D2.5: Future strategies and recommendations to support e-mobility

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D2.5: Future strategies and recommendations to support e-mobility

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Technical References

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[1] PU = Public

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0 EXECUTIVE SUMMARY

This document is the deliverable “D2.5 - Future strategies and recommendations to support e-mobility” of the H2020 project INCIT-EV (project reference: 875683).

The main objective of this deliverable is to propose policies and measures that encourage the transition to electric vehicle, and this resulted in the definition of:

1. Strategies for the integrated and sustainable charging infrastructure development;
2. Strategies to foster electromobility acceptance among users;
3. Recommendations for setting up a common EU methodology to assess user’s perspective regarding e-mobility and Charging Infrastructure.

In order to achieve the objectives, the following material coming from different project activities were analyzed (WP2, WP9): barriers to e-mobility highlighted by the stakeholders involved in the project; factors influencing EV penetration; interviews to professionals; contribution of public investments to promoting the e-mobility; results from an experiment conducted during the III Steering Committee in Tallin (October 2023); results collected during ad-hoc meetings with selected stakeholders.

The strategy for the charging infrastructures development has been addressed dividing it into these different sub aspects: logistics for the distribution of electric chargers within cities and in the periphery; technical constraints of the e-chargers; best way to incentivize the installation of electric chargers; electrical grid reinforcement to undertake the transition to electric vehicles; business models; standardization and interoperability of different systems.

Regarding strategies to foster acceptance, the study has highlighted how this acceptance and consequent diffusion of electric mobility are aspects strongly linked to the level of knowledge of the technologies, the diffusion of charging infrastructures, the possibility of having incentives to reduce the purchase price of vehicles and charging infrastructure. However, other topics were considered important such us the accessibility to people with disability, the diffusion of electric car sharing, or a regulatory system that enables the proper use of charging stations.

Finally, through the activities performed in WP2 including surveys to users and public consultation with interviews and focus groups, a range of issues for setting up a common methodology to assess user’s perspective related to electric vehicle adoption and charging services were identified that can be useful for future studies.

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Figures and Tables

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1 INTRODUCTION

1.1 Objectives

The objectives of Task 2.5 are the following:

- steer strategies to develop, in an integrated and sustainable way, the charging infrastructure network;
- elaborate European strategies to foster electric mobility acceptance;
- provide recommendations for setting up a common EU methodology to assess users' perspective regarding electric mobility and charging infrastructure.

This Task leverages on the input coming from Task 2.1, Task 2.3 and Task 2.4 and underlying the activities that led to the results of the task is the involvement of the SHs identified in Task 2.2 and involved to share information, experiences and contributions toward the overall benefit of the entire system.

1.2 General methodology

In order to achieve the objectives, it was decided to proceed collecting and analyzing a series of elements coming from different project activities and considered useful for the purpose:

- best practices of interest, with reference to charging infrastructures (the core of the project), but also to electric mobility in general (*Chapter 2 - Best practices analysis*).
- results of the Task 2.3 activities (D2.3, Discrete choice model + Surveys) that drew a framework of users' habits and relevant factors they consider for their decisions or feelings with respect to electric vehicle and charging (*Chapter 3 - Users' expectations and concerns about e-mobility*)
- the DSS developed in INCITEV to support to support municipalities, authorities, agencies, and other stakeholders in planning the optimal charging stations framework and in estimating the impacts of planned scenarios (*Chapter 4* - A Decision Support *System* (DSS) to Support Mobility **planners and Policy makers***)*
- relevant results coming from Work package 9 of INCITEV project (*Chapter 5 - Relevant Results from WP9*):
    - technical, commercial, and political barriers to e-mobility highlighted by the stakeholders involved in the Task 9.1 activities (D9.1 - Use cases value proposition)
    - factors that most influence the EV penetration in the cities/countries where the use case on the project are placed (Task 9.1; D9.2 Demand Scenarios)
    - interviews done in Task 9.1 (D9.2 Demand Scenarios) to know the professionals' perspectives. Several professional interviews were organised in the four countries to extract relevant information from people with advanced knowledge of the related technology and the associated business models

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  - contribution of public investments to promoting the e-mobility
  - results coming from an experiment conducted during the III Steering Committee in Tallin (October 26th, 2023)

- material collected during *ad-hoc meetings* with selected stakeholders organized to analyse the new challenges of electro-mobility, considering the needs that still exist and the possible actions and strategies that could be put in place to overcome any limitations (*Chapter 6 - National ad-hoc meetings*).

