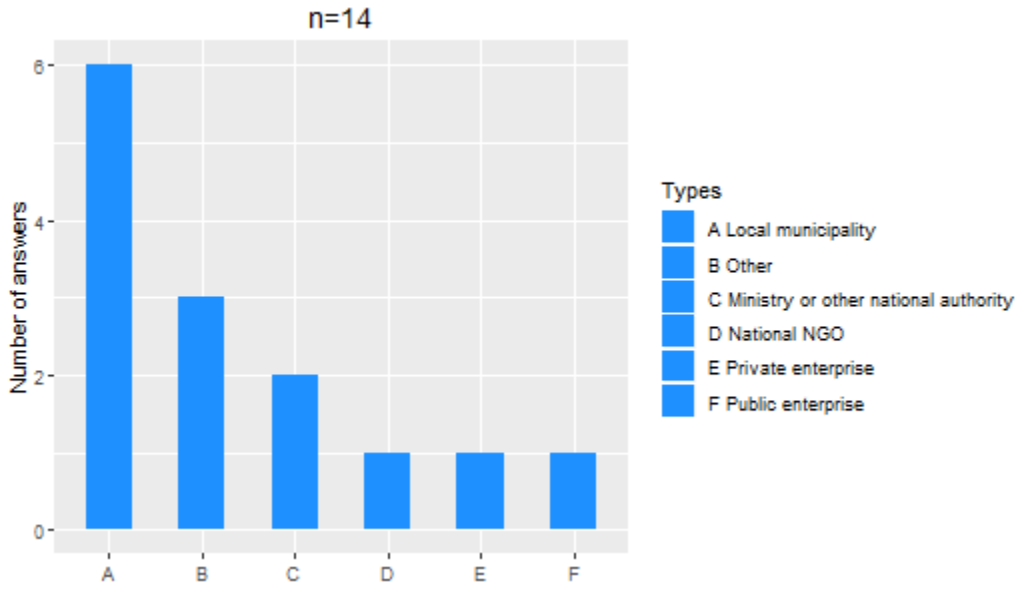


Figure 19 Types of Latvia's respondent

Of the 6 local municipalities, there was 2 large, 2 medium and 2 small cities. The involvement in e-mobility among the respondents were 1 with 1-2 years, 7 with 3-5 years and 5 with 6-10 years of experience. This is illustrated by the following graph.

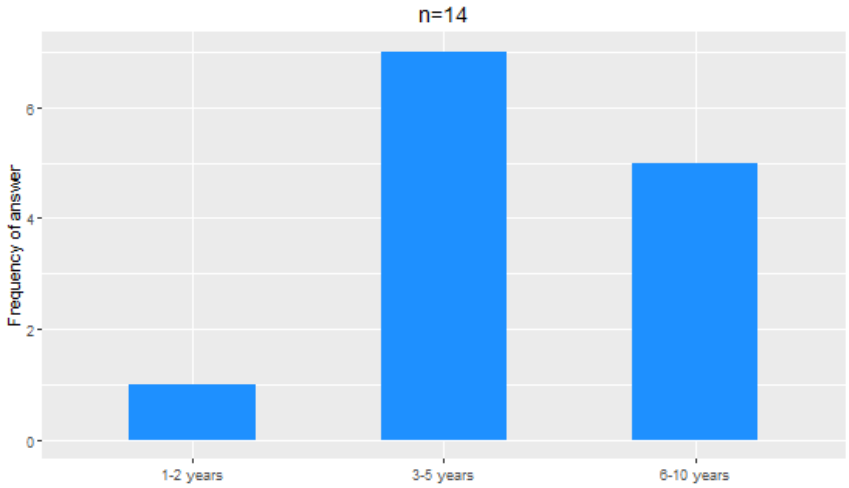


Figure 20 Latvia's respondents involvement in e-mobility in years

Number of employees involved in e-mobility was under ten in each respondent organisation.

The relevant policies related to promotion of e-mobility in Latvia

In Latvia there are six main categories of policies related to promotion of e-mobility. These categories are:

- Tax reliefs;
- Parking benefits;
- Road benefits;
- Subsidies for purchase of EVs;
- Development of public charging network;
- Awareness rising.

Tax reliefs

- Vehicle operating tax (road tax) is not applied to pure EVs (hybrid vehicles not included).
- Company car tax is reduced for EVs (10 €/month compared to 29-62 €/month for fossil fuel cars).
- Free first time registration of EVs, free special visually different number plates for EVs (first set)

Parking benefits

- Free parking for pure EVs (with blue color registration plates) in all municipal parking lots in Riga (including old town) and Liepāja.

Road benefits

- EVs equipped with special (blue) registration plates are allowed to drive on public transport lanes
- Free entry for EVs into territory of Jūrmala (resort town on the sea coast where entry fee of 2 € per vehicle is charged during the summer season).

Subsidies for purchase of EVs

In 2014 development of e-mobility was supported by the CCFI (Climate Change Financial Instrument) program.

Municipalities and other public bodies could apply for purchase of EVs and construction of public charging stations with 85% co-financing from the programme while private companies could receive co-financing of 35% to 55% from eligible costs.

Within this program purchase of 208 EVs and construction of 47 public charging stations was financed.

Currently in Latvia there are no subsidies available for purchase of EVs.

Development of public charging network

See next question.

Awareness rising

Zero Emission Mobility Support Society (BIMAB) is organizing informative events, including annual EV gatherings and marathons (rallies). The latest rally was organised on 30.08-01.09.2018 promoting the newly developed fast charging network. The route of the rally was Riga – Ventspils – Liepāja – Bauska – Jēkabpils – Daugavpils – Rēzekne – Valmiera – Riga (total distance over 1000 km).[18]

[18] http://www.bimab.lv/, 20.09.18

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Latvia

In July 2018 the public network of fast charging stations developed by CSDD (State Road Safety Directorate) has started operations thus ensuring the possibility to drive electric vehicles throughout the whole territory of Latvia.

70 fast charging stations located on main roads and populated areas have started operations in July 2018.

All charging stations are equipped with 50 kW DC fast chargers and all of them have CHAdeMO, CCS and Type2 (43kW) standard plugs.

The following map[19] shows the fast charging network in Latvia. The figures in circles indicate the number of available fast charging stations in the area.

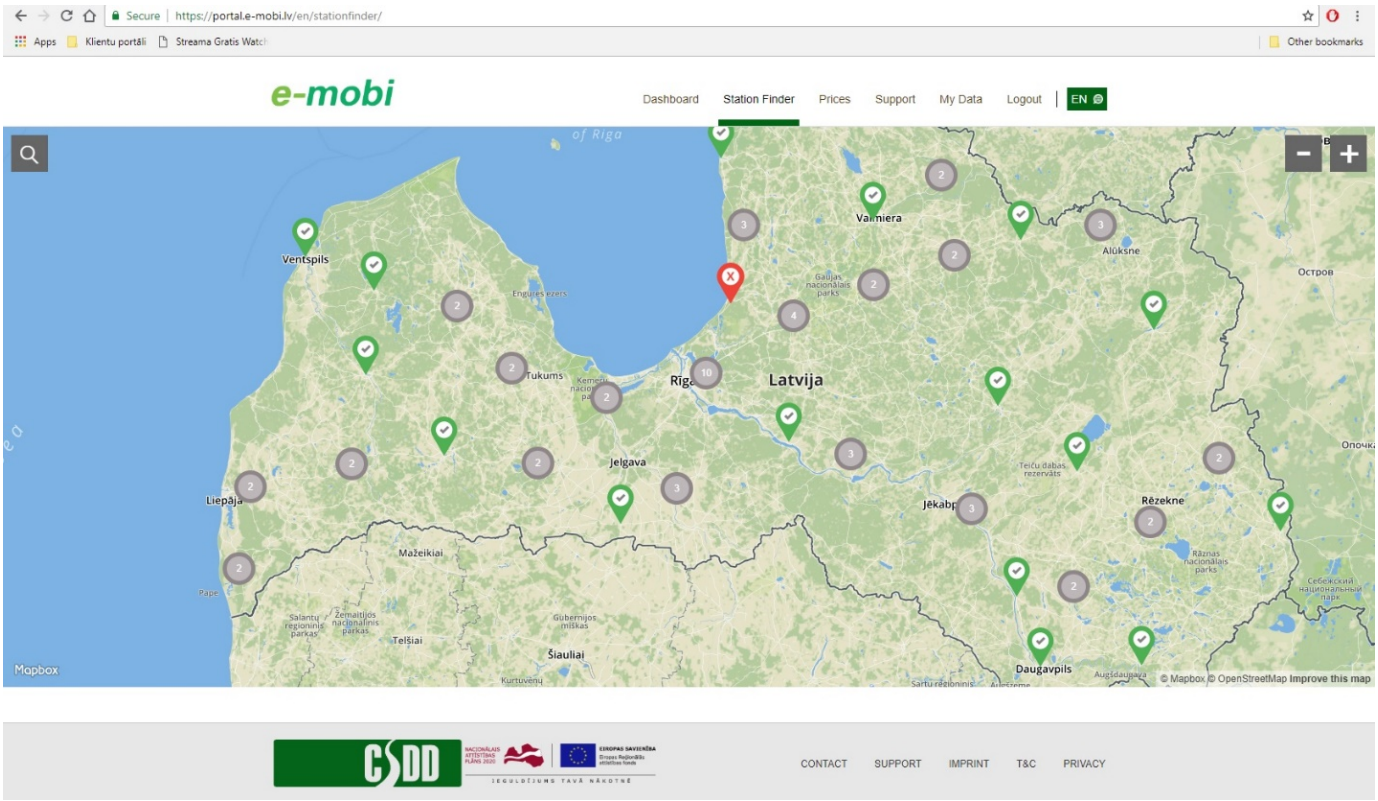


Figure 21 Fast charging network in Latvia

[19] https://portal.e-mobi.lv/en/home/, 20.09.18

Using https://portal.e-mobi.lv drivers[10] of electric cars can find charging points and their location. In addition to the exact location the status of charging points, the type of plug and output power is available.

Portal can also be used through the mobile application *e-mobi* downloaded free from AppStore or Google Play Store.

The cost of using fast chargers is set to 0.15 €/minute. Before using the chargers, one must register at the portal and receive an *e-mobi* card. By the end of 2018 the possibility of charging through the mobile application will be introduced.

Information on charging possibilities in Latvia is included in a number of international e-mobility platforms, e.g. plugshare[20] (see picture below).

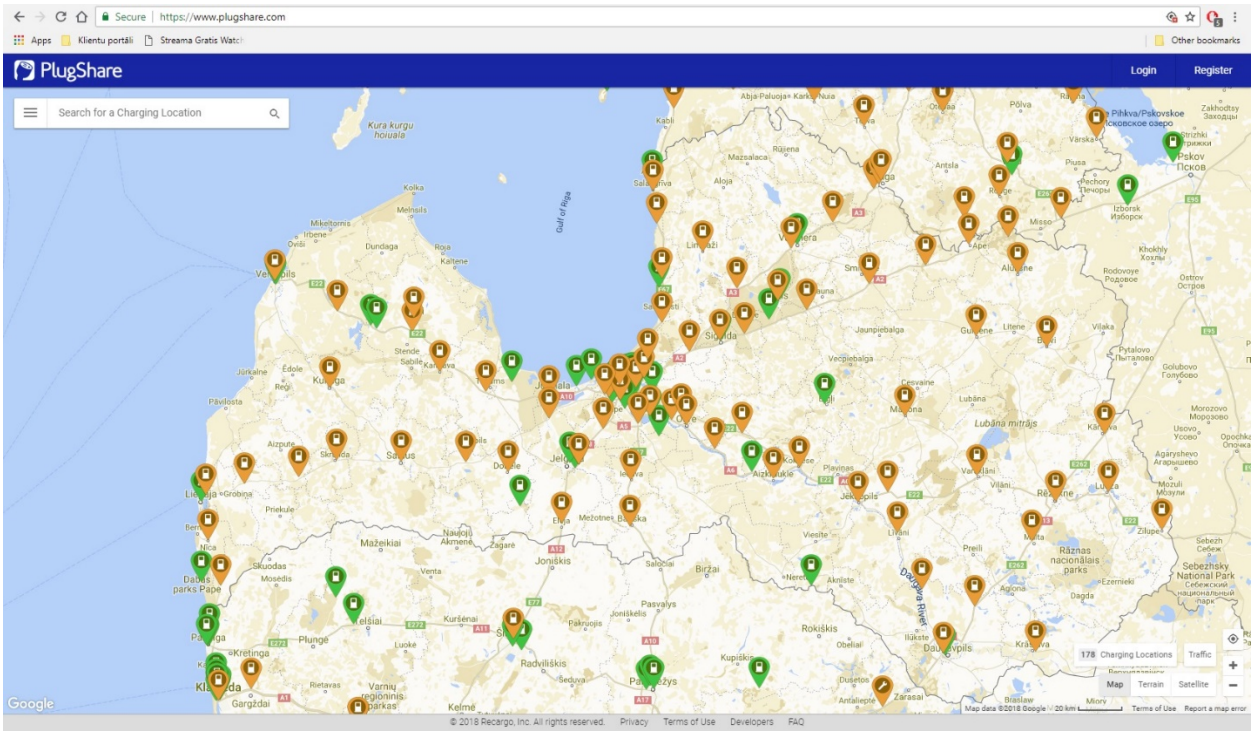


Figure 22 Charging possibilities in Latvia

[20] https://www.plugshare.com/, 29.08.18

Latvia's respondents have mostly been involved with e-cars, e-buses and e-bikes.

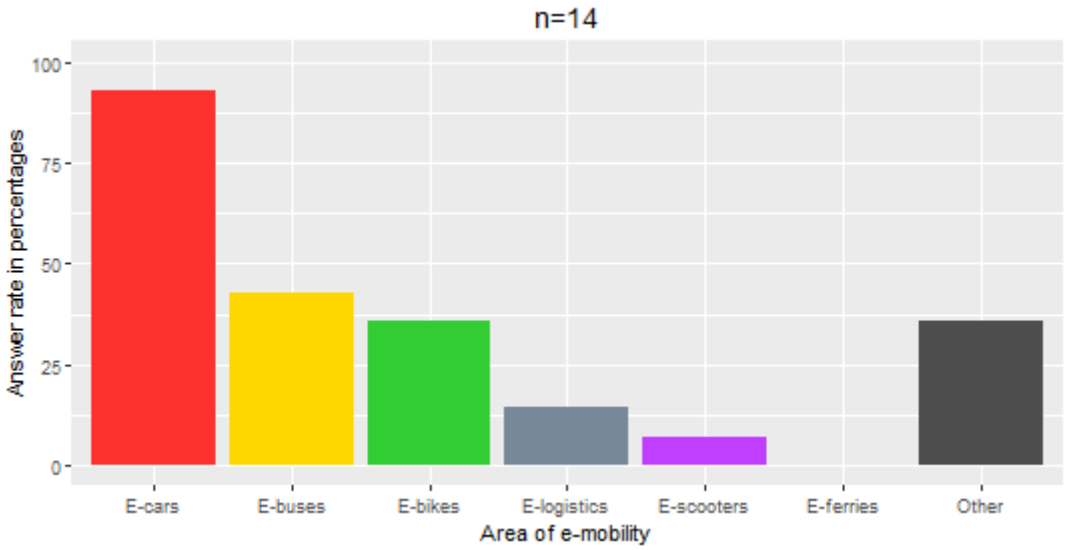


Figure 23 Latvia's respondents involvement in e-mobility areas

Figure 18 describes in percentages how many among Latvia's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents were from Latvia.

Besides e-cars, Latvia's respondents have also been involved with e-buses, e-bikes, e-logistics and e-scooters. The latter two have been marked only by few organisations. This means that Latvia's respondent organisations could improve upon their involvement in e-logistics and e-scooters. Since there are no islands, there is no need for ferries in Latvia.

There is a potential for use of e-ferries for transportation of vehicles and passengers across Daugava River in Riga, however according to the current legislation municipalities are not in charge of water transport therefore at the moment there are no initiatives in this respect.

Latvia's respondents have identified themselves in the role of providing support services to e-mobility the most.

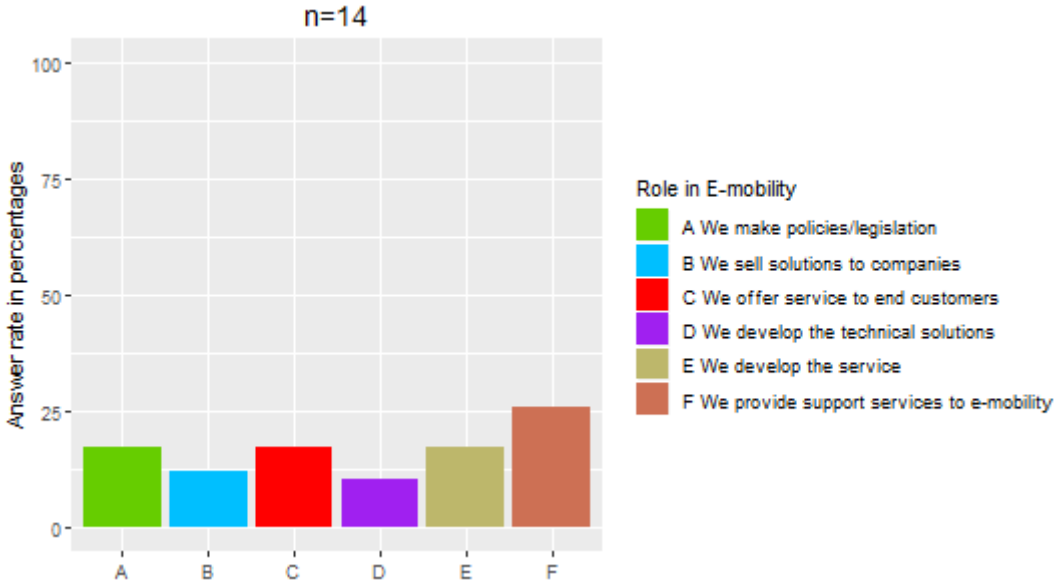


Figure 24 The roles of e-mobility in which Latvia's respondents have been in

Figure 19 describes in percentages how many among Latvia's respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Latvia.

As seen from the graph, the same number of respondents have marked down the roles we make policies and/or legislations, we offer service to end customer and we develop the service. Since the most Latvia's respondents were from local municipalities, then it is logical, that the respondents have mostly identified themselves in roles related to legislations and service in e-mobility. The least chosen answers among the respondents were developing the technical solutions and selling solutions to companies.

The following list contains smart specialization strategies, cluster policies or initiatives, that would be interesting for others to join with regard to e-mobility, brought out by Latvia's respondents.

- Emission free mobility support association (BIMAB)
- ZPR (Zemgale Planning Region) electromobility projects
- ZREA (Zemgale Region Energy Agency) electromobility projects

There is a map, that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

- https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Latvia's respondents best practices in the e-mobility application area.

- CCFI (climate change financial instrument) project competition for e-cars and charging stations support in 2014.
- Construction of fast charging network
- Use of e-cars for everyday corporate use
- Transport tax not applied to EVs
- Reduced amount of company car tax
- First registration of EV and first set of special EV number plates is free
- EVs with special number plates can use public transport lanes
- In Liepaja and Riga free parking at municipal parking lots, free entrance into Jurmala
- Electric car marathon, electric car gathering
- Co-operation with NGOs for the coordination of e-mobility informative events.

The following list is the best practices Latvia's respondents are willing to introduce to others.

- Organization of public e-mobility events
- Introduction of public transport lanes
- Daily use of e-cars
- Electric car marathon, electric car gathering
- Development of green project documents

The following list contains the Latvia's respondents proposed project ideas, that would be interesting to do in cooperation with.

- Superfast charging pilot projects, accumulation of solar energy for charging of EVs
- Development of diversity of e-services and products
- Development of EV charging network
- Testing of new EV technologies.
- Implementation of electric buses in Riga
- Projects related to development of EV infrastructure, as well as projects promoting use of EVs.

Potential and plans in Latvia by e-mobility areas

Respondents could discuss the potential in each area mentioned below and share any plans they know of any e-mobility area.

- **E-cars:**
    - Stage 2 of the fast charging network development is planned to be finalised by the end of 2020 when another 69 fast charging stations will be installed.
    - Project of upgrading the batteries for the first generation EVs (e.g. Nissan Leaf) is under development.[21]

[21] http://double-ev.tech/; https://climatelaunchpad.org/finalists/doubleev, 27.09.18

- **E-buses:** Implementation of e-buses is planned in several cities.
- **E-bike:** E-bikes and other electric two-wheelers are participating at the annual EV marathon and gathering thus promoting use of e-bikes.
- **E-logistics:** No initiatives to our knowledge
- **E-scooters:** Pilot use of e-scooters for transport of passengers and cargos is planned in a municipal hospital and a cemetery in Riga.
- **E-ferries**: No initiatives to our knowledge

7.2.1 Key ideas from Latvia:

1. Organising the electric car/ bike marathon is a creative and attractive way of promoting e-mobility without large investments. Participants are interested to cover their own costs and do their own promotion of the event via social networks and personal contacts. This idea can be extended to other BSR countries by organising a cross border marathon (rally) - Electric Via Baltica.
2. With introduction of the fast charging network in Latvia the issue of harmonising EV charging payment systems with the neighboring countries is becoming an important issue. Both technical and information activities are important to ensure easy access to EV charging when travelling abroad.
3. Although there is sufficient interest in development of e-mobility, most of the respondents have stated that financial constraints (high costs of EVs) is the biggest obstacle. Financial support on all levels (EU, national and local governments) is essential for further development.
4. There was a clear message from majority of the respondents that there is an interest to share information and learn from best practise examples in other countries. Therefore new projects and programmes for exchange of information should be developed.
5. The initiatives developed in Latvia (free parking, using bus lanes, etc.) are well received by EV users and have helped to generate some increase in the number of EVs. However, there is not sufficient information about these initiatives and about e-mobility in general.

More publicity is needed in order to create positive attitude, supply reliable information and eliminate myths about e-mobility.

7.3 Poland[22]

From Poland there were 10 stakeholders interviewed. Among those respondents 8 were local municipalities and 2 were private enterprises. This is illustrated by the following graph.

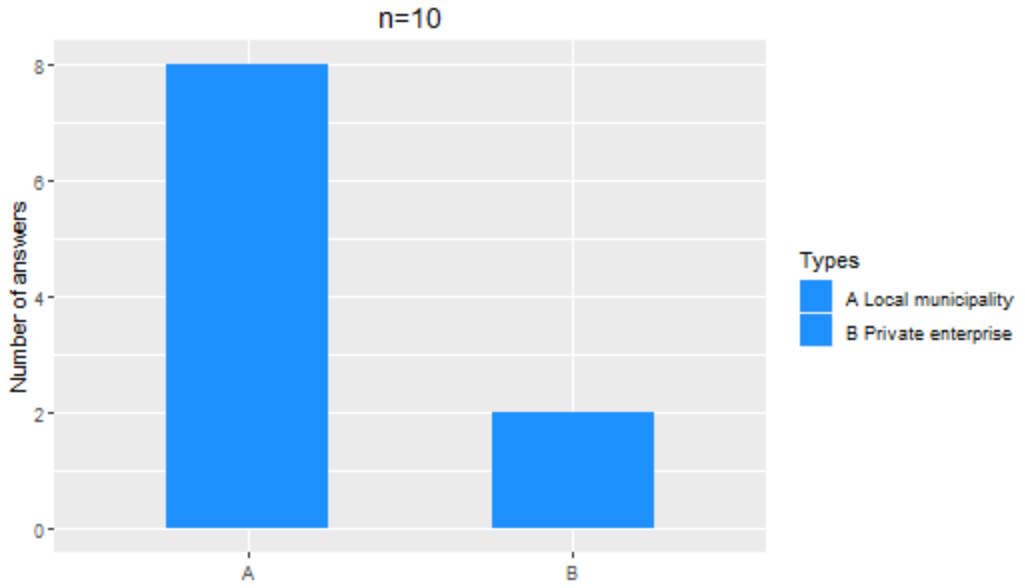


Figure 25 Types of Poland's respondent

Of the 8 local municipalities, there were 3 large, 4 medium and 1 small cities. The involvement in e-mobility among the respondents were 3 with 1-2 years, 1 with 3-5 years, 1 with 6-10 years of experience and 3 with over 20 years of experience. This is illustrated by the following graph.

[22] http://energypost.eu/polands-stunning-e-mobility-plans/; http://www.pzpm.org.pl/en/Publications/Newsletter/2018/01_18-New-perspectives-for-Polish-electromobility-the-Sejm-adopted-the-act-on-electromobility-and-alternative-fuels; https://mojafirma.infor.pl/moto/eksploatacja-auta/uklad-elektryczny/2699273,Punkty-ladowania-samochodow-elektrycznych-w-Polsce-lista-lokalizacji.html, 05.09.18

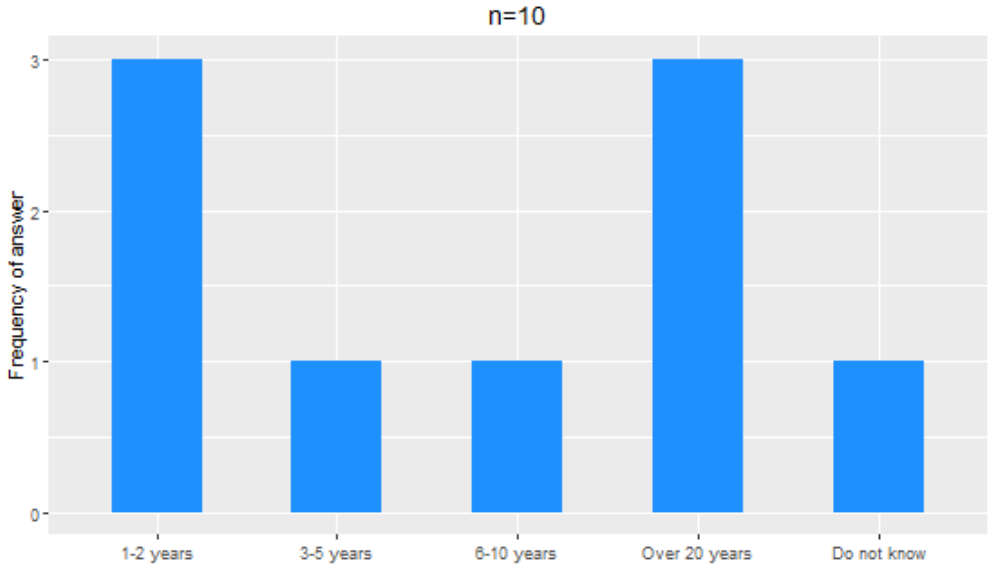


Figure 26 Poland's respondents involvement in e-mobility in years

Number of employees involved in e-mobility was near ten.

The relevant policies related to promotion of e-mobility in Poland

1. National level:

   Electromobility Development Plan, adopted by the Polish Council of Ministers in 2017.

   The new Act is the first set of rules in Poland on electrifying transport and is intended to promote electromobility and alternative fuel vehicles. It transposes a key European directive [Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014] on the deployment of alternative fuels infrastructure.

   The Act defines basic terms such as charging point, charging station, electric vehicle and alternative fuels. Most importantly, it establishes a framework for building a basic alternative fuels infrastructure (including electric energy, LNG, CNG and hydrogen) and vital administrative benefits for the development of such infrastructure. For example, according to the new legislation, a building permit will not be required for charging stations or charging points. Nor will the charging of electric vehicles be regarded as a sale of electric energy under existing legislation, and consequently, electricity supplier licenses will not be required.

There is no grant incentive for EV take-up. However, the Act does provide for the abolition of excise duties on electric vehicles, no property taxes for charging points, the use of bus lanes for electric cars and free parking in cities.

With the new legislation, local authorities are mandated to play an important role in the rollout of electromobility. Under the Act, e.g. administration in regional authorities (below 50 000 habitants) must ensure that a minimum of 30 percentage of their fleet is electric, the same should be the share of electric buses in these regions. To support these developments, subsidies are on offer for the construction of the charging infrastructure for public transport and charging stations for electric vehicles that are used by the local authorities. The market is already moving: in 2017, the Polish Development Fund (PFR) (along with several ministries, amongst others) signed an agreement with 41 local governments for the purchase of 780 electric buses.

2. Regional level – no regional strategies were identified.

3. Local level – policies and incentives introduced by individual municipalities based on recently established legal framework:
    a. Parking incentives:
        i. Free parking (Gdynia); discounted parking fees (Wrocław); dedicated parking spaces (Wrocław)
    b. Road benefits:
        i. EV allowed to use bus lanes (e.g. Warsaw)

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Poland

1. Charging network:

    In 2015, the number of publicly available charging points in Poland was estimated at approx. 30. According to more recent data collected by the Alternative Fuels Observatory (Obserwatorium Rynku Paliw Alternatywnych, ORPA), generally available infrastructure of charging stations for electric vehicles in Poland remains limited. As at June 2018 there

were approx. 180 points which met the adequate standard, of which only several dozen allow for quick vehicle charging.

The public road authority in cooperation with four energy companies and petrol station plans to establish approx. 170 charging points along motorways and expressways. Individual charging stations are established by private entities (office space operators) and municipalities in cooperation with energy companies (Gdańsk, Wrocław, Warsaw). Purchase of PT dedicated EV is coordinated with construction of charging facilities (Warsaw, Gdynia).

2. Cars: EV are incorporated to municipal (e.g. Gdańsk, Gdynia Wrocław) and private entities fleet (e.g. Olivia Business Centre in Gdańsk – office space operator).
3. Private e-scooter sharing scheme operates in 13 locations all over the country (September 2018).
4. In November 2018 Gdansk together with partners from the metropolitan area will roll-out bike sharing scheme with 100% electrically assisted bikes. Planned to be fully operational in March 2018 this will be the biggest e-bikes system in Central Europe with 4080 bikes.
5. There are no policies and infrastructures related to e-logistics and e-ferries/water taxis so far.

Poland's respondents have mostly been involved with e-cars and e-bikes.

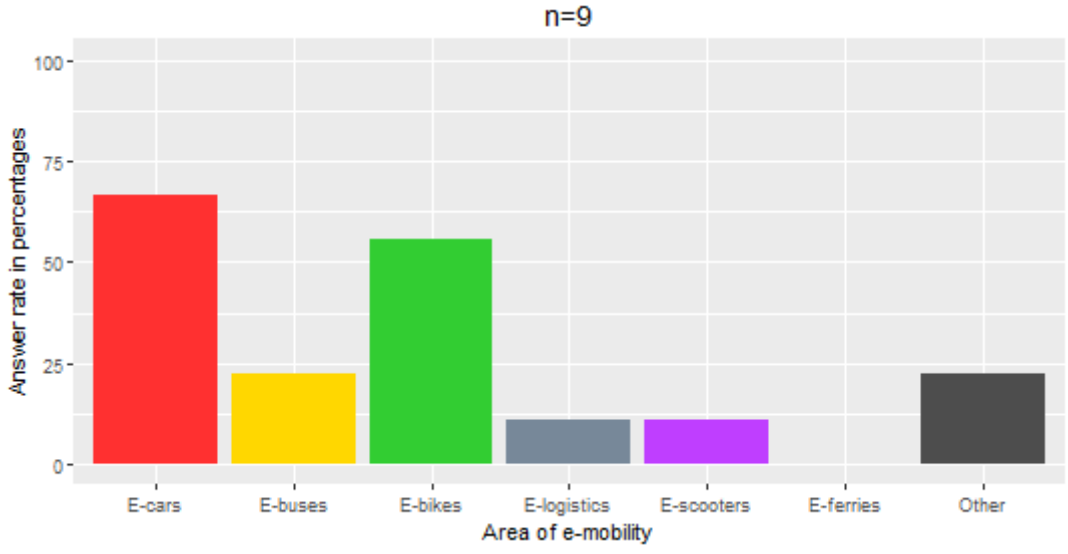


Figure 27 Poland's respondents involvement in e-mobility areas

Figure 23 describes in percentages how many among Poland's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents were from Poland. The reason why n=9 on this graph, even though from Poland were 10 respondents, is that one of the respondents did not answer this question.

More than half of the respondents had been involved with e-bikes and almost three quarters of the respondents have been involved in e-cars. Poland's respondents have also been involved with e-buses, e-logistics and e-scooters. Respondents have been less involved with the latter two areas. E-ferries was the area where none of the respondents felt involved with.

Polish respondents have identified themselves most often in the role of providing support service to e-mobility and making policies and/or legislations.

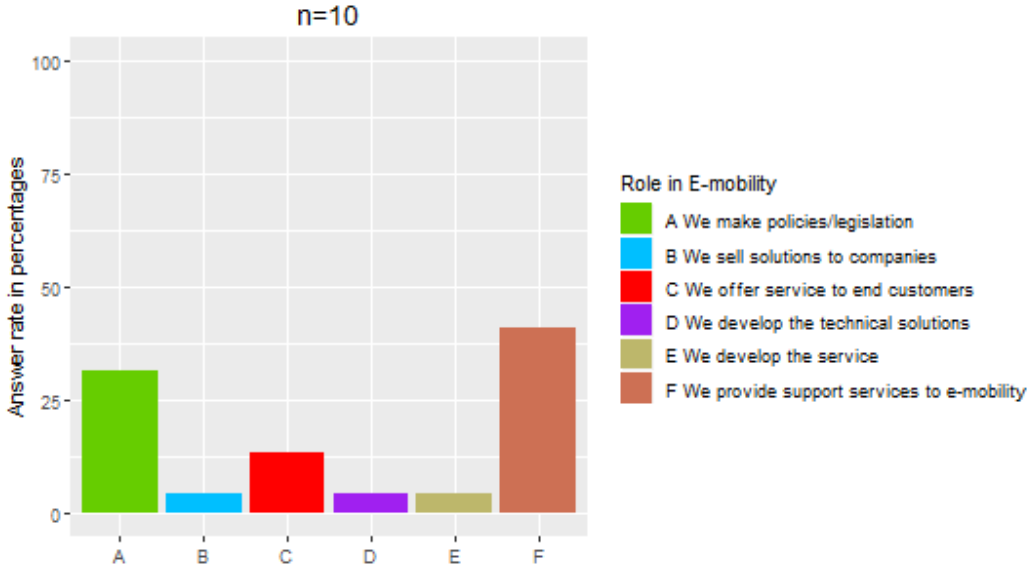


Figure 28 The roles of e-mobility in which Poland's respondents have been in

Figure 24 describes in percentages how many among Polish respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Poland.

Third or more identified themselves in the role of making policies and/or legislations and providing support service to e-mobility. Offering service to end customer was a role, that was also mentioned more than once.

The following list contains smart specialization strategies, cluster policies or initiatives, that would be interesting for others to join with regard to e-mobility, brought out by Polands's respondents.

- Klaster INNOeCAR - dolina elektromobilnosci na pomorzu

There is a map, that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Poland's respondents best practices in the e-mobility application area.

- Free parking space for electric car/ lower prices of parking/ Preferential parking spaces
- Events focused on energy used to promote electromobility
- Electric cars used by city guard
- Network of fast-charging stations situated along the transport corridor
- Electric public bike, electric bike sharing system
- Charging infrastructure
- Electric car-sharing
- Electric bus network
- Entry to the city centre only for zero-emission vehicles

The following list is the best practices Poland's respondents are willing to introduce to others.

- Equipped trolleybuses
- The construction and operation of charging infrastructure
- Customer service, analysis of the electromobility needs

- Smart CITY
- Electric bikes in public bicycle system
- Electric car-sharing

The following list contains the Poland's respondents proposed project ideas, that would be interesting to do in cooperation with.

- Creating Automotive Renewal - Interreg South Baltic Klaster INNOeCAR
- Installing EV fast-charging stations
- Electric carsharing
- Electric public bike
- Initiatives within the Metropolitan Area Gdansk Gdynia Sopot

Potential and plans in Poland by e-mobility areas

Respondents could discuss the potential in each area mentioned below and share any plans they know of any e-mobility area.

- **E-cars:** Not mentioned
- **E-buses:** Not mentioned
- **E-Bikes:** In November 2018 Gdansk together with partners from the metropolitan area will roll-out bike sharing scheme with 100% electrically assisted bikes. Planned to be operational in March 2018 this will be the biggest e-bike system in Central Europe with 4080 bikes.
- **E-logistics:** Not mentioned
- **E-scooters:** Private e-scooter sharing scheme operates in 13 locations all over the country (September 2018).
- **E-ferries:** Not mentioned

7.3.1 Key ideas from Poland:

1. Ease bureaucracy in building charging spots by not asking/needing building permission
2. Make city centre reachable only for e-transport
3. Electric bikes are handy and increase share of users in cities where are mountains.

7.4 Germany

From Germany there were 9 stakeholders interviewed. Among those respondents 3 were private enterprises, 2 were public enterprises and 3 were local municipalities. This is illustrated by the following graph.

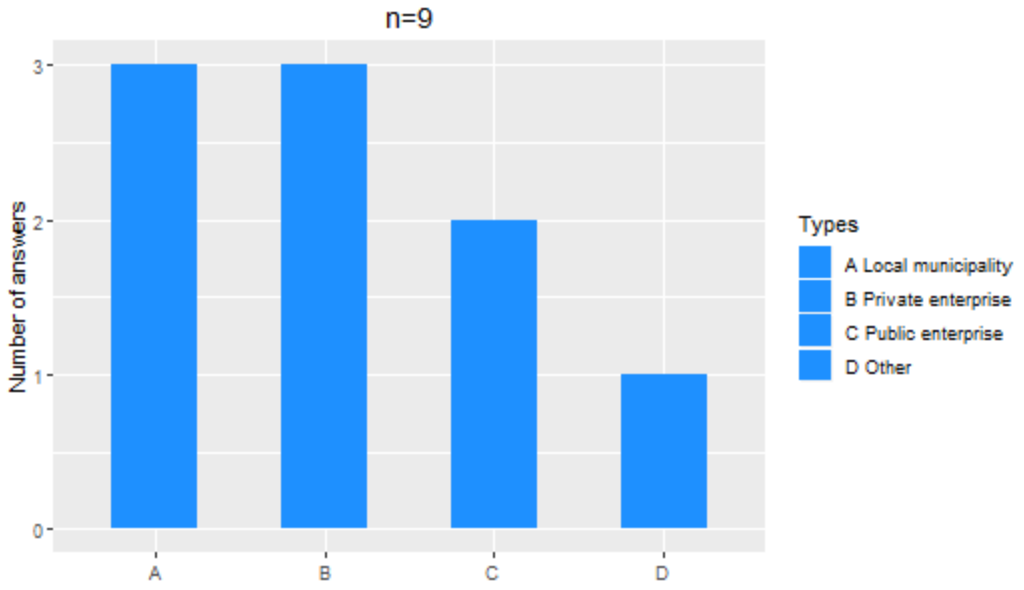


Figure 29 Types of Germany's respondent

Of the 3 local municipalities, there were 2 large, 1 medium cities. The involvement in e-mobility among the respondents were 2 with 1-2 years, 3 with 3-5 years, 3 with 6-10 years and 1 with 11-20 years of experience. This is illustrated by the following graph.