The information obtained will be relevant to propose policies and measures that encourage the transition to electric vehicle, that is to say (*Chapter 7- Strategies and recommendations*):

1. Strategies for Recharging Infrastructure Development.
2. Strategies to foster electromobility.
3. Recommendations for setting up a common EU methodology to assess user's perspective regarding e-mobility and Charging Infrastructure

To the extent that the ecological transition towards the electric vehicle fundamentally seeks the greatest positive environmental impact, the best policies or measures that accelerate electric mobility from the infrastructure and vehicle side will be different depending on certain parameters and characteristics of the cities and countries involved. That means that in general terms, where possible, the strategies will be adapted to leading, following, and lagging countries and, inside each of them, depending on the physiognomy of the cities and other factors.

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2 BEST PRACTICES ANALYSIS

2.1 Methods to collect best practices

The collection of best practices was initially conducted through the preparation of a structured form to systematically collect the following information:

- Title
- General description of the practice/action/measure/policy
- Main actors involved.
- Role of Public Administration, if involved
- practice/action/measure/policy addressed to
- Country(ies) of implementation
- Territorial level
- Current state
- Date or expected date of start [MM/YYY]
- Date or expected date of conclusion [MM/YYYY]
- Website and references
- Goals achieved and non-achieved.
- Barriers
- Budget
- Financial resources
- Transferability and scalability
- Future improvement

The form (see Annex 1 – Form to collect best practices) was disseminated starting in February 2023, online and in hard copy, by all partners involved in Task 2.5 to the stakeholders identified in Task 2.2 (categories: government, business, civil society, research) and to additional new actors identified in the specific activity. By the end of the summer, the contribution of external stakeholders involved was extremely low, so it was decided to proceed with the desk analysis, starting with the sources in the Table 1, later supplemented in the course of the work.

Name	Description	www
Policies Database	The IEA's Policies and **Measures Database** provides access to information on past, existing or planned **government policies and measures** to reduce greenhouse gas emissions, improve energy efficiency and support the development and deployment of renewables and other clean energy technologies	https://www.iea.org/policies?region%5B0%5D=Europe&sector%5B0%5D=Road%20transport&technology%5B0%5D=Battery%20electric&technology%5B1%5D=Electric%20charging%20infrastructure&status=In%20force&jurisdiction=City%2FMunicipal&year=desc
Interreg Europe Policy Learning Platform	It aims to **boost EU-wide policy learning** and builds on good practices related to regional development policies	https://www.interregeurope.eu/policy-solutions/good-practices
EMOBICITY project	**E-mobility Good Practices Report**. It is based on the information available by the Interreg Europe Policy Learning Platform (good practices validated, webinars, policy briefs, etc.)	https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1618498900.pdf
EMOBICITY project	EMOBICITY Project good practices	https://projects2014-2020.interregeurope.eu/emobicity/good-practices/ https://transport.ec.europa.eu/system/files/2021-05/stf_handbook.pdf

Table 1 – Preliminary source for best practice collection

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Best practices were classified with reference to four categories:

- Engineering & product development (best practices related to technical aspects of e-mobility) e.g. :
  - On-board recharge technologies
  - Recharge infrastructures.
  - Batteries
  - Management and optimization of electrical grid
  - Maintenance
  - Safety and monitoring systems
  - Payment system
  - Improvements to vehicles performance

- Policies & measures (best practices at regulatory and organizational level to incentivize e-mobility development) e.g. :
  - Local and European regulations
  - Incentives to the acquisition of EV
  - Regulation favourable to EV and/or against ICE vehicles
  - Availability and support to private charging (at home or at work)
  - Availability and support to opportunity chargers on the street and ultrafast charge along highways
  - Tax reduction.
  - Incentives
  - Integrated planning
  - Traffic management measures (e.g. dedicated traffic lanes for EVs, free parking, free access to traffic-restricted areas)
  - Tariffs
  - Interoperability and e-roaming agreements
  - Internal organization models for Public Administration and Local Public Transport companies
  - Training of personnel and HR strategies
  - Networks, platforms, and events for know-how sharing.

- Investments, funding and business models (best practices to promote investments on e-mobility) e.g.:
  - Funding strategies
  - Private Public Partnership
  - Drafting of service contracts and concession contracts
  - Business models

- Marketing & awareness promotion (best practices to commercially promote e-mobility and to divulgate EV culture and technologies to potential users) e.g. :
  - Marketing strategies
  - Promotions on tariffs and mobility packages (e.g. MaaS)
  - Organization events, talks, round tables
  - Organization of open days, free trials
  - Promotion of e-mobility for companies, mobility managers
  - Strategies to increase garages and service points qualified for EV.

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2.2 The selected best practices

Table 2 summarizes the best practices selected and considered of interest for the project and task objectives.

Although the desk analysis provided much of the information, it often lacked some of data required in the form described in the previous section. For this reason, simplified summary sheets have been produced to describe their main features, as shown in Annex 2 – Best practice description.

33 best practices characterised as presented in Figure 1 were analysed and reported.

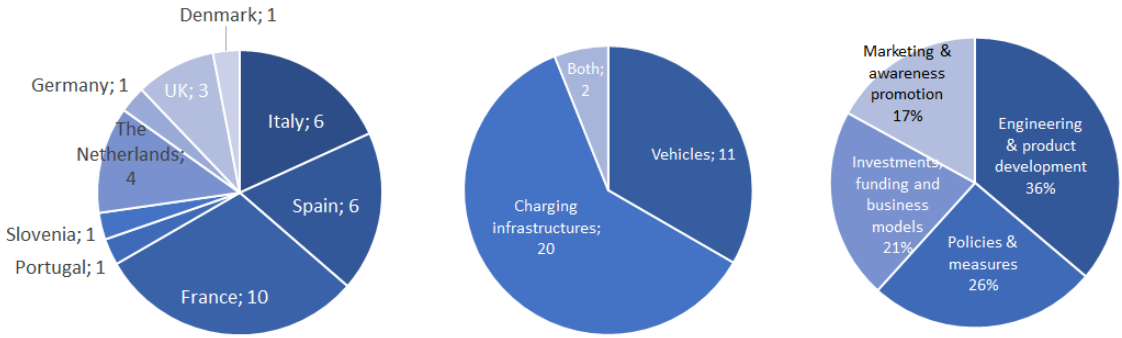

Figure 1– Characteristics of 33 best practices analyzed

TITLE	Topic		Typology				Country
	Vehicles	Charging infrastructures	Engineering & product development	Policies & measures	Investments, funding, and business models	Marketing & awareness promotion	
New charging stations in Turin		x		x			Italy
Exploring the interoperability between public transport and electric vehicles infrastructures in Turin		x	x				Italy
Smart streetlights in Verona		x	x				Italy
'Electrify Verona' project	x	x	x	x			Italy
A short-and long-term rental and maintenance service for electric vehicles in Reggio Emilia	x				x		Italy
EV Access in Florence's Limited Traffic Zone	x			x			Italy
Access to reserved traffic lanes for EVs	x			x			Spain
Streetlights used to recharge electric cars in Valencia		x	x				Spain

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TITLE	Topic		Typology				Country
	Vehicles	Charging infrastructures	Engineering & product development	Policies & measures	Investments, funding, and business models	Marketing & awareness promotion	
Sustainable electric charging stations in Segovia		x	x				Spain
The largest electric charging station in Spain		x	x				Spain
The most powerful urban EV charger in Spain		x	x				Spain
Battery swapping in a car sharing service		x	x				Spain
Concept of integral development of infrastructures for mass charging of electric vehicles		x				x	France
Web site of information for the public on electric mobility	x	x				x	France
Electric vehicle charging station financing program (ADVENIR)		x			x		France
National incentives to buy electric vehicles ("bonus écologique")	x				x		France
Social Leasing for electric vehicles	x			x		x	France
Regional incentives for electric vehicles (Ile de France; Auvergne Rhône Alpes; Normandie; Grand Est, Occitanie)	x				x		France
Municipality incentives for electric vehicles (Saint Maur city Centre Val de Loire)	x				x		France
Developing the purchase of EVs during the process of renewal of the university's vehicle fleet	x			x			France
Purchase of electric or hybrid vehicles when replacing service vehicles	x			x	x		France
Installation of electric charging stations available for private vehicles of the staff and of external visitors		x		x	x		France
Energy efficiency campaign with charging station prize in Azores		x				x	Portugal
Real use cases connected to smart charging		x	x				Slovenia
35.000 new smart chargepoints in 3 provinces / 74 municipalities	x			x			The Netherlands
Amsterdam's demand-driven charging infrastructure		x			x		The Netherlands
Pro-active preparation & demand-driven installation		x		x			The Netherlands
Battery swapping in 5 minutes		x	x				The Netherlands