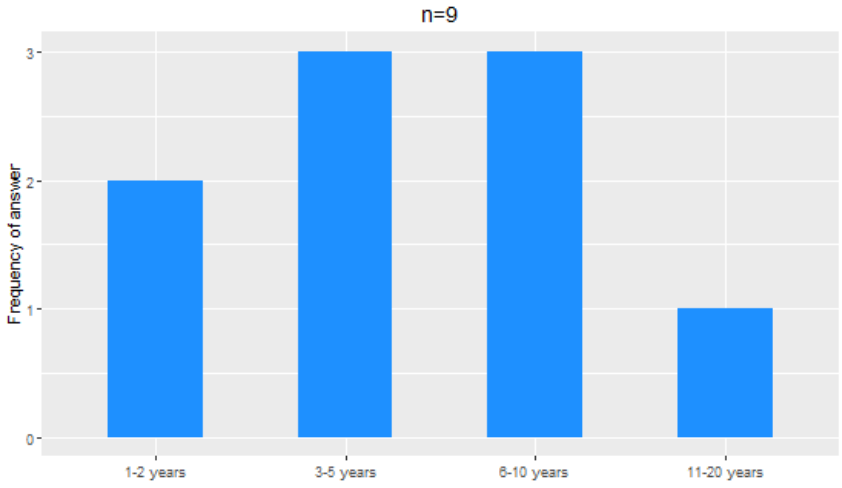


Figure 30 Germany's respondents involvement in e-mobility in years

Number of employees involved in e-mobility was mostly near ten or under.

The relevant policies related to promotion of e-mobility in Germany

The relevant policies for the German e-mobility market are focusing on four different sections: the electric cars, public transport, commercial traffic and charging infrastructure.

While there are also existing national policies related to promotion of e-mobility, most of the policies are regional relevant or even city specific. At first relevant national policies are portrayed. Up from May 2016, the German federal department "Bundesamt für Wirtschaft und Ausfuhrkontrolle" (i.e. Federal Office of Economics and Export Control) (BAFA) is subsidizing all hybrid and electric vehicles, the so called "environmental bonus"[23]. Furthermore, there is a nationwide promotional programme for public charging infrastructure with a total budget of 300 million euro. The programme is financing up to 60 percent of the total investment costs for charging infrastructure as well as costs to retrofit the power supply.[24] The Federal Ministry for Environment is supporting the green public transport and launched "Saubere Luft" (i.e. clear air) in 2018 to modernise bus fleets. The ministry is financing 80 percent of the additional costs of emission free vehicles compared to the investment costs of conventional vehicles. In total this programme has a budget of 35 million euro and is available to all German transport operators to help introducing emission free vehicles to the market and taking the financial risk from the operators, which are often managed by public utility companies[25].

The Borough of Hamburg Bergedorf is partner of the BSR project and interviewed different cities in Germany from large metropoles like Hamburg and Munich to a small city like Flensburg with less than 100,000 inhabitants.

Looking at the relevant policies promoting emobility in the different regions, the smaller cities have introduced direct actions to promote emobility, like free parking, parking and charging places for bicycles or building up charging stations through their public utility company (Flensburg). In

[23] http://www.bafa.de/DE/Energie/Energieeffizienz/Elektromobilitaet/elektromobilitaet_node.html

[24] https://www.bav.bund.de/DE/3_Aufgaben/6_Foerderung_Ladeinfrastruktur/Foerderung_Ladeinfrastruktur_node.html

[25] https://www.bmvi.de/SharedDocs/DE/Artikel/DG/sofortprogramm-saubere-luft-2017-2020.html?nn=12830

contrast larger cities like Hamburg or Munich tend to set a pathway for e-mobility through different programmes and guidelines.

In the case of Munich, the city set up a ninefold structured programme called IHFEM[26]: e-mobility support programme for vehicles and charging infrastructure. This programme maps actions and goals out for starting the electrification process of all kind of vehicles. The IHFEM includes an on-top subsidy programme for electric bicycles and commercial vehicles beside the national promotion programme, the installation of several mobility platforms until 2020 where citizens can use electric car-sharing vehicles and bikes or charge their EV, subsidizing electrified taxis, building up a bike-sharing system with pedelecs and cargobikes, electrifying one bus line until 2020, transform the public fleet into an emission free fleet, installation of 1.000 charging points in Munich until beginning of 2020 and support projects in strong cooperation with local universities and schools in terms of a research and teaching prospective.

The city of Hamburg formulated its e-mobility-goals as part of the official climate plan in 2013. Therein e-mobility is one instrument to reach the strong goal of cutting total greenhouse gas emissions by 40 percent in 2020 compared to 1990 and 80 percent in 2050. To achieve almost emission free traffic by 2050, the city of Hamburg wants to initiate a modal shift towards a higher share of public transport, cyclists and pedestrians by reducing the motorised individual transport (MIT). In consequence, the city of Hamburg challenges its transport providers Hamburger Hochbahn and Verkehrsbetriebe Hamburg-Holstein (VHH) to change their procurement towards emission free vehicles from 2020 on. Also, the MIT has to be organized carbon neutral therefore, the city of Hamburg has started to install 1.000 charging points in Hamburg for EVs and will accomplish this mark by 2019. The procurement of public vehicles has to be emission free, unless the application is necessary (e.g. police, fireworks). The VHH as local transport provider has to follow Hamburg's guidelines to transform their bus fleet towards electric buses but can profit from financial state aid, as the Federal Ministry of Transport is financing extra costs of emission free vehicles compared to combustion engines during the current pilot phase.

[26] https://www.muenchen.de/rathaus/Stadtverwaltung/Referat-fuer-Gesundheit-und-Umwelt/Klimaschutz_und_Energie/Elektromobilitaet/IHFEM.html

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Germany

Today there are in total 53.800 electric cars and 44.400 PHEV registered in Germany[27]. While the number of registered electric vehicles is increasing slowly the number of public charging stations counts more than 5.400 locations and nearly 11.000 charging points in August 2018. This number includes 1.300 DC fast chargers and 9.700 AC charging points[28].

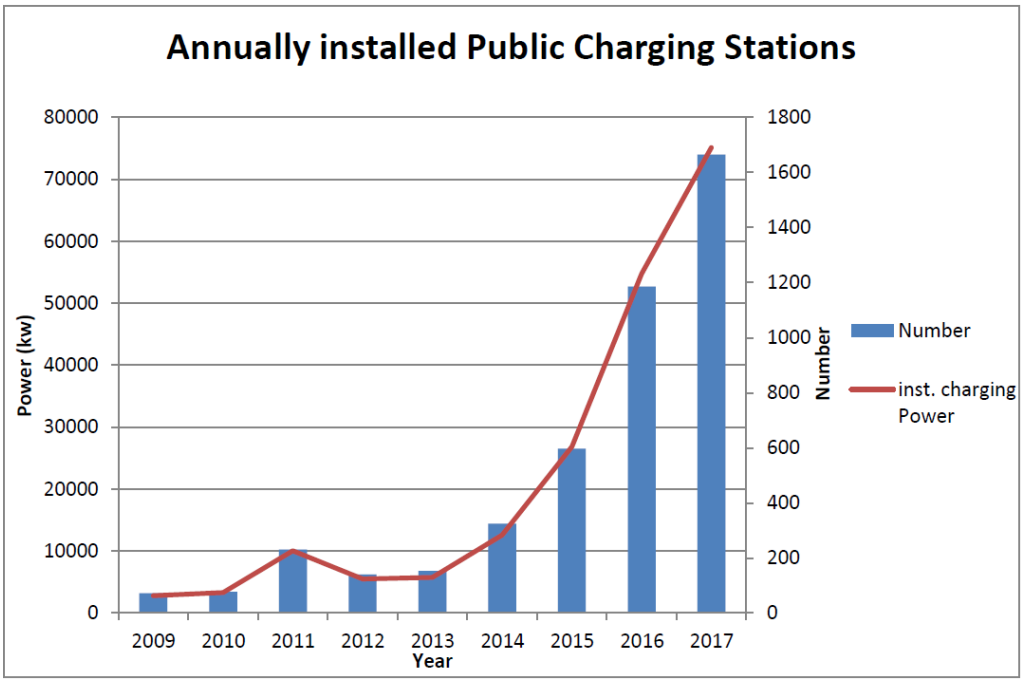


Figure 31 Annually installed public charging stations (own illustration based on open source data by German Federal Grid Agency[29])

In case of the interviewees the cities introduced different technologies, infrastructures or know-how through testbeds or innovation centres. While in smaller cities the organisational work is done by the municipality, bigger cities like Hamburg or Munich are coordinating the e-mobility projects through project offices in cooperation with the municipality, e.g "Hysolutions" in Hamburg. These

[27] https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Umwelt/2018_b_umwelt_dusl.html?nn=663524

[28] https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/HandelundVertrieb/Ladesaeulenkarte/Ladesaeulenkarte_node.html

[29] https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/HandelundVertrieb/Ladesaeulenkarte/Ladesaeulenkarte_node.html

offices and the local universities are coordinating financial applications for support, projects within the city and are representatives for all studies or events concerning the topic of emission free transport.

Coming back to the different interviewees, the cities have different stages in introducing e-mobility to their community. In Flensburg, there are in total 13 public charging station installed and the municipality is going to replace their public car fleet through car-sharing vehicles and bike-sharing. Furthermore, the local bus operator has nine hybrid buses in operation and will continuously reduce diesel buses.

In Hamburg the city is building up charging infrastructure and is introducing EVs to the public fleet. Today there are already 761 public charging points installed[30]. Today every newly procured vehicle in the public fleet has to be electric and also commercial vehicles and company cars are going to be electrified through different programmes e.g. ”Hamburg am Strom”. In consequence the number of registered electric cars increased to 4,371 vehicles in 2016[31].

Regarding electrification of the public bus fleet the following can be stated. The city of Hamburg is going to be one of the leading emission-free transport cities in Germany. Starting in 2014 the Hamburger Hochbahn launched a testbed for green buses, the so called “innovation line 109”. During the last four years several buses and different drive trains have been tested. On this bus line the city tested hybrid, plug-in-hybrid, battery and fuel cell buses to gather experiences of the different technologies and find the best fitting solution for the future bus system in Hamburg. Parallel the VHH, the second transport operator in Hamburg, commissioned two fully electric buses for the operation in Hamburg Blankenese. The service started in 2014 and is still in operation. Today there are in total four fully electric buses, three plug-in hybrids and several hybrid busses in service. Within the next year VHH and Hochbahn are commissioning over 40 electric buses and are tendering more than 100 electric buses until 2020[32]. Even in the field of ridesharing and on-demand services Hamburg will take the lead in Germany, as there are starting several on

[30] https://www.hamburg.de/pressearchiv-fhh/11568142/2018-08-29-bwvi-reloaded/

[31] https://www.kba.de/SharedDocs/Publikationen/DE/Statistik/Fahrzeuge/FZ/2017/fz13_2017_pdf.pdf?__blob=publicationFile&v=2

[32] https://www.hamburg.de/bwvi/medien/11275500/2018-06-29-bwvi-saubere-luft/

demand services with emission free vehicles in 2018 and 2019 operated by Deutsche Bahn and Volkswagen (clevershuttle, ioki, Moia)[33].

Germany 's respondents have mostly been involved with e-cars, but also very popular areas are e-logistics, e-buses and e-bikes.

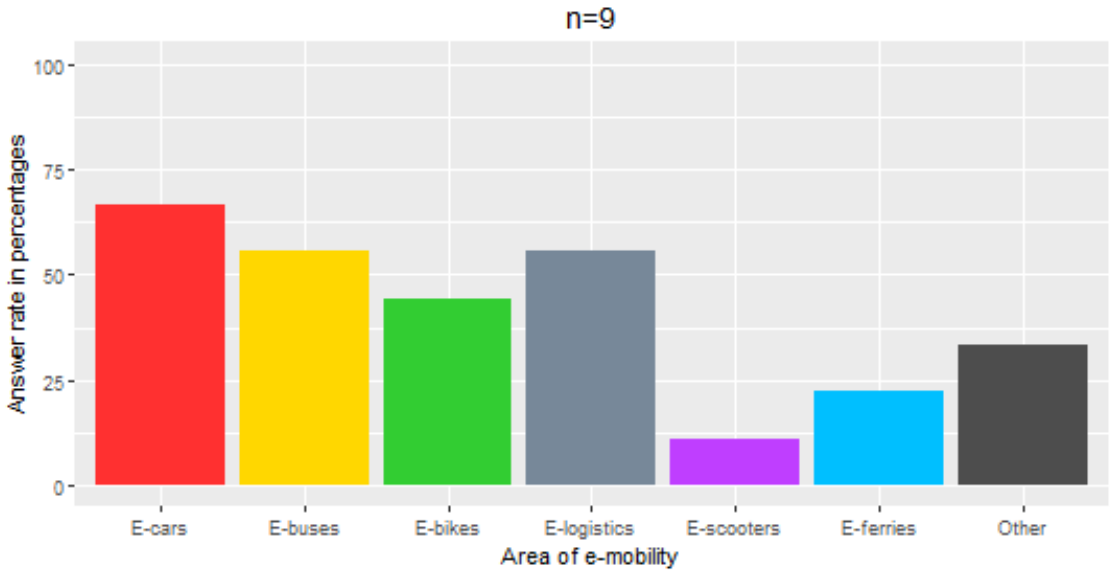


Figure 32 Germany's respondents involvement in e-mobility areas

Figure 29 describes in percentages how many among Germany's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents were from Germany.

Among Germany's respondents every area was represented. The most coverage got e-cars, e-logistics, e-buses and following closely was e-bikes. Quarter of the respondents mentioned e-ferries and e-scooters were also mentioned.

[33] https://www.hamburg.de/pressearchiv-fhh/11402166/2018-07-18-bwvi-elektroshutte-ioki/

Germany's respondents have been identifing themselves most often in the role of making policies and/or legislations.

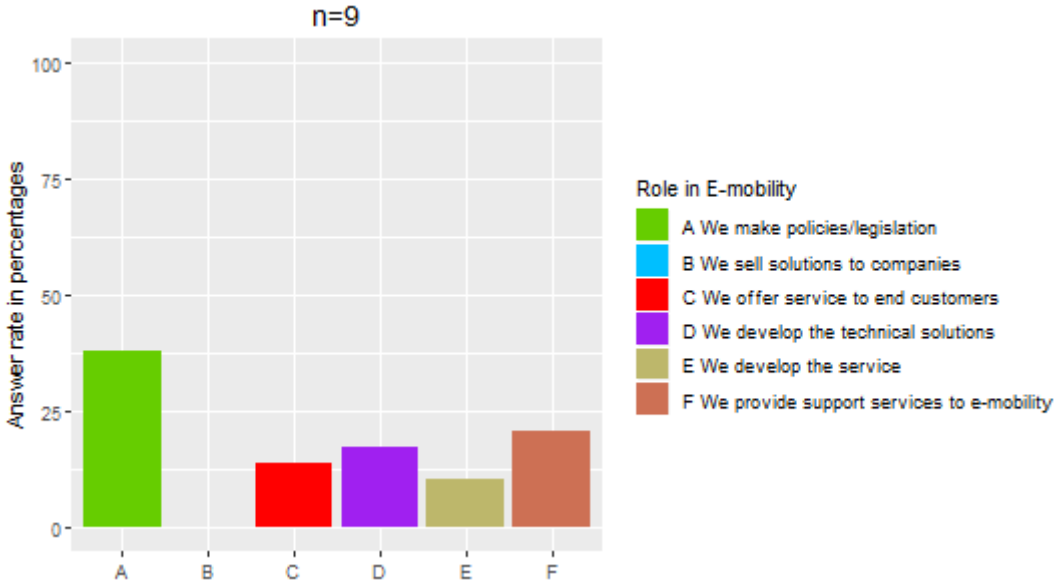


Figure 33 The roles of e-mobility in which Germany's respondents have been in

Figure 30 describes in percentages how many among German's respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Germany.

As seen from the graph, the most put down role is making policies and/or legislations. Other roles were less popular and among the respondents no one had marked the role selling solutions to companies.

The following list contains smart specialization strategies, cluster policies or initiatives, that would be interesting for others to join with regard to e-mobility, brought out by Germany's respondents.

- Network for joint procurement of e-buses already in place.
- E-Bus initiative
- ITS-Congress 2021 (Hamburg)
- Leka, Leea - these are projects, run by the Ministry of Energy of Mecklenburg/Pomerania

There is a map, that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

- https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Germany's respondents best practices in the e-mobility application area.

- Establishing an efficient internal process to locate public charging stations
- E-Bike leasing/ electric bicycle rental system Elros
- Availability of public charging infrastructure
- First fully electric bus
- First electric bus garage in Germany
- Field test w/ electric street cleaning machines in Wismar

The following list is the best practices Germany's respondents are willing to introduce to others.

- Accelerating approval processes to construct public charging stations
- Functionality of e-mobility stations in different city contexts
- Operational and strategic requirements for fleet introduction
- Setting up a bus depot for electric buses
- How to change a "diesel"-bus line towards an electric bus line
- Specific operating strategies reduce energy consumption
- Experience-Sharing via the Competence Centre E-Mobilität M-V

The following list contains the Germany's respondents proposed project ideas, that would be interesting to do in cooperation with.

- Regional integration in e-mobility and vehicles to reduce (internal combustion engine) commuter traffic (faster).

- Joint initiative: Introducing Electric Busses in public Transport for City and Regional transport in Mecklenburg-Pomerania.

Potential and plans in Germany by e-mobility areas

Respondents could discuss the potential in each area mentioned below and share any plans they know of any e-mobility area.

- **E-cars:**
    - Environmental bonus for all electric vehicles and PHEVs with a total budget of 600 million euro, which terminates in 2019. The program is coordinated by the Federal Office for Economic Affairs and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle, short BAFA)
    - Nationwide promotional programme for public charging infrastructure with a total budget of 300 million euro.
    - Fast-E EU Project: Installation of 300 DC fast chargers in Germany, Belgium and Czech Republic alongside the major highways.
- **E-buses:**
    - Nationwide promotional programme for emission free public bus traffic, which is financing up to 80 percent of additional costs of electric vehicles. Total budget is 35 million euro.
    - Reduction of tax on electricity for bus operators.
- **E-Bikes:**
    - Financial promotion of electric cargo bikes with up 30 percent of the total value or 2,500 euro per bike.
    - Financial aid for new bike lanes.

Potential and plans specifically in Hamburg

- **E-cars:**
    - Installation of 1,000 public charging points through “Stromnetz Hamburg” until 2019.

- Memorandum of understanding (MoU) with several carsharing companies to electrify their fleet (car2go, DriveNow)
- Directive related to procurement of emission-free public vehicles

- **E-buses:**
  - Directive related to procurement of emission-free buses from 2020 on.
- **E-Bikes:**
  - Changing Hamburg into bicycle-friendly city with a future modal split of 25 percent.
    - Improvement of safety
    - Construction of new bike lanes
- **E-logistics:**
  - Many MOU signed with parcel services to increase the share of electric vehicles in the fleet.
  - Electrification of public disposal company with first fully electric lorry for collecting dustbins.
  - Directive related to procurement of electric vehicles for all city owned companies

7.4.1 Key ideas from Germany:

1. Replace bus fleet radically to e-buses. This brings remarkable benefit for cleaner air and less noise.

2. Financial support for installation of public charging infrastructure and realisation of non-discriminatory access to all users of e-vehicles.

3. Introduce electric bicycle rental system, because it teaches users to trust e-vehicles

7.5 Denmark

In Denmark there were 7 stakeholders interviewed. Among those respondents 3 were private enterprises, 1 was ministry or other national authority, 1 public enterprise and 2 were local municipalities. This is illustrated by the following graph.

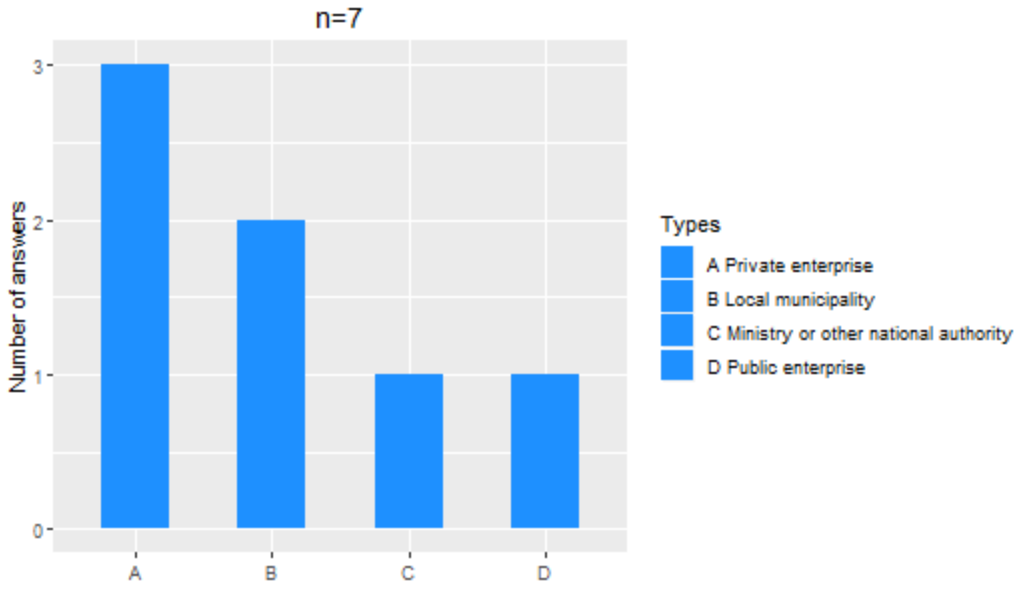


Figure 34 Types of Denmark's respondent

Of the 5 local municipalities, there was 1 large and 1 medium city. The involvement in e-mobility among the respondents were 2 with 3-5 years and 3 with 6-10 years and 2 with 11-20 years of experience. This is illustrated by the following graph.

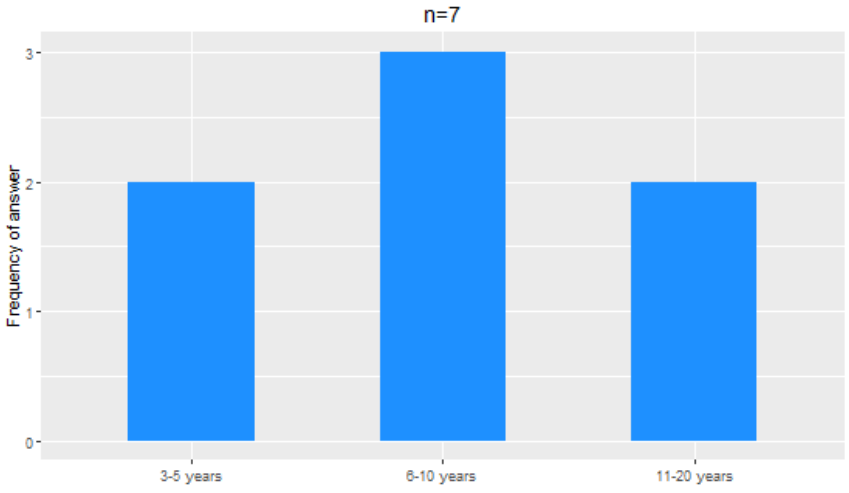


Figure 35 Denmark's respondents involvement in e-mobility in years

Three out of the seven respondents had 20, 32 and 45 employees working in relation with e-mobility, the rest had employees near 10 or under.

The relevant policies related to promotion of e-mobility in Denmark

In Denmark, the number of cars being sold and used is very low compared to the high involvement in the climate friendly agenda for many years. To understand this pattern, it would be useful to give a short summary of the political actions and incentive programs, which have been implemented in Denmark for the last 10 years.

Back in 2009 the EV technology was at a very basic level. The cars introduced in Denmark where mainly from Citroen and Peugeot called the twins, since they looked alike and were very limited in range and features. Unfortunately, the cost was high and performance low. At that time the Danish politicians decided to free EV´s from tax, since the taxation of cars are very high (highest level in the EU) at 180%, on top of the import price and then added VAT of 25%. This was actually the only direct subsidy to EV´s and was not given to hybrid cars, which where still taxed at that time.

At the same time, there was a large support from both EU funds and Danish fund (the green infrastructure pool of about 5 million €) to support infrastructure development in Denmark. Also, some of the Danish municipalities started to invest in EV´s for homecare, carsharing and public fleet replacement of Ice-cars for small trips. Since the basic price on the car models introduced to the Danish market was still very high compared to similar ICE cars, the result was quite low numbers although the introduction of Tesla with no taxation made the car "cheap" compared to other luxury cars and therefore the most sold car in 2014-15 was actually Tesla.

Since 2010 there has been a lot of focus from political side to support the infrastructure, but not much on the actual sales of EV´s in the Danish market. Therefore, there have been no direct incentive programme to present to possible EV buyers. There has been a deduction on the electricity used for EV's that resulted in a 0,15 € deduction to the Electric price, which has improved the business case on the "fuel" for EV´s in Denmark. Although efforts have been made to create other programs for either free parking, reduction on bridgetax, incentive reimbursement for buyers or deduction in company car taxation, but none of this has been implemented. At the same time, the number of cars introduced in the Danish market have been very limited and still at a very high initial cost. Furthermore, the infrastructure partners have been fighting to get incentives

to establish more private chargespots and to lower the price on initial installations of chargespots in private homes.

Since the 1th of January 2016, there has been added a 20 % taxation to EV´s and a running taxation up to 40 % in 2018 – going as a staircase model from 2016-2021 from 0 to a 100 % taxation. This caused the market and uptake of EV´s in Denmark to totally stop in 2017. There has been a pause and a fixed limit of 5.000 cars are now to be sold with the 20 % taxation plan as the cheapest EV´s in the market. In short, one could argue that even though EV´s have been a very popular subject to discuss and politicians have done so in almost 10 years, it has never been a positive business case for either private, company or municipalities to buy or integrate these in larger numbers or private households. At the same time, a taxation system has made the ICE cars in the Micro segments (more than 50 % of all cars sold in Denmark) cheaper and more affordable to Danish customers. This matter is of course a challenge and has made introducing EV´s to the Danish market very difficult.

The good news in Denmark today is that the government managed before the summer holidays to get a majority of the political parties to sign a new common agreement on climate and investments in the climate agenda and sustainable renewable energy supplies. This also means that approximately 75 million euros have been set aside for a energy plan that shall be used for promoting and incentify the transition to more climate friendly initiatives. This also includes the EV programme, the infrastructure and we are therefore awaiting how the budgets and pools for this programme will be presented in the coming weeks of September or October. We know that the red wing of political parties mostly the social democrats have spoken out loudly about much more focus to EV implementation and support the infrastructure development in Denmark. At the same time, we now see an increase in the numbers of private people looking into the EV market and positive sales figures are coming from the Danish dealers of both Nissan and Renault with The Nissan Leaf and Renualt Zoe as the two most sold cars in that category.

In general, one could add that the political parties have been interested in the private car market and have shown a very limited interest in the freight of goods market and EV uptake. This lack of focus and incentives for the uptake of bigger vans or e-mobility solutions have resulted in a very limited number of projects or companies in Denmark to start tendering for Greener solutions.

These challenges are now gaining a greater focus. Furthermore, more debates, including political debates, are being held about these challenges.

Copenhagen municipality, which is the biggest municipality in Denmark, has just stated that it will now take a bigger part in the Green sustainable agenda and has spoken to medias in Denmark about at new tendering process for all its procurement (estimated value 1,7 Billion €) to be green and delivered by EV or other alternative fuels methods. Also, that all busses in Copenhagen area should become electric and all new tenders would demand operators to support this.

Looking at a list of the total sales of EV´s and hybrid cars shows that it is less than 2 % of the total market sales. This statistic shows the current sales of EV´s and hybrids is less than 2,5 % of the total new cars sold.

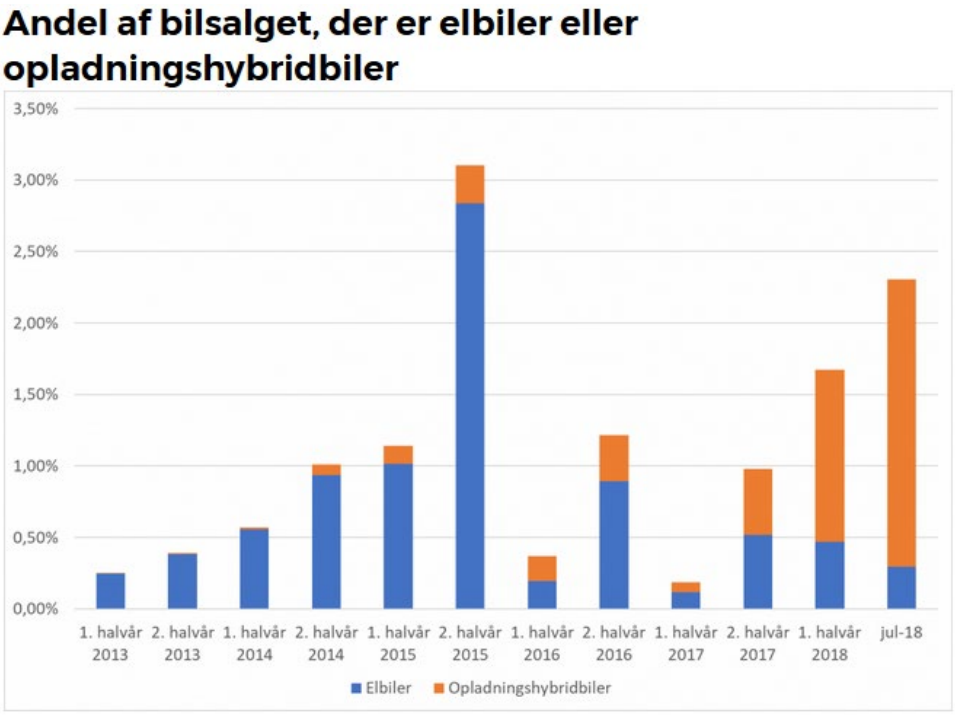


Figure 36 E-vehicle and hybrid vehicle sales from 2013 to 2018 in Denmark

As seen from the table above, there was a high sale of cars (more than 3 %) in the second half of 2015, which was due to new tax regulations on cars starting the 1th of January 2016. Before that date EV´s were not taxed in Denmark, but hybrid cars were, which explains the very low number of hybrid cars sold in Denmark in general. At the same time, it has to be noticed that a vast amount

of all cars sold (between 60-75 % is an estimate) are sold to governmental companies, municipalities and carsharing companies. So the sales for private ownership and households are very limited at this stage. In Denmark we actually faced sales numbers in 2017 that showed only 17 private EV´s sold and 165 EV´s sold to municipalities.

The total amount of EV´s and hybrids in Denmark is less than 12.000 cars, which is a very low compared to the infrastructure set in place in major cities and along the highway.

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Denmark

The following table shows and overall picture of the amount of chargespots and Quick charging stations in Denmark.

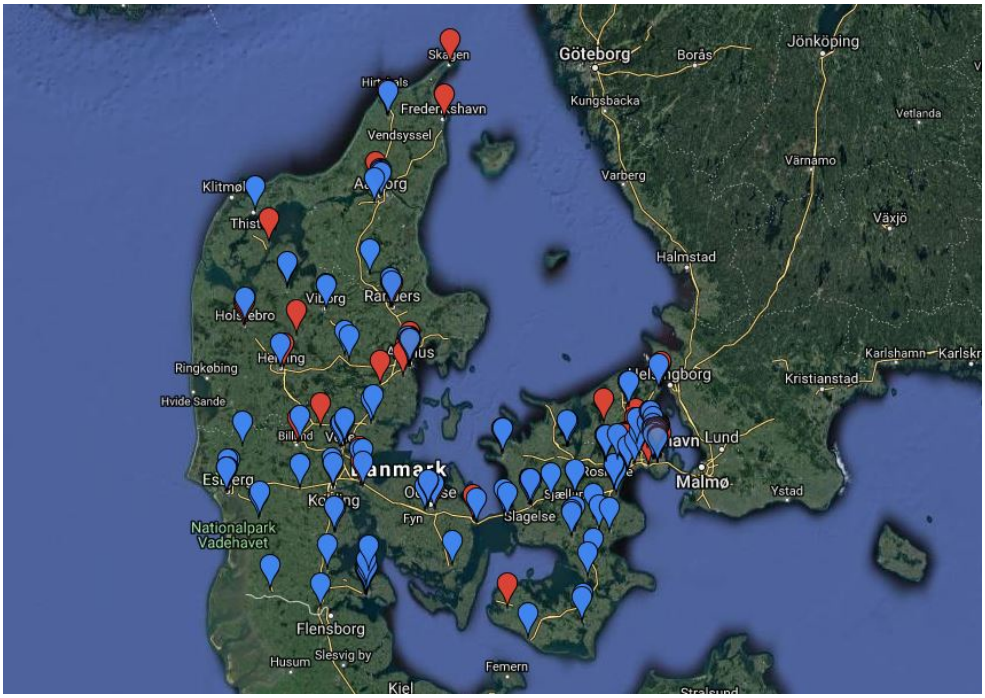


Figure 37 Charging stations in Denmark

This table shows that we have installed more than 2.050 chargespots in Denmark and at the highway a comprehensive Quick Charge (red dots in table) network operated mainly by the big operators, such as Clever and EON. They have both done huge private investments in addition to the EU funding to build this network of both slow and quick charging in Denmark.

From 2009 to May 2013 the company called “Better Place” was operating in Denmark and tried to introduce the “battery swop car” from Renault called the Renault Fluence. This operation started the real investments in infrastructure and therefore we have a very well established and high number of chargespots in the Capital region and Aarhus. When Better Place went bankrupt in spring 2013 EON decided to buy the network and therefore they are today operating this large number of slowcharging chargespots in Denmark. Back in 2012 we actually had the first full national QC network established by Clever that made it possible to travel all around Denmark in an EV and to charge it at 21 different QC stations.

In 2018, there is more charging stations than gasoline and diesel stations in Denmark. Also, in Copenhagen there is a dense charging station network.

Tesla has during the last 5-6 years invested in building up their own network of Tesla Charging and have created facilities around Denmark to service their clients.

At the same time, we now experience that the infrastructure with faster and bigger QC installations are being implemented less on designated areas around Denmark. The 150 Kwh charging is done by an operator named Clean Charge with support from EU funding.

We will also set the infrastructure development from Ionity to take form in Denmark and soon the new stations will also be built in Denmark to create an even stronger network.

There is still no current rooming network established between the providers of charging in Denmark. Although there is a small number of operators with whom there is no common platform to pay or buy charging as seen in the Telco branch. This is still a huge challenge and seems to slow down the further development and growth in sales of EV´s since the operators together create the network, but independently create two different solutions and no commen platform for customers. This reduce the network and flexibility to customers and force them to buy to different subscriptions with a higher cost for charging as a result.

In general the Danish infrastructure is based on QC with both Mennekes and CHAdeMO charging possible. All slow charging chargespots are mennekes and can charge with 11 kwh. Most of the installed charging is chargespots with two sockets mounted.

As showed in the figure below, the price of electricity in Denmark is very high in EU compared to other markets. This is due to high taxation of the initial price of a Kwh. In Denmark the price is about 0,05 € pr Kwh excluding tax, but including tax it would be around 0,40.

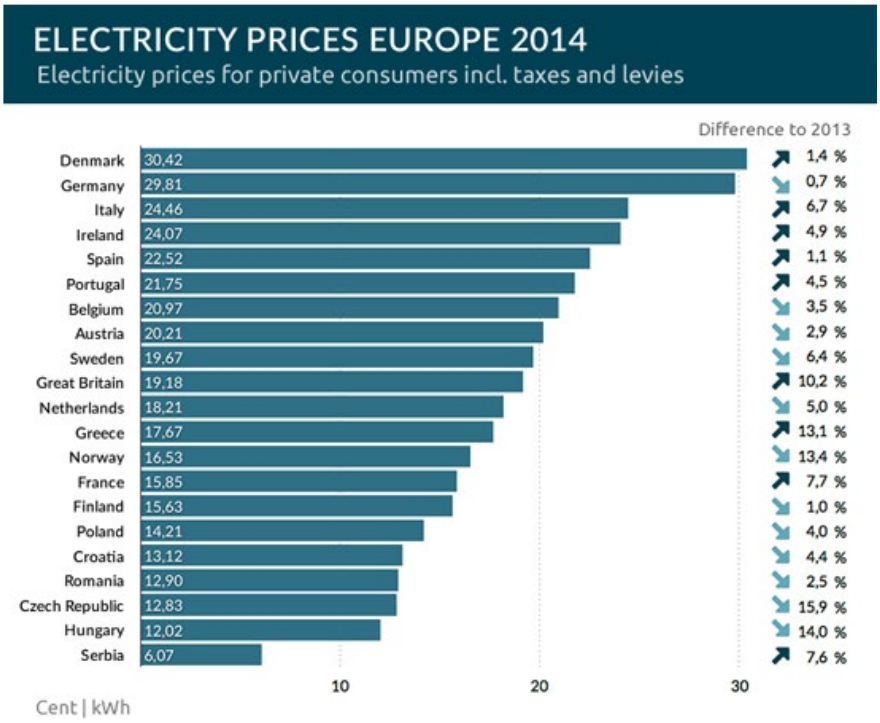
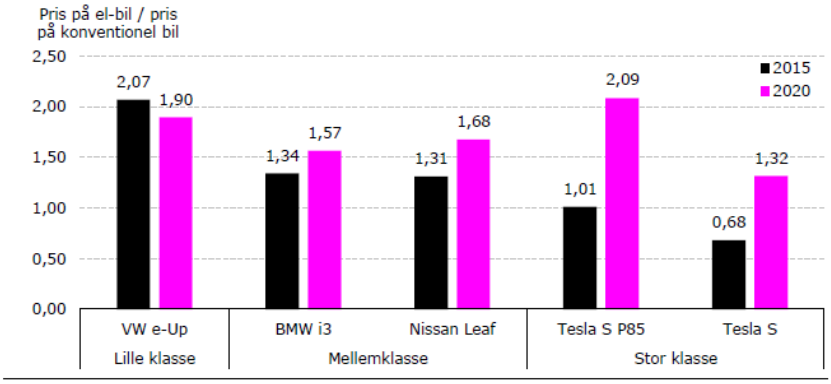


Figure 38 Electricity prices in Europe 2014

The following table shows the difference in sold numbers of same type electric and hypbrid cars.

Figur 2 Prisforskel på elbiler og konventionelt alternativ som følge af aftalen



Note: Y-aksen indikerer det relativt prisforhold mellem elbiler og konventionelle biler. En værdi på 1,5 betyder, at elbilen er 50 procent dyrere end den konventionelle bil.