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TITLE	Topic		Typology				Country
	Vehicles	Charging infrastructures	Engineering & product development	Policies & measures	Investments, funding, and business models	Marketing & awareness promotion	
"Fleetalyzer" – Analyzing the potential of substitution of vehicles in fleets with electric cars	x		x				Germany
Pop-up EV charging points in Oxford		x	x				UK
Hidden EV charging points in Barnet		x	x				UK
On-Street Residential ChargePoint Scheme guidance for local authorities		x			x		UK
Battery swapping near to borders		x	x				Denmark

Table 2 – Best practices

To complete the framework of best practices, the 2022 update of comprehensive overview for EV tax benefits and purchase incentives in the European Union, according to ACEA (European Automobile Manufacturers' Association), is presented in Annex 3 – Tax benefits/purchase incentives for EVs in the 27 EU member states (2022).

It shows the fiscal measures for buying electric vehicles that are currently available in the 27 EU member states, looking at tax benefits (related to vehicle acquisition and ownership, as well as company cars) and purchase incentives, such as bonus payments or premiums for buyers.

Nearly all EU member states offer some form of fiscal support to stimulate the market uptake of electric vehicles, but both the nature and the monetary value of such tax benefits and purchase incentives still differ widely across the European Union.

In particular, 21 EU member states (four more than in 2021) offer incentives for the purchase of electric vehicles. Six countries (four less than last year) do not provide any purchase incentives, but they grant tax reductions or exemptions for electric vehicles (Bulgaria, Denmark, Estonia, Latvia, Malta, Slovakia).

2.3 Lessons learned

Recent measures to push and increase electric mobility are mainly aimed at involving operators to equip territories, and especially cities, with more charging infrastructures.

The focus here is on pro-active preparation & demand-driven charging point installation and reducing land occupancy related to charging infrastructures, as well as visual impacts.

Cities try to install new charging infrastructures at locations requested by citizens, according to city's installation plans, and charging solutions that take advantage of street furniture already present in cities (i.e.

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street lighting columns with integrated electric vehicle charging points) or charging solutions that are small and disappear when not in use (retractable charging points) are proposed.

There are experiences with the creation of charging hubs, with high parking capacity, near railway stations or arterial roads, as well as battery swapping experiments.

There are numerous governmental economic efforts to promote electric mobility:

- funds for the construction of charging infrastructures (including domestic ones)
- incentives for purchasing electric vehicles.
- long-term rental offer for electric cars to enable the most modest households to switch to electric.

In many countries there are still active or new initiatives to promote electric mobility. However, a new trend has appeared recently in those countries/cities where the spread of electric cars has already reached medium-high levels. They are starting to take a different direction aimed at restoring high economic losses, due to the exemption for electric vehicles to pay some taxes (first and foremost the road tax), or exemptions and or reductions in the cost of parking or access to UVAR (Urban Vehicle Access Regulation) areas. There is also a loss in collected taxes due to the reduced fuel consumption resulting.

In Norway, for instance, the boom in electric cars generated a tax shortfall estimated at around 2 billion euros. A shortfall that lawmakers want to remedy by eliminating some of what are called "privileges" introduced over the past decade, reintroducing 25% VAT for electric cars priced above 500,000 Norwegian kroner (about 50,000 euros), the registration tax and the road tax.

Switzerland, where 20 % of cars sold each year are now electric, will reintroduce for electric cars the 4% tax that is applied for all vehicles to the import price.

British government has also announced that by 2025 electric vehicles will be required to pay VED (Vehicle Excise Duty), the annual motor vehicle tax, as endothermic cars.

And some cities in Ireland (e.g., Waterford) have said they can no longer financially support free parking for EVs due to the increase in the number of electric vehicles, reintroducing paid parking in early 2023.

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3 USERS' EXPECTATIONS AND CONCERNS ABOUT E-MOBILITY

I Task 2.3 tried to draw a framework, as complete as possible, of users' habits and relevant factors they consider for their decisions or feelings with respect to EV and charging.

Specifically, the most important aspects addressed by Task 2.3 were:

- General information about the characteristics and habits of users, as well as their preferences regarding e-mobility
- Identification of the relevant factors for potential EV users when decide to buy an EV or other type of vehicle.
- Specification of the relevant attributes for EV users regarding public charging infrastructure
- Unveil the expectations, fears of end users with respect to EV.
- Understand trends in mobility changes that will have an impact on the EV adoption and penetration.

To obtain this information, three approaches were considered:

- Online surveys, to obtain different types of information from the participants including socio-demographic data, car ownership and usage and parking habits and other specific topic for EV already owners.
- Preference questions (Discrete Choice Model experiments) to rank the factors that end users consider when they have to make a decision. Two different tests were considered to investigate what factors are important when buying a new car and for public electric charging.
- Face to face interviews, to obtain qualitative information about the expectations, fears and perceived risks from users.

The following are a summary of the Task 2.3 main results. For further details refer to Deliverable 2.3 and its annexes.

3.1 Online survey

In this chapter the evidence about owners and users of electric vehicles are summarized.

Unless made explicit, quantitative data reported refer to averages for all countries involved in the survey:

- **Brand.** Tesla is the leading brand in all countries. The other brands alternate positions depending on the country.
- **Experience using EVs.** In all countries, participants report mostly an experience between 1 and 3 years with EVs. The exception is Estonia, where the most frequent range is <1 year.

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- **Perception of the EVs.** The most valued attributes are linked to environmental friendliness. The least valued attributes are related to safety and costs.
- **Relevant factors to buy an EV.** The four most important attributes when buying an electric car are: environmental friendliness, safety, reliability, consumption. On the other hand, those attributes that were selected less frequently as very important are: resale value, brand, tax advantages, interior space.
- **Use of EVs.** Electric cars use decreases with the distance to be travelled. Commuting and short trips are dominant. This behaviour is replicated in all countries.
- **Battery level before charging.** 50% charge their vehicle when the battery is between 10-30%. 22% charge when the battery is at 30-50%
- **Battery level after charging.** 14% do not charge the vehicle to 100%. 36% indicate that they always charge the vehicle to 100%, while 43% only do it occasionally due to time constraints. The remaining 7% also charge the vehicle to 100% but only on days when they do not use the car.
- **Charging location.** When at home the 80% of users charge their car at home. The 20% are users that cannot charge at their private parking, use indistinctly any charging stations around their residence. When not at home, 84% EV users report that they have the possibility charge at work, and almost half of the participants use it frequently. Other charging stations are available for charging close to the work/study place for more than 75% of the participants. The use of these public charging stations at work varies between 15% and 20%. The behaviour of the drivers changes slightly while using their EV for other activities. The availability of charging options is more or less the same, but there is an increased use of public parking charging or chargers at commercial areas.
- **Charging at home.** The most common charge duration is between 3 and 5 hours (15-20% of the participants). There are differences depending on the day of the week. During workweek days, the more frequent time slots are: 0-3 am, 3-6 am, 9 pm-00 and the percent of charging time decreases during the working time. During the weekend, the distribution is much more fragmented and there are not many differences between slots.
- **EV daily use.** Electric cars are used for commuting and short trips regularly: 5-20 km one way trip 56% (10-20 km one way trip 20%). 80% regularly charge outside home for 3-4 hours at work or 1-2 hours in other activities. Preferred car over ICEs when both are available.
- **Fast or ultra-fast public charging points.** There is a consensus in all countries regarding the use of fast or ultra-fast public charging points: 1 out of 4 (most frequent response) would only use it if the price of electricity does not go up. 14% are reluctant to switch regardless of cost. 9% would use the service regardless of a cost increase. Each increase in cost implies less acceptance by the population.
- **Knowledge about wireless charging technology.** Almost 1/3 of the respondents claim to have seen static wireless charging while in the case of dynamic wireless charging, having seen/used this technology drops to about 1/5. As long as the charging price remains unchanged, Europeans would be willing to use wireless technologies.

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3.2 Discrete Choice experiments

Two different experiments were considered to investigate the factors that are relevant when buying a new car and for public electric charging.

They were distributed in Italy, Spain, The Netherland, and Estonia, at national level.

Regarding the experiment that explores factors in the purchase of a new vehicle, purchase price, operative costs and travel ranges represent the most impacting attributes.

Quantitatively, purchase price weight twice as much as operative costs and travel range.