Kilde: Copenhagen Economics på baggrund af den politiske aftale om ændring i fritagelse for registre-ringsafgift samt bilpriser fundet på letsauto.com/da

Figure 39 Number of sold electric and hybrid cars in Denmark

Denmark's respondents have mostly been involved with e-cars. E-buses, e-logistics and e-bikes are marked down by over the half of the respondents from Denmark.

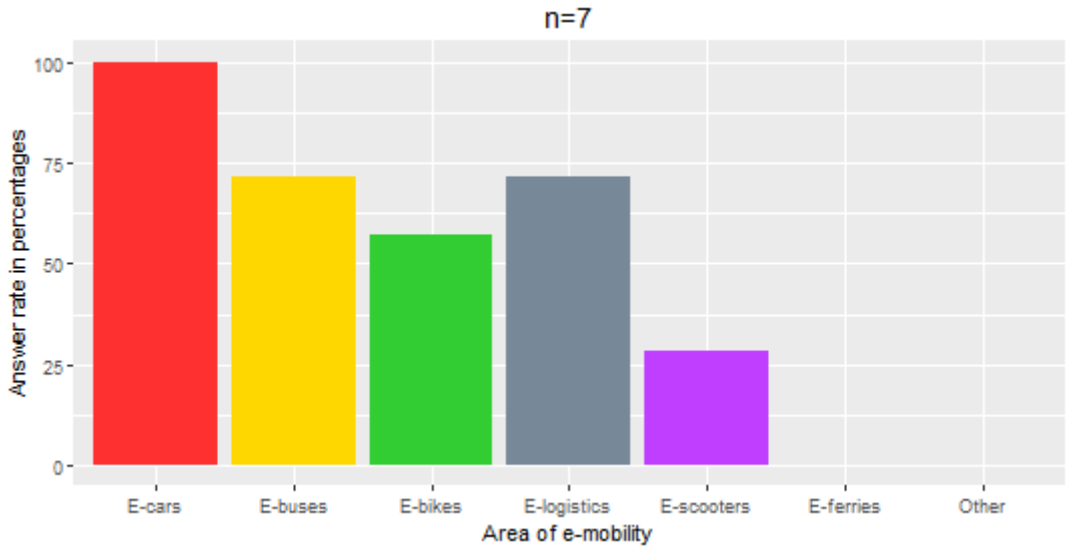


Figure 40 Denmark's respondents involvement in e-mobility areas

Figure 34 describes in percentages how many among Denmark's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents were from Denmark.

Every respondent from Denmark put down, that they have been involved with e-cars. Three quarters put down that they had been involved with e-buses and e-logistics. E-bikes were mentioned more than half of the respondents. E-scooters was mentioned, but not as many times and e-ferries were not mentioned.

Denmark's respondents have been identifing themselves most often in the role of making policies and/or legislations and providing support service to e-mobility.

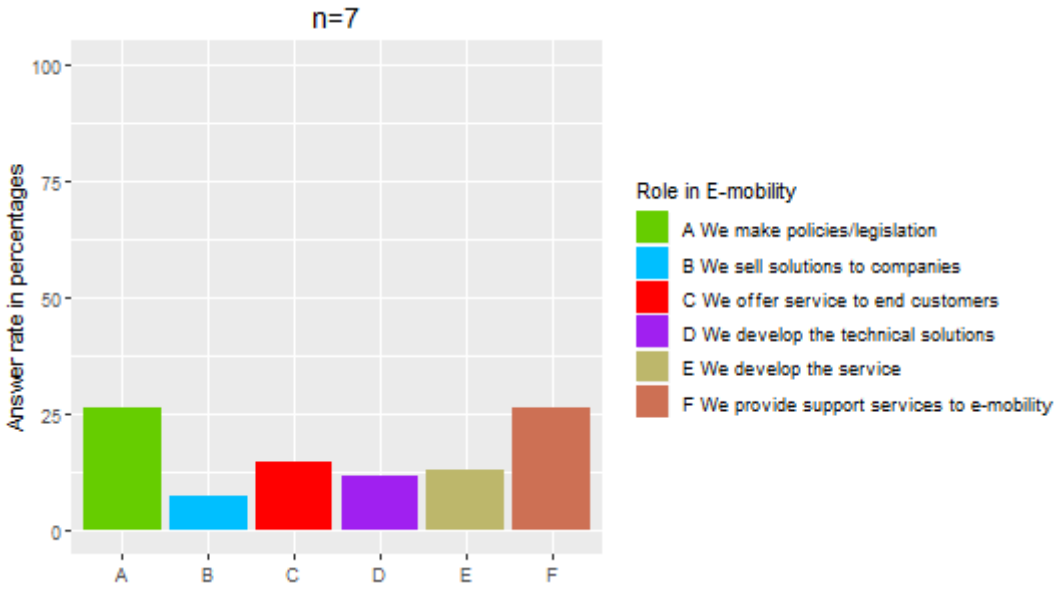


Figure 41 The roles of e-mobility in which Denmark's respondents have been in

Figure 35 describes in percentages how many among Denmark's respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Denmark.

Denmark's respondents have mostly been in the roles of making policies and/or legislations and providing support service to e-mobility. The respondents have been in the other roles mentioned in the questionnaire as well. Least in developing services and technical solutions and selling the solutions to companies.

The following list contains smart specialization strategies, cluster policies or initiatives, that would be interesting for others to join with regard to e-mobility, brought out by Denmark's respondents.

- EV for Smart cities,
- Green cooperation in energy storage – battery production
- EV roaming for EU, FREVUE

There is a map, that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

- https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Denmark's respondents best practices in the e-mobility application area.

- Municipality owned e-cars for home care employees
- Test of e-bikes in the municipality
- Development of e-charging system
- Regional E-mobility activity plan
- Carsharing – DriveNow Green Mobility
- Public Partner Partnerships on infrastructure
- Public & Private partnership on carsharing
- "Test and e-bike"; e-bike City System
- "Test and e-car"
- Common Procurement and regional buy of E-cars, partnership in municipalities and regions
- Fleet owners in b2b – pendlers, family 2 cars

- Logistic – daily freight companys
- Userfriendlyness in infrastructure decision
- Infrastructure in national highway network
- Financing the infrastructure product buy
- Creation of E-mobility office (Copenhagen Electric)

The following list is the best practices Denmark's respondents are willing to introduce to others.

- E-bike projects and testing
- Regional planning
- Common procurement (private, public, cross border)
- Carsharing
- City logistic business improvement
- E-mobility infrastructure (B2B, B2C, B2G)

The following list contains the Denmark's respondents proposed project ideas, that would be interesting to do in cooperation with.

- E-mobility in national or regional programs and projects cross border
- E-mobility in general – infrastructure – practical projects (cars on the road or market maturement)
- Market related projects – where municipalities work together cross border on tenders and procurement.
- E-mobility in national or regional programs and projects cross border
- EUDP – EL ferries, taxi´s, E-vehicles heavy transport

- Cross-borders E-mobility solutions (roaming, ultra-fast charging stations, smart-grid)

Potential and plans in Denmark by e-mobility areas

Respondents could discuss the potential in each area mentioned below and share any plans they know of any e-mobility area.

- **E-cars:** Right now we have a energy plan on its way on national level. This also have a new pool of money included, and there is talks about incentives to both EV´s and Hybrid including infrastructure in Denmark. The plan and the pools of money will be presented during October 2018. At the same time there is a political majority of parties that would like to fix the taxation on EV´s to a limited number of cars until the EV´s sales have picked up on a higher scale. The actual number and period of time has not been published yet.
- **E-buses:** In Denmark E-busses and public busses are done through a public travel agent tendering process. Earlier this has not been tendering for E-busses, but this year new tender processes have been initiated and now E-busses are included. We have seen the first implementation of 20 E-busses including infrastructure from a Chinese operator south of Copenhagen in the municipality of Roskilde. At the same time the Lord mayor of Copenhagen municipality has just announced that all busses operating in the Greater Copenhagen should be only E-busses from 2025 and onwards.
- **E-Bikes:** There is a big public e-bike program running in Copenhagen including 1.800 E-bikes. This is a partnership between the municipality, governmental funding an a private fond and operator. The system is only implemented in Copenhagen and not in any other city of Denmark. There are no talks about other governmental subsidies or programs to enhance sales by incentives the price for E-bikes.
- **E-logistics:** Several big networks in Denmark are right now looking into the E-logistic. We have 1 small company trying to introduce the E-logistic and freight of goods product into several cities right now with big success. Since the Municipality of Copenhagen has just announced that it will start to tender all their procurement of goods, net value app 1,7 bio. €, this will be a great support to the green city logistic and this area in general. Denmark in involved in several EU project regarding this subject, and we see now the bigger Danish based international companies start to have serious CO_2 neutral targets.

- **E-scooters:** No programs have been introduced in Denmark regarding this topic or area of E-mobility at this moment.
- **E-ferries:** We will see the first 2 E-ferries in Denmark this fall. With huge support and funding from Elena T the two ferries will be implemented in a very popular crossing from Denmark to Sweden, a trip of only about 25 minutes. This area has not been politically supported or have been a high interest area, and therefore we see a very limited number of ferries and projects regarding this. We also now see a E-bus (ferry) running in the channels around Copenhagen as they are a huge success and very popular. This is operated by one of the big public bus companies in Denmark "Arriva" owned by Deutche Bahn. There are no talks about incentive programmes or promoting E-ferries on a national level at the moment.

It was announced 26.09.18 by the Danish Climate Council, that a suggestion to ban all diesel and gasonline cars for sale in Denmark in 2030. This is a council that works as a advisory board to the politicians, and on top of this they have suggested that a incentive for buying should be added to all electric cars on a 6.500 € incentive until 100.000 cars are sold in Denmark. At the same time, they wish the Electric cars to be included in the normal tax programs for Danish cars, and therefore a model that would go from the 20 % taxation today up to 100 % taxation in 2030 should be implemented.

7.5.1 Key ideas from Denmark:

1. Introduce e-bike sharing, because it has large influence on citizens.

2. Pay attention to city logistics

3. Introducing af full network of charging across the country

4. Carsharing 100 % E-mobility and work between public and private partners to create sustainable solution to the City of Copenhagen

7.6 Norway

From Norway there were 6 stakeholders interviewed. Among those respondents 3 were private enterprises, 1 was public enterprise, 1 was national NGO and 1 was local municipalities. This is illustrated by the following graph.

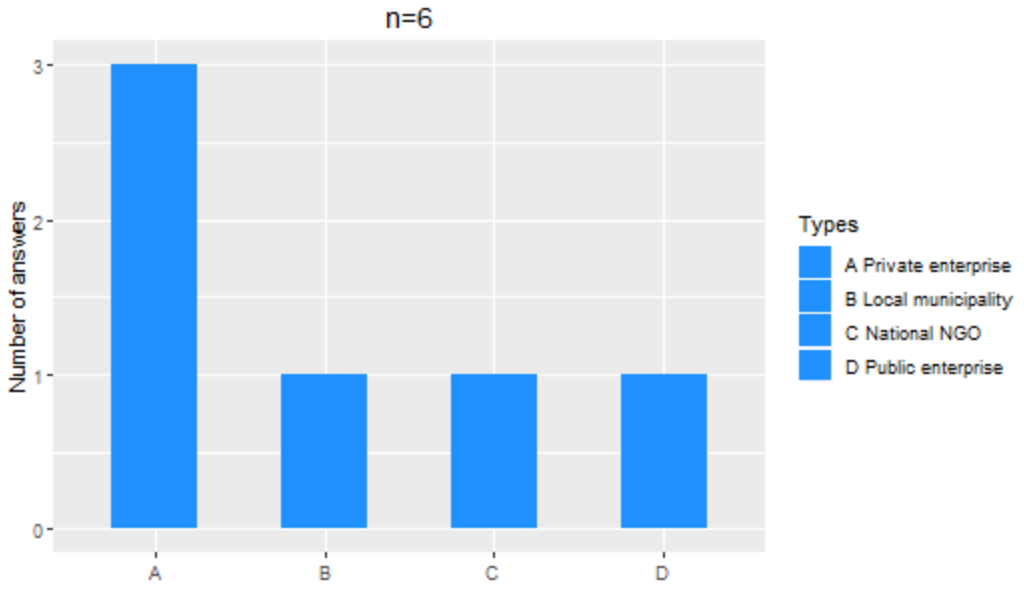


Figure 42 Types of Norway's respondent

The local municipality was a medium sized town. The involvement in e-mobility among the respondents were 4 with 6-10 years and 2 over 20 years of experience, according to the respondents. This is illustrated by the following graph.

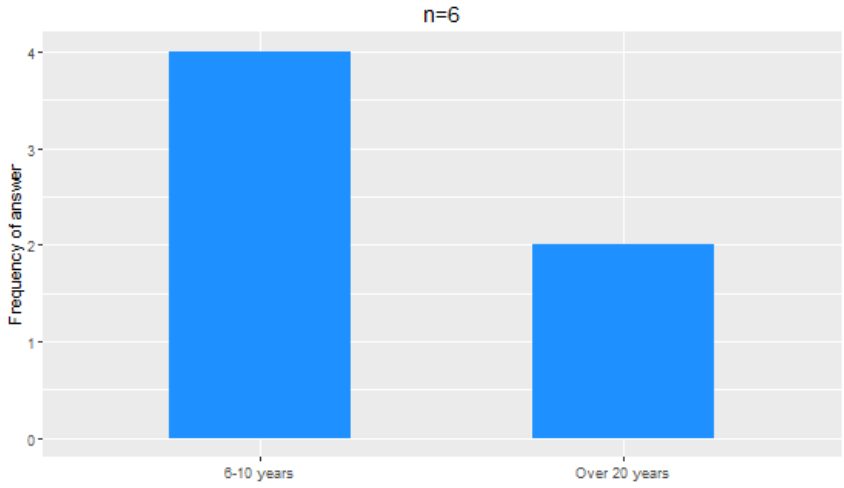


Figure 43 Norway's respondents involvement in e-mobility in years

Number of employees involved in e-mobility was mostly near 20, but there were respondents with less and more employees.

The relevant policies related to promotion of e-mobility in Norway

"*Both the level of ambition and stability in the policy environment are important. This is regarded as a key characteristic for the successful deployment of electric cars in Norway."* (Nordic EV Outlook 2018, page 35. Read more on the relevant EV policies in Norway: http://www.nordicenergy.org/wp-content/uploads/2018/05/NordicEVOutlook2018.pdf)

- Exception from VAT and purchase tax
- Free/discount on parking and toll roads
- Access to public transport road lane
- Exception from annual road tax
- Free/discount ferries
- Availability of low cost overnight charging
- Availability of fast charging 150KW or more
- "produce your own electricity" solarpanels, local storage and production of el power
- "Fast track" / bus lane use electric cars, long distance buses and trucks
- Subsidies for infrastructure/buses from the government (Enova) to bus companies
- Subsidies for infrastructure/buses from the government (Klimasats) to municipalities
- Pilot E financial support for RnD/Innovation projects (government)
- Free passing in tollroads for electric express bus

- Environmental requirements in public procurement, locally and nationally, but this is still in an early stage.
- National Parliament decision: “All public transport shall be zero/low emission by 2025”
- In Skedsmo municipality there is a City Council EV plan with at goal of 25 % zero emission cars of total fleet in 2020 (BEV, FCEV and biofuels) There is also a goal that 100 % of the passenger cars and vans in the municipal fleet shoult be electric in 2020. Public financial support. Like several minicipalities Skedsmo help facilitate charging in cooperative housing. Skedsmo also facilitate use of ebikes in municipal administration.

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Norway

- 8 fast chargers for cars in Skedsmo, 2 of them are owned by the municipality.
- Normal chargers publically available.
- Housing cooperatives get free inspection report and charging advice from the municipality. They also get financial support, but low level of support, not many have applied.
- The Skedsmo municipality have 118 charging points for their own car fleet, 170 charging points for guests and emplyees. The goal is to have charging at every municipal buildings and 200 EVs.
- BEV Fast chargers
- For ebuses, both depot charging and end stop charging is established.
- Chargers for ferries
- Chargers on parking spaces
- Bicycle lanes
- Public charging stations

- Commercial fast charging
- Bus lane availability
- Free Parking
- Over night charging
- Pantograph charging
- Training e-bus driving for drivers and at service mechanic workshop. Operators/bus companies take responsibility.
- Exchange of experience between bus operators, in spite of competition
- Depot charging infrastructure
- Fast charging infrastructure

Norway's respondents have mostly been involved with e-buses and e-cars.

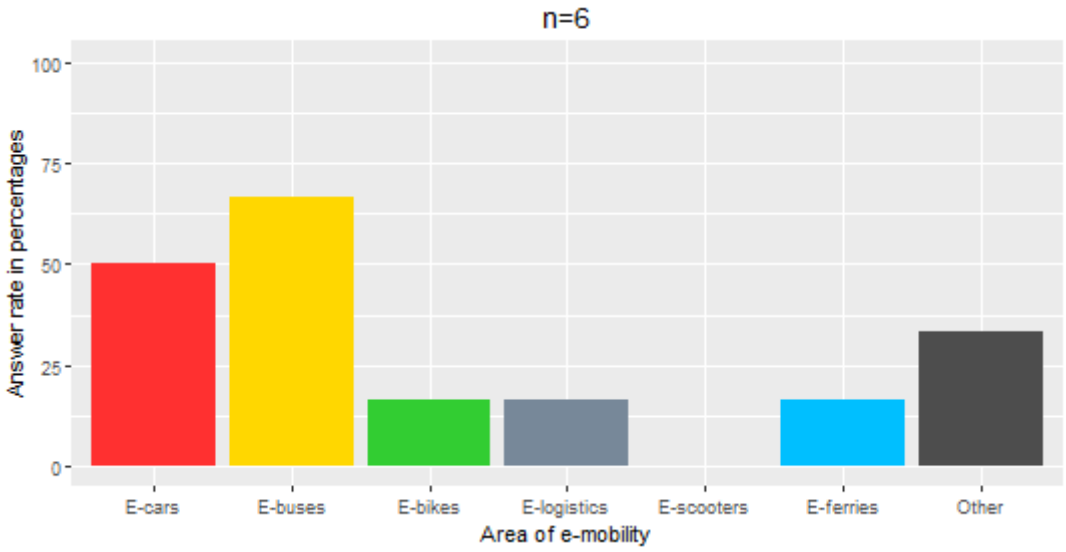


Figure 44 Norway's respondents involvement in e-mobility areas

Figure 39 describes in percentages how many among Norway's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents were from Norway.

Every area, except e-scooters, were mentioned atleast once by Norway's respondents. Most mentioned areas were e-buses and e-cars.

Norway's respondents have been identifing themselves most often in the role of offering service to end customers and providing support services to e-mobility.