Incentives have around 20% of the purchase price value, lastly charging time and the diffusion of charging infrastructure present unexpectedly values ten times lower than the purchase price one, meaning that they are strangely considered irrelevant attributes.

In the experiment related to the use of charging infrastructures emerged that when drivers need to recharge their electric vehicles while on the road, they prefer low charging time, the possibility to book (optionally) the charging point or low waiting time before having access to it, and the availability of food and shops.

If charging operation is while other activities are going (home, work, other) in general respondents have not considered connection technology, charging time, possibility of booking, ancillary services (shops) and connection technology as something that impact their choice.

There are some possible reasons behind: respondents were asked to imagine to be in a normal day where they need to recharge their vehicle while doing other activities, hence is reasonable thinking they are not in a rush and they do not care about charging time; the presence of shops is also not considered, since they already have tasks to do and they do; also having a covered charging point is not perceived as important, since they are not waiting to that place; connection technology is not perceived as an important feature; lastly, the possibility of booking seems to put constraints over the daily schedule and it is not always perceived as a positive optional.

3.3 Face to face interview

Face-to-face interviews involved a sample of about 30 respondents, living in the city of Zaragoza. Following is a synthesis of the main findings.

Non EV users	EV users
Mobility in the future	
They all indicate that cars will be electric. Many mention that electric public transport will grow, and the majority of responses indicate that there will be more scooters and electric bicycles and specific lanes for them. There will be a reduction in the use of private vehicles and more car sharing services will be used. City centers will be more pedestrianized and hardly any traffic will circulate through them.	100% of the sample indicates that vehicles will be electric. Many mention that there will be many autonomous vehicles (such as bicycles and scooters) and that car ownership will be reduced. There will be even more scooters.

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EV general feeling	
They like EVs for their environmental friendliness and innovative technology but that they have high costs and they do not know as much as they would like too about them. Main advantages: They are quiet, they do not pollute, there are cost saving in the long term. Main disadvantages: Vehicle autonomy, Shortage of charging points, Charging speed, Initial cost of the vehicle	This group sees electric cars as a technological breakthrough, they say they are the future and that electric cars will become the norm. Main advantages: Less pollution, Operational cost, Comfort, Quietness, Maintenance, Efficiency Main disadvantages: Poor charging network, Batteries, Vehicle autonomy, Initial cost of the vehicle
Environmental aspects	
Around half of the sample consider the environmental factor to be one of the most important reasons why they would switch to electric vehicles. Some emphasize that EVs improve the noise in cities and some participants know that these cars do not pay for paid parking.	Everyone is in favour of taking measures to protect the environment. They see the ecological transition as a slow process in which more individual actions should be taken to improve the environment. EU membership has a positive impact on change.
EV purchase	
60% of the sample would consider buying an electric vehicle. Of this group, all but 1 person would want it to be a hybrid vehicle, and most would want it to be non-plug-in (most of them didn't know the difference between the car types. This information had to be clarified first for them). 70% of this group would want their car to be first hand because the second-hand market has little supply of these cars, and they are suspicious. However, many say that just as they would value it, they would reject it because of the initial cost of the vehicle or charging points. The main reasons why they would not buy an electric vehicle today are as follows: Initial cost of the vehicle (65%), Charging points (50%), Lack of information (45%), Vehicle autonomy (25%), Lack of development of these vehicles (15%), Cost (€) of charging (15%), Vehicle maintenance costs (10%), Batteries (10%)	100% of the participants have battery-powered vehicles and most of them bought them first-hand. All of them acquired them between 2020 and 2021. About the purchase process, the experiences are quite different from each other, but the following aspects stand out: • The car was either purchased from a dealer in the city or through car apps abroad. • There is a lack of information about these vehicles, even from the professionals who sell them at dealerships. • Some are still waiting for the subsidy to be given to them
Long trips	
60% of the sample considers that with an EV they would have more problems managing long trips, mainly related to charging stations. This same percentage of participants would not buy an EV for long trips for the same reason.	80% of the sample use their EV for long trips. The experience is generally positive, but they emphasize that the trip needs to be planned more and that it is not possible to go so fast (100-110 km/h). 90% of the sample affirms that with a conventional car they would have fewer problems, due to the charging network in Spain. Regarding planning: All of them highlight the fact that they have to use an app to optimize the route and another one to see the map with the charging points. Regarding the problems that may be encountered, the main one is that the charging point is not operational or is busy. This is solved by using apps.
EV use	
35% of the sample has used an electric vehicle. Of these, the majority have tried a hybrid vehicle. They emphasize above all that they are quiet, comfortable to drive and have good power.	They are all delighted with their EVs. All agree that their usage habits have improved in different aspects: "I have reduced vehicle expenses", "I drive slower", "I am planning my trips better and better", "I go to areas where I know there».