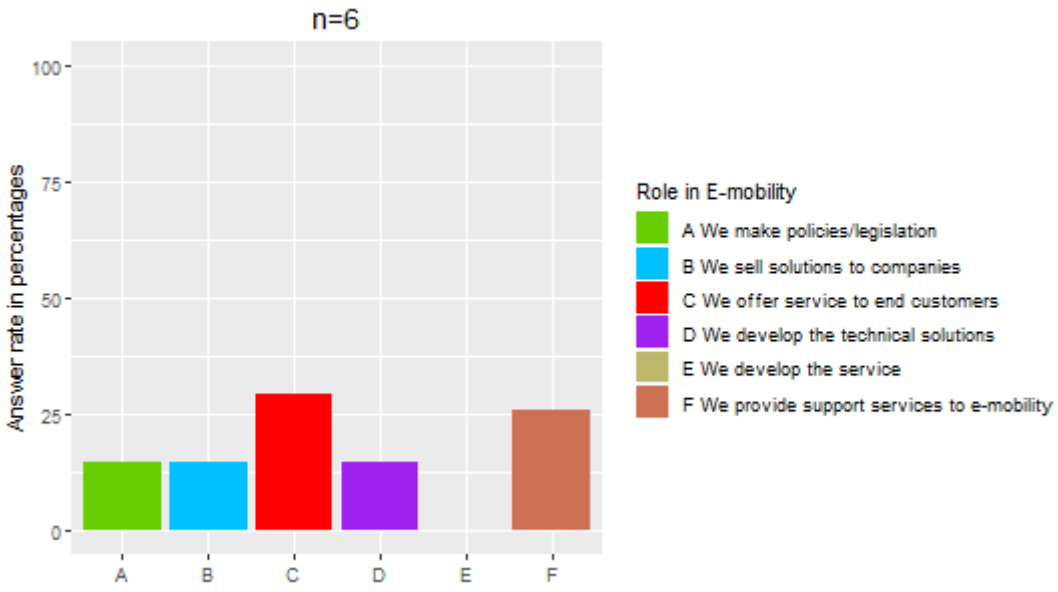


Figure 45 The roles of e-mobility in which Norway's respondents have been in

Figure 40 describes in percentages how many among Norway's respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Norway.

Except for developing the service, all roles have been mentioned by Norway's respondents. The most mentioned roles are offering service to end customers and providing support services to e-mobility. Both of these roles are more of a service providing nature. The respondents could discuss about the situation in the solution development standpoint in Norway. Whether there are already enough companies doing it or should they themselves get involved and take a more developing role in e-mobility.

The following list contains smart specialization strategies, cluster policies or initiatives, that would be interesting for others to join with regard to e-mobility, brought out by Norway's respondents.

- Skedsmo's Strategy for fossil free vehicles. IFE National center for renewable transport, MOSES.
- The Nobil database (national charging database used in Norway, Sweden and Denmark).
- We need to reduce heavy-duty vehicle emissions, which are expected to double within 2050. There is a German-Swedish initiative, recently joined by France, to develop charging infrastructure along European highways for heavy-duty vehicles. This collaboration is on a governmental level and run day-to-day by the national public road authorities. It seems increasingly evident that conductive charging through overhead contact lines seems to be the most mature and cost-efficient concept (Siemens has developed the eHighway system, and are not unbiased on this subject). Norwegian authorities and more relevant stakeholders should involve themselves in eRoad initiatives.

There is a map, that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

- https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Norway's respondents best practices in the e-mobility application area.

- Charging logistics / network
- A lot of dialogue and exchange of experience between bus operators, in spite of competition
- Focus on charging at home, cooperative housing
- Free parking for EVs (has been taken away, but new national regulation says max 50 % payment for EVs vs ICE)
- Exception from VAT and purchase tax
- Local usage incentives like reduced toll road tariffs, access to public transport lane
- Creation of a free and publicly available database for charging infrastructure

- The Norwegian EV revolution with a broad set of tools. We need similar broad sets of tools for other e-Mobility areas.
- Pilot E: A more streamlined public financing process for emission-reducing technology projects. Public support through all phases, from idea development to commercialization.

The following list is the best practices Norway's respondents are willing to introduce to others.

- Fossil free vehicle strategy
- Charging in cooperative housing
- Market shares for EVs
- Charging infrastructure development
- Possibilities for electric vehicles in a country with varying weather
- The Nordic charging infrastructure database Nobil

The following list contains the Norway's respondents proposed project ideas, that would be interesting to do in cooperation with.

- Fossil free construction sites. Green business development. Electric machines and vehicles for city maintainance.
- Preferably cooperation should be related to system / smart city development, electric buses, metro, train, autonomy/vehicle-to-X/ITS or mobility-as-a-service technologies. The above-mentioned electric road collaboration is one initiative we wish to promote and expand.

Potential and plans in Norway by e-mobility areas

Respondents could discuss the potential in each area mentioned below and share any plans they know of any e-mobility area.

E-cars:

- The National Parliament has set a goal that all new cars sold in 2025 should be electric.

- Goal in Skedsmo municipality: 100 % EV passenger cars and vans in the municipal fleet in 2020. EV plan for Skedsmo: 25 % zero emission cars of total fleet in 2020 (BEV, FCEV and biofuels).

E-buses:

- Parliament decision 2015: "All public transport shall be zero/low emission by 2025".

- Oslo and Akershus county have tha goal that all public transportation (bus, ferry, tram, metro) is going to be fossil free in 2020.

E-Bikes: Not mentioned.

E-logistics: Not mentioned.

E-scooters: Not mentioned.

E-ferries:

- National Parliament decision in 2014 that at public ferries should be zero or low emission. About 72 e-ferries are either in operation or ordered and under construction.

- Oslo and Akershus county have tha goal that all public transportation (bus, ferry, tram, metro) is going to be fossil free in 2020, and all electric in 2028.

7.6.1 Key ideas from Norway:

- To succeed with upscaling of emobility, it is key to set ambitious goals combined with a broad spectrum of long-term measures, both on a national, regional and local level.

- Important at an early stage in the roll-out of new technology like the e-buses: Dialogue conferences on e-bus at county level, including bus producers, operators, PTAs, charging companies etc. Strategy forums and breakfast meetings.

- The Nordic charging infrastructure database Nobil.

- Ticketing systems for e-solutions should be seamless to enable simple action for passenger.

7.7 Sweden

From Sweden there were 7 stakeholders interviewed. Among those respondents 1 was public enterprise, 1 was ministry or other national authority and 5 were local municipalities. This is illustrated by the following graph.

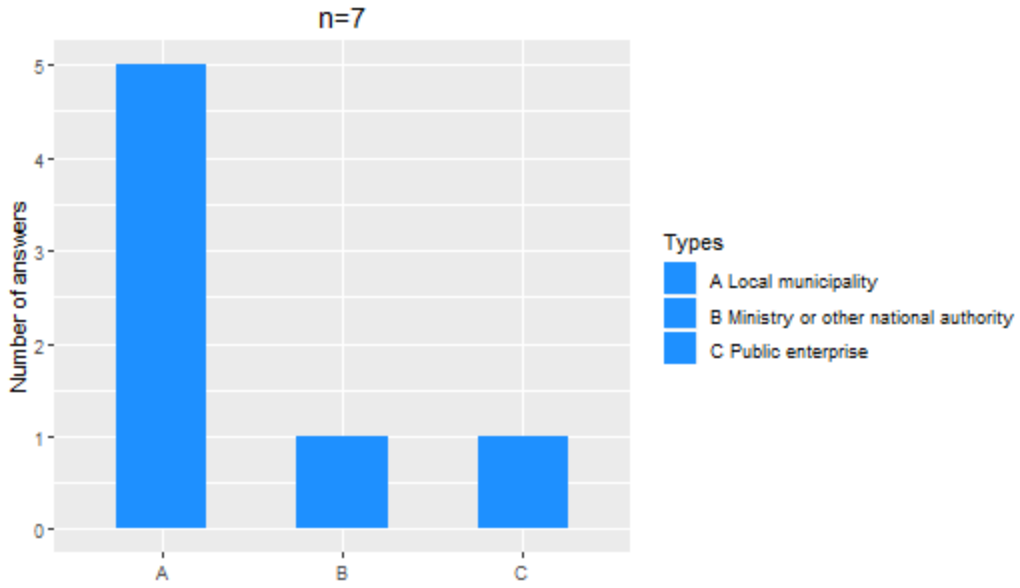


Figure 46 Types of Sweden's respondent

Of the 5 local municipalities, there was 1 large, 3 middle and 1 small cities. The involvement in e-mobility among the respondents was 1 with 1-2 years, 1 with 3-5 years and 3 with 6-10 years, 1 with 11-20 years and 1 with over 20 years of experience. This is illustrated by the following graph.

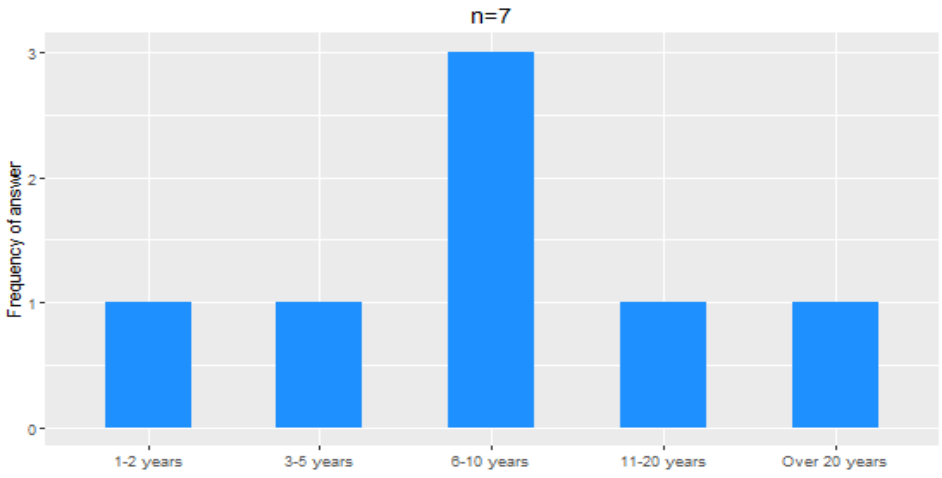


Figure 47 Sweden's respondents involvement in e-mobility in years

Number of employees involved in e-mobility was mostly ten or under, one organization had 50 employees.

The relevant policies related to promotion of e-mobility in Sweden

Sweden has several funding programmes for e-mobility. There is support both for purchases and for charging infrastructure.

From 1 July 2018, Sweden has a Bonus-Malus passenger car system, which means that a buyer of an electric car will receive SEK 60.000 (approximately EUR 5.800) in support. A long-range plug in hybrid car buyer receives approximately 40.000 SEK (about 3.800 EUR). Buyers of cars with significant greenhouse gas emissions receive an increased tax charge. The system has increased the proportion of electric vehicles since the market share was 10% of the plug-in electric car in Sweden during July.

For e-buses, Sweden has a support system since 2016, and the support will remain in place until 2023. The maximum amount is 20% of the purchase price, but there is also a rule that cost differences cannot be too significant between electric bus and diesel bus. The Swedish state has set 100 million SEK for this funding.

The Swedish state has also developed purchasing support for e-bikes, e-scooters and e-motorcycles. The total size of the aid is SEK 350 million. The maximum a buyer can get 25% of the purchase price, but it is also limited to a maximum amount of 10,000 SEK.

For charging infrastructure, there is support for home recharging. Every year, SEK 90 million will be awarded for home recharging. The support is 50% of labour and material costs, but max. 10.000 SEK. The funding will be available until 2020.

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Sweden

There is also a significant support program called the Klimatklivet, which fund climate investments in Sweden. The support program is what has mainly financed public and non-public charge infrastructure, which is not home recharging, in Sweden. From 2015 until 2018, Klimatklivet has invested in 5.600 public charging points and 8.500 non-public charging points.

There is also a support program, called City Environment Agreement (Stadsmiljöavtalet) with a focus on sustainable transport. Where cities and states jointly agree on action. This support can be used to support investment in recharging infrastructure for electric buses.

Swedish Energy Agency also has various information campaigns for e-mobility in Sweden.

Many Swedish cities also support e-mobility. One of the most common is that they have targets for the purchase of electric vehicles for their fleet, but many are also investing in information campaigns.

Sweden's respondents have mostly been involved with e-cars, e-buses and e-bikes.

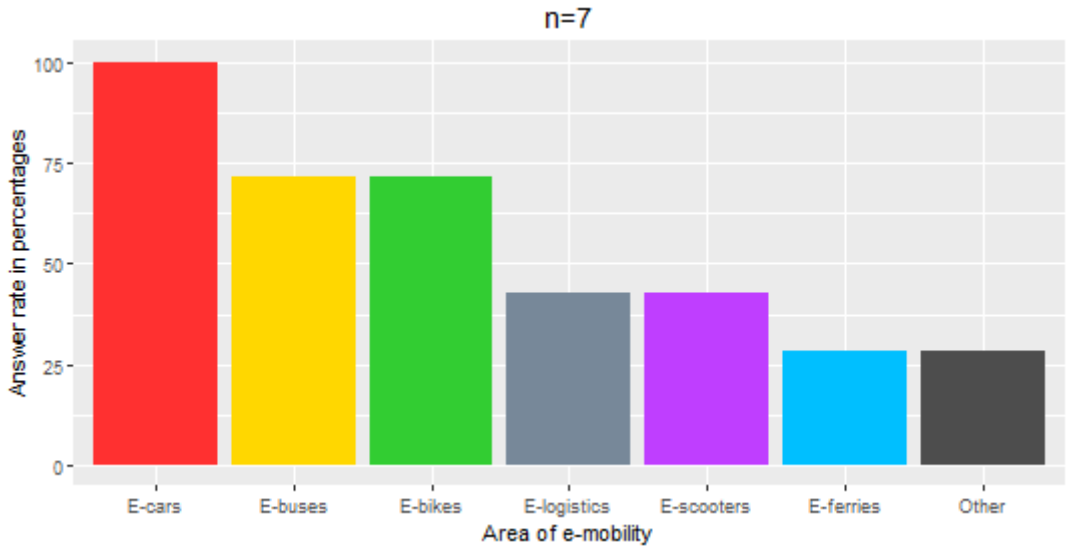


Figure 48 Sweden's respondents involvement in e-mobility areas

Figure 44 describes in percentages how many among Sweden's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents were from Sweden.

Every respondent from Sweden has marked that they have been involved with e-cars. The second popular area among the respondents were e-buses and e-bikes. Furthermore, every area has been marked at least once.

Sweden's respondents have been identifing themselves most often in the role of making policies and/or legislations and providing support services to e-mobility.

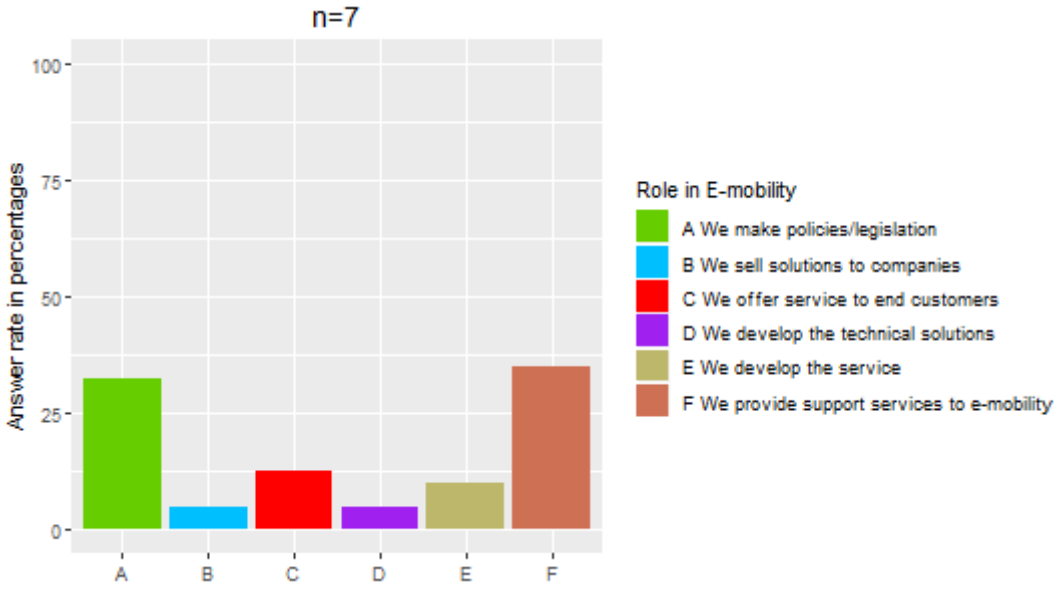


Figure 49 The roles of e-mobility in which Sweden's respondents have been in

Figure 45 describes in percentages how many among Sweden's respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Sweden.

Sweden's respondents have identified themselves in every given role. Mostly in providing support service to e-mobility and making policies and/or legislations. Since most of the respondents were from local municipalities, it is logical that the developing and selling roles have been chosen less by the respondents.

The following list contains smart specialization strategies, cluster policies or initiatives, that would be interesting for others to join with regard to e-mobility, brought out by Sweden's respondents.

- Electric Vehicles Initiative, EV Pilot City Programme
- "Vad är en miljöbuss egentligen" E-bus "Olivia"
- Fossilfritt 2030 (Fossile free 2030)
- Project GREAT and GreenCharge

There is a map, that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

- https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Sweden's respondents best practices in the e-mobility application area.

- Stadsleveransen.[34]
- Bus line 55.[35]
- Charging at private homes
- Charging at workplaces
- PEV technology procurement, PEV policies for company cars
- E-bus demonstrations
- At an early stage we formed a department for handling E-car charging and all related isssues.
- Intro of cargo E-bike pool
- CO_2: Awareness of pollution change cars

[34] www.innerstadengbg.se, 20.09.18
[35] www.electricitygoteborg.se, 20.09.18

The following list is the best practices Sweden's respondents are willing to introduce to others.

- What to consider when deploying charging infrastructure
- CO_2 emissions project
- Conference and exhibition of E-cars Regionally

The following list contains the Sweden's respondents proposed project ideas, that would be interesting to do in cooperation with.

- Business models for deploying charging infrastructure.
- To be member of Green Charge

Potential and plans in Sweden by e-mobility areas

Respondents could discuss the potential in each area mentioned below and share any plans they know of any e-mobility area.

- **E-cars:** Not mentioned
- **E-buses:** For e-buses, Sweden has a support system since 2016, and the support will remain in place until 2023.
- **E-Bikes:** Not mentioned
- **E-logistics:** Not mentioned
- **E-scooters:** Not mentioned
- **E-ferries:** There are a lot of waterways with potential for e-ferries, however any concrete plans were not mentioned

7.7.1 Key ideas from Sweden:

1. Support charging spots in working places, because vehicles stay there for longer period of time and enables the vehicle to be fully recharged.
2. Bonus-Malus passenger car system.

7.8 Finland

From Finland there were 10 stakeholders interviewed, all located either in Helsinki or Turku regions which were the studied regions in Finland. Among those respondents 1 was public enterprise, 1 was ministry or other national authority, 1 was regional authority and 6 were local municipalities. This is illustrated by the following graph.

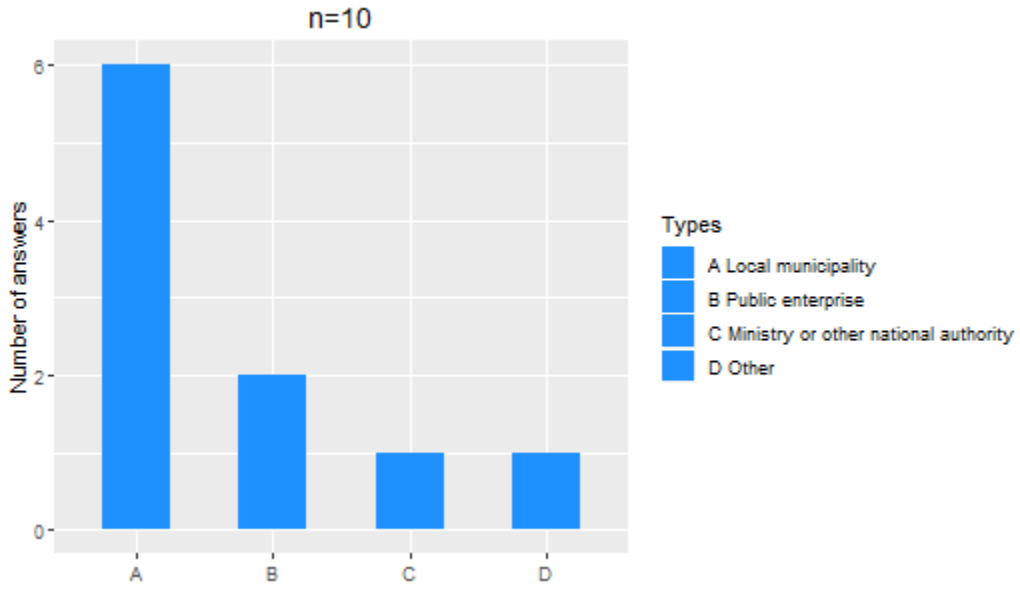


Figure 50 Types of Finland's respondent

Of the 5 local municipalities, there were 3 large, 2 medium and 1 small city. The involvement in e-mobility among the respondents was 1 with 1-2 years, 4 with 3-5 years and 5 with 6-10 years of experience. This is illustrated by the following graph.

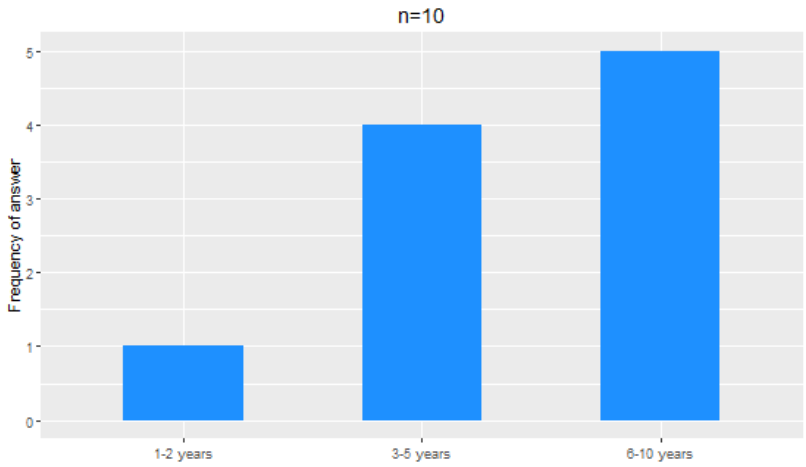


Figure 51 Finland's respondents involvement in e-mobility in years

Number of employees involved in e-mobility was ten or under.

The relevant policies related to promotion of e-mobility in Finland

National level:

The national level policies related to low-emission transportation are:

- Finnish Energy and Climate strategy[36]
- Distribution network for alternative transport fuels. Finland´s national plan (The Finnish Government accepted the National Alternative Fuels Plan in February 2017. According to the plan, the distribution station network of different fuels and the public charging points required by electric vehicles be built in Finland primarily on a market basis. Commercial operators, such as energy companies, shopping centres and parking operators, would primarily be responsible for construction of the infrastructure)[37]
- Government Report on Medium-term Climate Change Plan for 2030 – Towards Climate-Smart Day-to-Day Living (KAISU)[38]
- Transport Services Act entered into force on 1 July - The Act brings together the legal provisions on transport markets, with the aim to offer better transport services to users and have more freedom of choice on the market. It also promotes digitalisation of transport services and more efficient use of data. Opening the data has a key role in the reform as it also enables to offer new kinds of travel chains composed of different modes of transport to consumers.

Support currently available in Finland:

Buying a full-electric car or leasing one for a long term is supported by EUR 2.000 subsidy under a fixed-term act which is in force between 01.01.2018 and 31.12.2021. The budget for the subsidies is EUR 6 million annually and the maximum acquisition price for the electric car is EUR 50.000, including VAT and car tax and. The proposal promotes the aims of the Government Programme project on bioeconomy and clean solutions.[39]

[36] https://tem.fi/en/energy-and-climate-strategy, 20.09.18
[37] http://julkaisut.valtioneuvosto.fi/handle/10024/79530, 20.09.18
[38] http://julkaisut.valtioneuvosto.fi/handle/10024/80703, 20.09.18
[39] https://www.trafi.fi/oleedellakavija/tayssahkoauto/sahkoauton_hankintatuki, 20.09.18

The Finnish national level policies are mainly reflecting the EU policies and directives.

Municipality level:

It is mainly the big cities who have introduced plans to become carbon neutral, mainly by 2030. This objective will be most likely reflecting into e-mobility policies in these cities, since transportation is one of the major sectors causing the emissions in the city. The small cities still rarely have such strategies.

Helsinki, Espoo and Vantaa:

Helsinki has announced to be a carbon neutral city by 2030. The action plan to reach this goal is finalized in Autumn 2018 and the final decisions on the action plan will be made by the Helsinki City Council. The action plan details how electricity consumption in the city can remain at today's level, despite trends that increase consumption including electric vehicles. According to the plan, Helsinki can reduce greenhouse gas emissions from transportation by 69% with the help of increased use of sustainable modes of transportation, regulation, and electric vehicles projected by represent 30% of the total fleet in 2035.[40] Helsinki is already preferring e-mobility in city's public procurement and demanding e-mobility charging when giving building permissions.[41]

Espoo is also having a strategy to become carbon neutral city by 2030. In its climate programme, Espoo has committed to improve its public transportation and increase low-emission mobility.[42] The objective that all bus transportation in Espoo will be low-carbon by 2025

Vantaa has the objective to become carbon neutral city by 2030. A roadmap to reach this goal is prepared and approved by the city council in June 2018.[43]

Turku:

In June 2018 Turku announced its new Climate Plan according which the city aims to be carbon neutral by 2029. Travel-related emissions are aimed to be halved from the current state by 2029. In order to reach this, the conditions for cycling and walking are being strongly developed, as well as a culture of sustainable mobility. Public transport will be turned into a completely carbon neutral

[40] https://www.hel.fi/uutiset/en/kaupunkiymparisto/carbon-neutral-helsinki, 20.09.18
[41] https://www.hel.fi/hel2/ksv/julkaisut/los_2016-6.pdf, 20.09.18
[42] https://www.espoo.fi/en-US/Housing_and_environment/Sustainable_development/Climate_goals, 20.09.18
[43] http://www.vantaa.fi/resurssiviisasvantaa, 20.09.18 (only in Finnish)

service.[44] The city of Turku favours e-vehicles in services bought by the municipality (taxi services for disabled people etc). Turku also currently develops innovative solutions for sustainable mobility of people and emission free freight logistics through a Horizon 2020 funded project CIVITAS ECCENTRIC. Among other concrete outcomes a Mobility Node will be developed to the Kupittaa district.[45]

The specific technologies, infrastructure, services, know-how related to e-mobility that is being implemented in Finland

Turku

E-cars and parking:

- There are 7 ev charging stations in downtown Turku at street parking zones where the parking is free of charge during the charging of the ev (max 4 hours). These charging stations are operated by a national company Liikennevirta Oy under the brandname Virta that has over 300 charging stations all around Finland and also an app for the easy use of navigation to the charging stations.[46]
- Also, private actors like gas stations, hypermarkets and shopping centres, some hamburger restaurants have installed ev charging points to their parking areas. At some of these stations (for example at IKEA) the charging is free of charge.
- The city of Turku has allowed changing some street parking spaces into ev charging stations where parking is free of charge during the stay of maximum 4 hours

E-busses:

- The bus line 1 is operated by 6 fully electric Linkker buses. There is one slow depot charging point and 2 quick charging points at the end stations of the electric bus line 1: one at the harbour and one at the airport. Turku's mobility planners but also R&D partner Turku University of Applied Sciences have gained much new know-how through the experiences with the implementation and operation of these fully electric buses.[47]

[44] https://www.turku.fi/en/news/2018-06-08_turkus-new-climate-plan-global-forefront, 20.09.18
[45] https://www.turku.fi/en/civitas-eccentric, 20.09.18 (For more information)
[46] https://www.virta.global/, 21.09.18 (For more information)
[47] https://www.foli.fi/en/ef%C3%B6li-electric-buses, 21.09.18 (For more information)

E-ferry:

- Turku's landmark river ferry Föri has been newly modernised from diesel to electric motor. Föri carries people across the river free of charge between Tervahovinkatu (on the east side) and Wechterinkuja (on the west side).[48]
- Finland's first first electric vehicle ferry Elektra started operation on a route between islands of Parainen and Nauvo in the Turku archipelago in June 2017. Elektra is operated by the publicly owned ferry operator Finferries, is free of charge to use for the passengers and recharges its batteries at each end of its run directly from the domestic power grid. The ferry also has pv panels.[49]
- Although not directly concerning Turku, the company Finnferries Ltd, which operates archipelago ferries (including the e-ferry Electra mentioned above), has just recently converted an old cable ferry into an e-cable ferry. First of its kind, this newly converted e-cable ferry may indicate that Finnferries Ltd. is looking for ways to electrify their extensive ferry fleet at least to some extent.

Other:

- Fully automated electric funicular is currently under construction and is expected to begin operation between Linnankatu street and the Kakola hill in late 2018. The funicular will be part of Turku's public transportation and free of charge for the passengers.[50]

Helsinki, Espoo and Vantaa:

E-cars and parking:

- In Helsinki, there is e-car charging infrastructure available in public places. In example Helsinki energy company Helen has over 40 charging points around Helsinki. The network is being expanded and developed.
- City of Espoo has been offering some parking lots for service providers to offer charging points for e-cars in the metro- and train stations.

[48] https://www.turku.fi/en/fori, 21.09.18 (For more information)
[49] https://www.finferries.fi/media/elektra-technical-data.pdf, 21.09.18 (For more information)
[50] https://www.foli.fi/en/funicular, 21.09.18 (For more information)

- Espoo -based energy company Fortum is having over 400 charging points around Finland (Fortum Charge & Drive)[51]
- In Vantaa the charging network is mainly developed by private service providers and located mainly in shopping malls or in private parking halls.
- Currently the City of Helsinki will grant a 50 percent discount on parking fees to low-emission passenger cars and light quadricycles run entirely by electricity.[52]

E-busses:

- Espoo has been testing 2 fast-charging e-busses in their bus fleet (busses by Linker) as a first city in Finland.[53]
- There is an e-bus charging station being planned to be constructed in Kivistö in Vantaa, estimated to be ready in 2020.
- There is an e-bus charging station under construction at Helsinki Central Railway station.

Helsinki Region Transport (HSL) is a joint local authority whose member municipalities are Helsinki, Espoo, Vantaa, Kauniainen, Kerava, Kirkkonummi, Sipoo, Siuntio and Tuusula. HSL has rented 12 e-busses from Linkker for transportation operators to test and educate the drivers with.

E-bikes:

- Within BSR-Electric project, Helsinki Regional Environmental Services is implementing a e-biking promotion campaign called "Virtaa Fillariin" (*~Electricity to bike*). The objective is to promote e-biking as an alternative to family's 2nd car. The campaign is implemented in 2018 and 2019.[54]
- Helsinki energy company Helen is providing a free charging station for electric cyclists in Helsinki. The e-bike charging station is the first of its kind in Finland and utilises solar panels and an electricity storage unit as power sources. The charging station obtains power

[51] https://www.fortum.fi/fortum-charge-drive-tietoa-meista, 21.09.18
[52] https://www.hel.fi/helsinki/en/maps-and-transport/parking/vahapaastoisten_alennus, 21.09.18
[53] https://www.espoo.fi/fi-FI/Ensimmaiset_kotimaiset_pikaladattavat_sa%2880532%29, 21.09.18

[54] https://virtaafillariin.fi/, 21.09.18

from the four solar panels on its roof. Any excess electricity is stored in a battery, from which it is available for charging bikes on days when there is no sunshine.[55]

E-logistics:

- There is some piloting done in the last-mile logistics in Vantaa Aviapolis and in Helsinki Jätkäsaari within the "The Last mile" – project. The project seeks smart mobility solutions for tourists, residents and commuters in the Helsinki metropolitan area.

E-scooters:

- No applications or initiatives related to e-scooters were pointed out by the interviewees.

E-ferries:

- There are ferries operating in Helsinki region, but currently none of them is electric.

Some additional notes on upcoming plans and potential

Turku:

In order to achieve carbon neutrality by 2029, Turku is investing heavily in clean transport solutions. One concrete example of this process is the CIVITAS ECCENTRIC project (https://www.turku.fi/en/civitas-eccentric) which will develop electric transport, shared use of cars and bicycles, and the Mobility as a Service (MaaS) model. The focus area is Kupittaa. The project will, for example, develop a mobility node to the Kupittaa district combining public transport with city bicycles and car sharing services. The project will also pilot different e-vehicles to be used by city employees and support the electrification of public transport. [56]

National:

The expansion of public EV charging infrastructure in Finland is boosted by the government's EUR 4.8 million subsidy. The objective in this public investment is to catalyze 15 million euros in investments to EV charging systems and triple the amount of public charging stations. The subsidy is targeted only to public smart charging stations and especially tries to boost the implementation

[55] https://www.helen.fi/en/news/2018/Charging-station-for-electric-cyclists-in-Katajanokka/, 21.09.18
[56] https://www.turku.fi/en/civitas-eccentric, 21.09.18

of fast chargers. The subsidy rate for normal chargers is 30 %. Half of the 5 million is allocated to fast chargers, which get a higher 35 % subsidy rate.

In spring 2018 the Ministry of Transport and Communications suggested granting a subsidy of EUR 400 to individuals buying an e-bike but this proposal was withdrawn before parliamentary vote due to heavy criticism. The proposed subsidy would have been part of the government's programme to promote walking and cycling.[57]

[57] https://yle.fi/uutiset/osasto/news/ministry_shelves_400-euro_subsidy_scheme_for_e-bike_purchases/10156559, 21.09.18

Finland's respondents have mostly been involved with e-buses, e-cars and e-bikes.

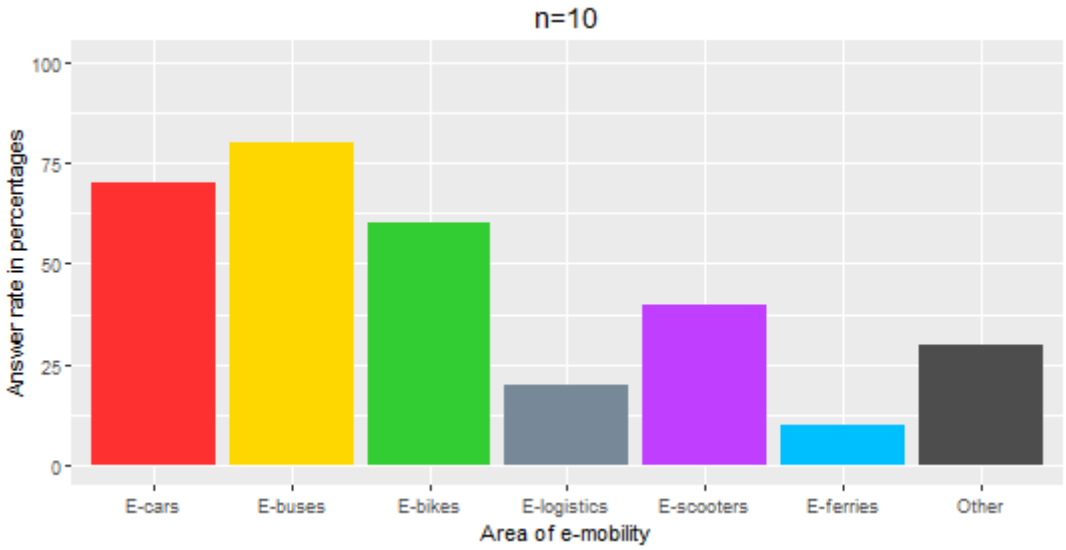


Figure 52 Finland's respondents involvement in e-mobility areas

Figure 49 describes in percentages how many among Finland's respondents have been involved with a specific e-mobility area. The question asked was: "Which application areas of e-mobility have you been involved with?". The "n" shows how many respondents were from Finland.

Finland's respondets have been most involved with e-buses, e-cars and e-bikes. Some have been involved with e-scooters. Only few have been involved with e-logistics and e-ferries. Finland's respondents might want to discuss the situation in e-logistics and e-ferries in Finland, whether it is sufficiently covered or not. Furthermore, the respondents could join a cooperation project with organisations from other countries and share their experience in e-buses, e-cars, e-bikes, e-scooter and e-ferries. The latter, because there is not many with e-ferry experience.

Finland's respondents have been identifing themselves most often in the role of making policies and/or legislations, developing service and providing support services to e-mobility. There are lot of plans and visions in Finland when it comes to e-mobility, but still the actual implementations are somewhat rare (despite the e-cars charging system which has been developing nicely as market-based development). E-bikes are still rare in Finland, even though their role as low-emission transporation is recognized. Good examples though exist – such as Turku e-busses and e-ferry Föri, as well as how Helsinki Region Transport (HSL) is providing 12 e-busses from Linkker for transportation operators to test and educate the drivers with.

Majority of the interviewees were people working for municipalities. Municipalities strongly saw themselves as facilitators of (commercial) solutons, not as solution providers. The role of the municipality seemed to be quite difficult to evaluate for the people who were interviewed and worked for the municipality. Even though they saw their role as a facilitator, it would be important for municipalities to understand their role as pioneer and the power of i.e. public purchasing.

It is though good to underline that making country-level conclusions based on interviews only in Helsinki and Turku region is fairly difficult in country size of Finland.

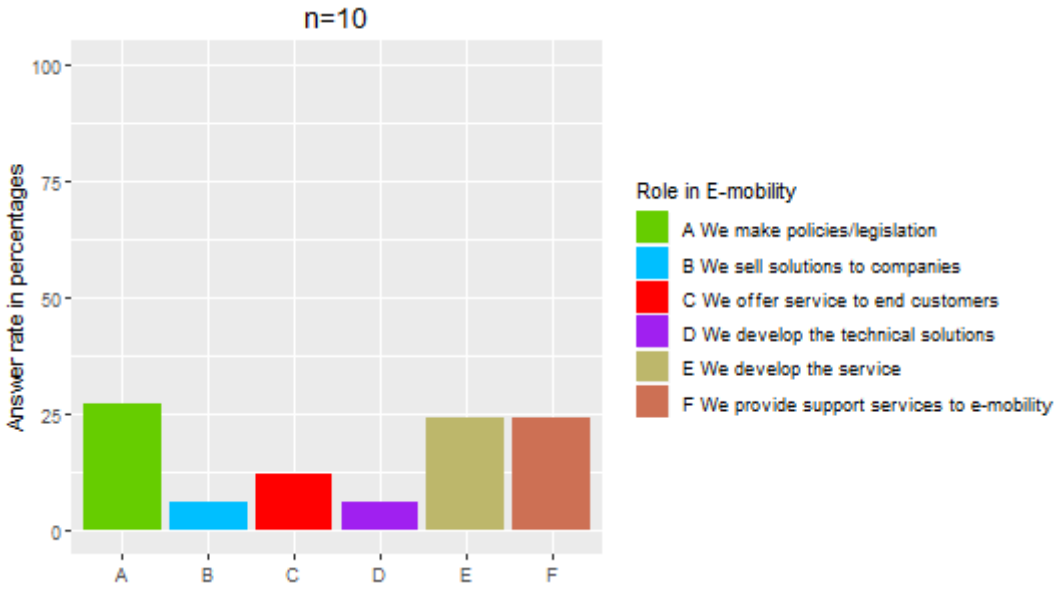


Figure 53 The roles of e-mobility in which Finland's respondents have been in

Figure 50 describes in percentages how many among Finland's respondents have identified themselves in a specific role in e-mobility. The question asked was: "Specify the role of your organisation in the following e-mobility areas". The "n" shows how many respondents were from Finland.