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The rest of the participants, although they have not driven an electric vehicle, have ridden in them (mainly cabs or taxis) and emphasize the fact that they are very quiet.	60% of respondents indicate that they do own more than one car. However, they do not make very different use of each one. 60% of the sample say that the experience is positive (no noise, comfortable and free parking in the blue zone). The main aspects that would improve the EV experience are considered as follows: more charging points 80%, battery capacity to improve the autonomy 70%, higher charging speed 40%, greater reliability in the use of the charging points 30%.
Charging network	
100% of the sample considers that the charging network is very important when buying an electric vehicle. The majority say that there are hardly any charging points in Spain at the moment to switch to electric vehicles. 100% of the sample agrees that the pre-installation of charging points would favour the switch to electric vehicles.	They all consider that the pre-installation of charging points in garages is a key factor for people to switch to electric vehicles. Bad experiences related to recharging points: not being operative, no coverage or being occupied by a combustion vehicle. Some emphasize that it would be great if there was no need to use the app or validate the card : "It would be ideal that as soon as you plug it in, it would start charging without having to validate a card/app". About charging points: • At home: 50% are satisfied with the charging point they already have (slow, night charging). 20% would like to have their charge point with dynamic power control. • At work: 40% would be satisfied if there were points for everyone. 20% would like to have ultra-fast charging systems • Public: 40% would be satisfied if there were more points (on street lights, for example). 20% would like to see more fast charging points.
Home charging points	
75% of the sample consider the initial costs of installing a charging point at home to be important. There is a lot of ignorance about how much it costs to install this charging point (answers ranging from 300€ to 8000€). Except for one person (who has a pre-installed charging point in his garage), none of them has a charging point at home. All of them would install charging points in their garages, but 15% do not see the need for a Wallbox (nobody knew what a Wallbox was, it was clarified for them) 30% say (they think) that it is not easy to install a charging point at home. 85% of the respondents have a private parking place in a shared parking area for the building.	Practically everyone used at first only their own charging point at home and little by little more public charging points have appeared, in supermarkets, shopping centers... Everyone considers that having a charging point at home is essential even though the costs are significant. They also all agree that the installation process at home was very easy. 70% have a private parking place in the shared parking area of the building. 80% of the sample charge their vehicle at their private charging point at home. Charging times and costs are variable: 40% indicate that they charge in about 8 hours and 40% charge in about 1-2 €/charge. 60% would not pay more on their electricity bill for better charging conditions and 50% say that there should be subsidies for this. 70% would like to have a separate line to charge the vehicle but only 30% would pay more for it.
New charging technologies	
Regarding the new charging methods (ultra-fast charging, static and dynamic wireless) practically nobody knew about them. Of them, the most accepted by all is the ultra-fast charging, followed by the static wireless system. Everyone agrees that e-roads are "science fiction" and that they are not at all feasible, especially in Spain.	70% of the sample indicated that a static charging point by induction would not help the penetration of electricity. Of the 30% who say yes, they would be willing to pay from 500-1000€ extra for this point (over the value of their current private charging point).

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3.4 Lesson learned

Survey participants report having experience with electric vehicles (at various levels) for 1-3 years. Only in Estonia, participants' experience with EVs was under one year. Electric vehicles are valued above all for their environmental aspects. Safety and costs are considered problematic aspects. Electric cars are regularly used for home-work trips and short journeys (within 20 km each way) and mainly charge at home. The importance of installing fast or ultra-fast public charging points is recognized, but in general their use would be conditioned by an unchanged energy cost compared to other charging points. Almost a third of respondents have seen static wireless charging, only a fifth dynamic wireless charging. If the price of charging remains unchanged, Europeans will be willing to use wireless technologies.

Regarding the experiment that explores the situation of buying new vehicles, purchase price, operative costs and travel ranges represent the most impacting attributes. In the investigation focused on the usage of charging infrastructures, it was revealed that for electric vehicles on the road, factors such as rapid charging, the option to reserve charging points, minimal wait times before accessing them, and the presence of services (food, shops, …) are a priority. When charging occurs with other activities (home, work, other), these aspects are not considered as relevant in the decision-making process.