As seen from the graph, Finland's respondents have mostly been in roles of making policies and/or legislations, developing service and providing support services to e-mobility. There were respondents, who were in the role of offering service to the end customers. The roles of selling solutions to companies and developing the tehnical solutions were also mentioned, however only once. Finland's respondents could discuss, whether the roles of developing solutions and technical

solutions are present in Finland in a sufficient amount. If not, is there a possibility to take up the role oneself or is there any cooperation possibilities in partner or other countries.

The following list contains smart specialization strategies, cluster policies or initiatives that would be interesting for others to join with regard to e-mobility, brought out by Finland's respondents.

- Espoo E-busses and a robot-bus that is being developed in Finland and tested in Espoo (Otaniemi). It is the world's first winter-proof robotbus. The testing will be ready next spring (SOHJOA -project[58])
- The Finnish unique law about traffic services (Liikennekaari)
- City of Turku has laid ambitious Climate goals in the newly published Climate Plan.
- Team Finland is developing e-mobility issues on e.g. automation, these would be interesting to look at.

There is a map that shows manufacturers of products and solutions for e-mobility. The map can be seen by the following link:

- https://www.easymapmaker.com/map/953c4d07877adc64405706ed6b812486

The following list contains the Finland's respondents best practices in the e-mobility application area.

- Espoo e-bus pilot project (2 e-busses operating).
- The purchase of 12 e-busses and letting the operators to test them by HSL.
- Operational reliability was one important factor when the e-bus line was planned and therefore quick charging points were installed in both ends of the line even if just one could be enough.

[58] http://sohjoa.fi/sohjoa-in-english, 28.09.18

- Electrification of the previously diesel operated river ferry. Föri acts as an example of the local political will to follow the newly adopted municipal Climate Plan. According to the Plan the city area will be transformed carbon neutral by 2029.
- Free parking of electric vehicles while charging at one of the public charging stations located next to street parking in downtown Turku
- Turku Energia itself has 1 plug-in hybrid and 2 fully electric vehicles and thereby acts as an example of using e-vehicles in corporate operations.
- Exchange of information and knowledge through the national e-keko network.
- Proactivity and political leadership of the City of Turku in the willingness to test e-buses on a wide scale.
- The overall improvement of urban space, whether related to decrease of noise, exhaust fumes or other things.

The following list is the best practices Finland's respondents are willing to introduce to others.

- E-Vehicle charging systems
- The city gives operators street space for charging electric cars on specified terms. The city does not fund the implementation of charging points.
- The city develops and maintains the charging points master plan.
- Public charging points are not included in the city plans but in the deed of land.
- The experiences and lessons learned through changing bus line 1 electric in Turku and other forms of the electric public transportation (city ferry Föri) under the name "e-Föli"

The following list contains the Finland's respondents proposed project ideas that would be interesting to do in cooperation with.

- Development of residential charging stations
- Testing of any e-mobility transport mean by the municipality (including follow-up on the user experiences, climate impacts etc.)
- Helsinki and Tallinn twin-city program

Potential and plans in Finland by e-mobility areas

The expansion of public EV charging infrastructure in Finland is boosted by the government's EUR 4.8 million subsidy. The objective in this public investment is to catalyze 15 million euros in investments to EV charging systems and triple the amount of public charging stations. The subsidy is targeted only to public smart charging stations and especially tries to boost the implementation of fast chargers. The subsidy rate for normal chargers is 30 %. Half of the 5 million is allocated to fast chargers, which get a higher 35 % subsidy rate.

- **E-cars:** Charging system is already quite broad and has been growing on commercial basis.
- **E-buses:** Several cities are planning to test e-busses and are building up the charging infrastructure.
- **E-Bikes:** In spring 2018 the Ministry of Transport and Communications suggested granting a subsidy of EUR 400 to individuals buying an e-bike but this proposal was withdrawn before parliamentary vote due to heavy criticism. The proposed subsidy would have been part of the government's programme to promote walking and cycling.[59]
- **E-logistics:** Interest in first mile and last mile solutions, piloting and testing is made.
- **E-scooters:** Not mentioned
- **E-ferries:** There are several ferries around Finland, but there's no information on how many of them could potentially be electrified in the future.

Potential and plans in Helsinki region:

- **E-cars:** Charging system is already quite broad and has been growing on commercial basis.

[59] https://yle.fi/uutiset/osasto/news/ministry_shelves_400-euro_subsidy_scheme_for_e-bike_purchases/10156559, 21.09.18

- **E-buses:** Cities are building up the charging infrastructure for e-busses and piloting them in the near future.
- **E-Bikes:** E-bikes are getting more popular. Campaing "Virtaa fillariin" (*~Electricity to bike)* is promoting e-biking in Helsinki region.
- **E-logistics:** First mile and last mile piloting done in Helsinki, Espoo and Vantaa. Possibility for e-mobility solutions.
- **E-scooters:** Not mentioned
- **E-ferries:** There are ferries operating in Helsinki, but there's no information on how many of them are potentially planning for electrifying them.

Potential and plans in Turku region:

- **E-cars:** The CIVITAS ECCENTRIC project is aiming to develop car-sharing in the city of Turku. Some of the service providers will most likely introduce also e-cars and thus widen the current fleet of e-cars.[60]
- **E-buses:** The electrification of bus line 1 will take a step forward during the CIVITAS ECCENTRIC project. New e-busses have been procured and the entire bus line is now electrified. More e-busses will be eventually introduced, if technical challenges can be successfully solved.
- **E-Bikes: T**he CIVITAS ECCENTRIC project will develop a mobility node in the Kupittaa district. The node will combine public transport with city bicycles and shared cars.[61]
- **E-logistics:** Not mentioned
- **E-scooters:** The CIVITAS ECCENTRIC project will include a pilot where smaller e-vehicles (including e-scooters) will be tested by city employees. The experiences gathered via this pilot may affect the decisions the city of Turku takes in terms of procuring smaller e-vehicles for work related travel inside the city for its employyes.

E-ferries: Although not directly concerning Turku, the company Finnferries Ltd, which operates archipelago ferries (including the e-ferry Electra mentioned above), has just recently converted an old cable ferry into an e-cable ferry. First of its kind, this newly converted e-cable ferry may

[60] https://www.turku.fi/en/civitas-eccentric, 21.09.18
[61] *Supra* note 61

indicate that Finnferries Ltd. is looking for ways to electrify their extensive ferry fleet at least to some extent.

7.8.1 Key ideas from Finland:

1. Finland has electrical ferries and busses fully operating. There is extensive know-how what works in this segment.
2. Encourage citizens to replace second car to e-bikes. However, it is crucial to develop infrastructure and legislation, and to offer incentives for full deployment. In addition, offering possibilities to test e-bikes shows a lot of promise to encourage people.
3. Bigger PTA's are involved in a national e-bus network "e-Keko" which is a network for knowledge and experience sharing. Its members include PTA's from bigger Finnish cities currently operating e-buses, service providers and representatives from research organisations and ministries. The network meets 3-4 times per year to share experiences and knowledge.
4. Offering a test platform for bus operators who are in the process of switching to e-buses may be a good way to lower the barrier for operators to invest in e-buses (for more information see the HSL example from above).

8 Appendix

8.1 Appendix 1: Questionnaire

E-mobility Stakeholder's Survey

Part 1. General questions

1.1. Please select your country

- [ ] A Germany
- [ ] B Poland
- [ ] C Latvia
- [ ] D Estonia
- [ ] E Finland
- [ ] F Sweden
- [ ] G Denmark
- [ ] H Norway

1.2. What is the name of the organisation?

1.3. What is the type of your organisation?

- [ ] A Ministry or other national authority
- [ ] B Local municipality
- [ ] C Educational institution
- [ ] D Public enterprise
- [ ] E Private enterprise
- [ ] F National NGO
- [ ] G Other (please specify) _____

**Questions 1.4. and 1.5. will be asked only if the answer to question 1.3. was 'Local municipality'.*

1.4. What is the name of the municipality?

1.5. What is the size of the municipality?

- ☐ A Large city (with tram, rail, bus, subway etc transport)
- ☐ B Middle sized town (with some bus lines)
- ☐ C Small town (with no regular public transport lines)

1.6. How many years has your organisation been involved in e-mobility planning activities?

- ☐ A Over 20 years
- ☐ B 11-20 years
- ☐ C 6-10 years
- ☐ D 3-5 years
- ☐ E 1-2 years
- ☐ F Less than 1 year
- ☐ G Do not know

1.7. How many employees in your organisation are involved in activities related to e-mobility?

Please make sure you count in only the employees of your organisation that deal with e-mobility specifically, not the whole organisation. Please insert the number of people.

☐ employees

1.8. What was the total revenue/budget of your organisation in 2017?

Please insert the revenue/budget in number.

☐ A ☐ €

	B	Do not know
	C	Not applicable

1.9. What was the revenue/budget in 2017 for e-mobility related activities in your organisation?

Please insert the revenue/budget in number.

	A		€
	B	Do not know	
	C	Not applicable	

Part 2. Policies

For the following questions it is important to specify which e-mobility application the given answer is applicable to. E-mobility applications that are in the focus of the survey are:

- *E-logistics*
- *E-bikes*
- *E-scooters*
- *E-buses*
- *E-ferries*
- *E-cars (like Nissan Leaf or Tesla)*

Please mark also whether the given answer applies to a local municipality, regionally or nationally.

4.1. What are the relevant policies related to promotion of e-mobility in your region? (For example tax benefits or parking etc.)

Please select which e-mobility application the given answer is applicable to and whether it applies to a local municipality, regionally or nationally.

		E-logistics	E-bikes	E-scooters	E-buses	E-ferries	E-cars	Other	E-mobility in general	Municipality	Regional	National
A												
B												

C												
D												
E												

2.2. What specific technologies, infrastructure, services, know-how related to e-mobility is being implemented in your region? (For example public charging network etc.)

Please select which e-mobility application the given answer is applicable to and whether it applies to a local municipality, regionally or nationally.

		E-logistics	E-bikes	E-scooters	E-buses	E-ferries	E-cars	Other	E-mobility in general	Municipality	Regional	National
A												
B												
C												
D												
E												

2.3. What (measurable) impacts have e-mobility applications brought to the region? (For example reduced $C0_2$, less noise, market share of e-solutions etc.)

Please select which e-mobility application the given answer is applicable to and whether it applies to a local municipality, regionally or nationally.

		E-logistics	E-bikes	E-scooters	E-buses	E-ferries	E-cars	Other	E-mobility in general	Municipality	Regional	National
A												
B												
C												

D												
E												

Part 3. Experience with e-mobility

3.1. Which application areas of e-mobility have you been involved with?

You may choose more than one answer if applicable.

	A	E-logistics
	B	E-bikes
	C	E-scooters
	D	E-buses
	E	E-ferries
	F	E-cars
	G	Other (please specify)

3.2. Please specify the role of your organisation in the following e-mobility areas.

Ask this question only about the e-mobility areas that the respondent chose in question 3.1. If the area is not applicable to the organisation, please choose 'N/A'. You may choose more than one answer if applicable. You can also ask the respondent to comment his/her answer and describe their organisation's role more thoroughly. In that case please write the answer to question 3.2.1.

	We make policies / legislation	We sell solutions to companies	We offer service to end customers	We develop the technical solutions	We develop the service	We provide support services to e-mobility	Other (please specify)	N/A
A E-logistics								
B E-bikes								
C E-scooters								
D E-buses								

E	E-ferries								
F	E-cars								
G	Other								

3.2.1. OPTIONAL! Would you like to comment your answer? Would you describe the role of your organisation?

8.1.1.1 GOOD PRACTICE

3.3. What are the advantages of ..... technology (product or service) compared to other technologies?

On the dotted line you can add what technology the respondent is speaking about (it can be a specific technology (batteries etc) or an e-mobility application in general (e-bikes etc)).
Ask this question only about the e-mobility areas that the respondent chose in question 3.1.
If the given advantage is not applicable to any of given applications or the respondent doesn't know, please choose 'N/A'.
You can also ask the respondent to comment his/her answer and describe the advantages more thoroughly. In that case please write the answer to question 3.4.1.

	More user friendly	More environ-mentally friendly	TCO – total cost of owner-ship	Long-term economic benefits	Higher efficiency of tech-nology	Longer expected life-span	Image	Other (please specify)	N/A
A E-logistics									
B E-bikes									
C E-scooters									
D E-buses									
E E-ferries									
F E-cars									
G Other									

3.3.1. OPTIONAL! Could you please comment the advantages of the technology?

3.4. What have been the best practices in the e-mobility application area? Please describe each practice separately.

Please select which e-mobility application the given answer is applicable to and whether it applies organisationally, regionally or nationally.

		E-logistics	E-bikes	E-scooters	E-buses	E-ferries	E-cars	Other	E-mobility in general	Organisational	Regional	National
A												
B												
C												
D												
E												

8.1.1.2 LESSONS LEARNT

3.5. Please evaluate the limiting factors in your country/region related to application of e-mobility products/services.

You can show the list to the respondent, so it is easier to answer. If an aspect is not relevant for the organisation please choose 'Do not know'. You can also ask the respondent to comment their answer more thoroughly. In that case please write the answer to question 3.5.1.

		This is not a problem	This is a small problem	This is moderate problem	This is significant problem	This is a major problem	Do not know
A	Problems related to laws/regulations in our country						
B	Conservative credit policies in banks						
C	Lack of financial means						
D	Internal problems in our organisation						
E	Lack of skills/competence among our employees (please specify missing skill)						
F	High costs associated with accessing and transferring knowledge						
G	Lack of foreign contacts						
H	Limited availability of skilled local professionals and competence						
I	Barriers for hiring skilled international specialists						
J	Limits in production capability for markets with big demand						
K	Lack of the most up-to-date technology in our use						
L	Lack of consistence and coherence in our R&D work						

M	Limited availability of charging infra-structure						
N	Limited range/performance of currently available batteries						
O	Low cost efficiency of the technology compared to gasoline/diesel engines						
P	Lack of motivation of consumers to engage with e-mobility						
Q	Lack of suitable e-vehicle models						
R	Low technology readiness level (TRL) of solutions						
T	Other problem (please explain)						x

3.5.1. OPTIONAL! Could you please comment your answer?

3.6. What kind of challenges / obstacles have you faced in the e-mobility application area? What was (were) the solution(s) to each obstacle/challenge?

		E-logistics	E-bikes	E-scooters	E-buses	E-ferries	E-cars	Other	E-mobility in general	Organisational	Regional	National
A	*Challenge / Obstacle*											
	Solution(s)											
B	*Challenge / Obstacle*											
	Solution(s)											
	Challenge / Obstacle											

C	*Solution(s)*												
D	*Challenge / Obstacle*												
	Solution(s)												
E	*Challenge / Obstacle*												
	Solution(s)												

3.7. If you would start the e-mobility initiative/development again, what would you do differently?

Please select which e-mobility application the given answer is applicable to and whether it applies organisationally, regionally or nationally.

		E-logistics	E-bikes	E-scooters	E-buses	E-ferries	E-cars	Other	E-mobility in general	Organisational	Regional	National
A												
B												
C												
D												
E												

3.8. What would it take to manage a complete shift from fossil to electric vehicles? Please describe the actions and expected results.

Please select which e-mobility application the given answer is applicable to and whether it applies organisationally, regionally or nationally.

		E-logistics	E-bikes	E-scooters	E-buses	E-ferries	E-cars	Other	E-mobility in general	Organisational	Regional	National
A	*Action*											
	Result											
B	*Action*											
	Result											
C	*Action*											
	Result											
D	*Action*											
	Result											
E	*Action*											
	Result											

3.9. What do you think, how different modes of transportation could be combined into one intermodal e-mobility chain? Please describe the possible intermodal e-mobility chain.

8.2 Part 4. Future perspectives and cooperation

4.1. Do you know of any smart specialisation strategy, cluster policy or initiative that would be interesting for others to join with regard to e-mobility in your region/country?

☐	A Yes (please specify)	
☐	B No	

4.2. Is your organisation interested in participation in e-mobility related cooperation projects and/or clusters?

You may choose multiple answers if applicable.

☐	A Yes, on local/regional level	
☐	B Yes, on state level	
☐	C Yes, on cross-border cooperation level in Baltic Sea region	
☐	D Yes, on global level	
☐	E No (if 'No' then why?)	

The following questions in PART 4 will be asked only if the answer to question 4.2. was either A, B, C or D.

4.3. What is the name of your proposed project(s)/initiative you would be interested in participating in cooperation with?

4.4. What are the 5 most important aspects that could help the development of activities related to e-mobility in your organisation?

You can show the list to the respondent, so it is easier to answer. You can also ask the respondent to comment their answer more thoroughly. In that case please write the answer to question 4.4.1.

☐	A	Improvement of local/regional/national legislation
☐	B	Clear definition of roles and responsibility areas of organisations involved in the area
☐	C	Conditions for fair competition regarding service/technology providers
☐	D	Support and cooperation with (other) public organisations
☐	E	Cooperation with (other) scientific organisations in the region
☐	F	Cooperation with (other) scientific organisations internationally
☐	G	Cooperation with (other) private sector organisations in the region
☐	H	Cooperation with (other) private sector organisations internationally
☐	I	Cross-disciplinary or cross-industrial cooperation
☐	J	Increasing the awareness of local population and/or involving them in using/testing the services/technologies
☐	K	Synchronization/availability of databases between different organisations
☐	L	Availability of local skilled professionals and competence
☐	M	Availability of international skilled professionals and competence
☐	N	Availability of some unique technology or know-how
☐	O	Availability of testing services and set levels of standardization
☐	P	Availability of efficient and low-cost information sharing and knowledge access/transfer mechanisms
☐	Q	Availability of financial incentives from the local/regional/state authorities
☐	R	Availability of charging network for the batteries
☐	S	Other aspect (please explain)

4.4.1. OPTIONAL! Would you like to comment your answer?

4.5. In which e-mobility areas is your organisation capable and interested in cooperation?

☐	A	E-logistics
☐	B	E-bikes
☐	C	E-scooters
☐	D	E-buses
☐	E	E-ferries
☐	F	E-cars
☐	G	Other (please specify)

4.6. What type of future cooperation partners is you organisation interested in?

☐	A	Local/regional companies and enterprises
☐	B	Other local R&D institutions, departments
☐	C	Educational institutions, schools
☐	D	International companies, enterprises
☐	E	International R&D institutions, departments
☐	F	Regional/local public sector organisations
☐	G	Other (please specify)

4.7. What kind of future cooperation areas is your organisation interested in?

☐	A	Sales and marketing
☐	B	Research and development
☐	C	Language and communication
☐	D	Investment support

	E	R & D support
	F	Networking
	G	Strategic planning
	H	Export-oriented know-how and marketing (taxes, permits etc.)
	I	Other (please specify)

4.8. Please list (best) practices you are ready to introduce to others?

A	
B	
C	
D	
E	

4.9. OPTIONAL! What are the most critical success factors for other players to remember in order to apply your best practice in their country?

A	
B	
C	
D	
E	

4.10. Contacts of the respondents

Contact person's name	
Department	
Address	
Telephone	
E-mail	
Webpage	

4.11. Would you like to receive information (by e-mail) regarding the e-mobility project?

	A Yes
	B No

8.3 Part 5. Additional comments

5.1. Is there anything else you would like to add regarding the survey?