It is clear from face-to-face surveys that the vehicle autonomy, the diffusion of charging points and the initial cost of the vehicle represent important and common aspects to both EV users and non-EV users that influence the e-mobility diffusion. Non-EV users would consider buying an EV, but they would prefer a first-hand, hybrid and non-plug-in vehicle. EV users use an electric car without any problems even for medium-long journeys (within 100 km), but in this case it is necessary to plan the journey carefully in order to better manage charging. Medium-long journeys worry non-EV users. EV users are all delighted with their EVs and they agree that main aspects that would improve the EV experience are: the charging points diffusion, the battery capacity to improve the autonomy; the charging speed; the reliability in the use of the charging points. EV users highlight as the pre-installation of charging points garages is a key factor for people to switch to electric vehicles. They complain that charging stations are often not operative or illegally occupied by combustion vehicles. Non-EV users underline the importance of wide and accessible charging network as a key element to consider buying an EV. In general, for non-users, there is clearly a lack of knowledge and the need for more information on available technologies, both for vehicles and charging infrastructures, and of installation cost for wallboxes.

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4 A DECISION SUPPORT SYSTEM (DSS) TO SUPPORT MOBILITY PLANNERS AND POLICY MAKERS

One of the objectives of INCITEV Project has been the development of a Decision Support System (DSS), a tool aimed to support municipalities, authorities, agencies, and other stakeholders in developing ad-hoc action plan to boost the penetration of electric vehicles in a city through the planning the optimal charging stations framework and in estimating the impacts of planned scenarios.

The tool, developed in Work Package 6, aims to facilitate the harmonious growth of electric mobility throughout Europe, especially in supporting cities without powerful tools, data, or competencies. For this reason, just open and Europe-wide datasets have been considered for the module implementations.

These principal design objectives and strategies have been considered to build the model:

- Applicability in all EU cities (even if no specific mobility data are available): based mainly on official and publicly available data.
- Support the strategical Charging Points (CPs) location at the zone level: the output of the DSS should be based on user-defined zones to support operative decisions without the purpose of giving precise information (e.g., new CP geographical coordinates) on phenomena that may require access to detailed local data and interactions with local stakeholders/users.
- Robustness and reliability: simple, easy to calibrate and validate, without needing complex and data-demanding approaches that require lots of inputs from users.
- User-friendly and customizable by the users: the users can upload their data (e.g., city shapefile) and modify the configuration of the analyses.
- Fast computing: it should provide the results in a reasonable and possibly short amount of time.

The DSS comprises four modules: User Behavior, Mobility, Charging Infrastructure, and Power (Figure 2).

User Behavior & Mobility Module (UB&M) aims to outline and describe users' mobility habits and behavior given the input data provided by DSS users and/or coming from specific surveys in cities.

The last two modules deal with aspects related to the supply of charging and the impacts on the energy system.

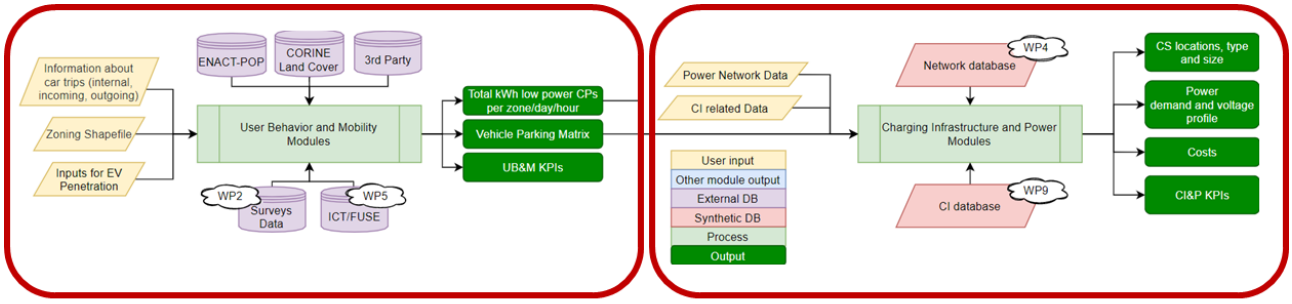

Figure 2 – DSS main structure (4 modules)

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Following an example of the possible output of the model (Figure 3).

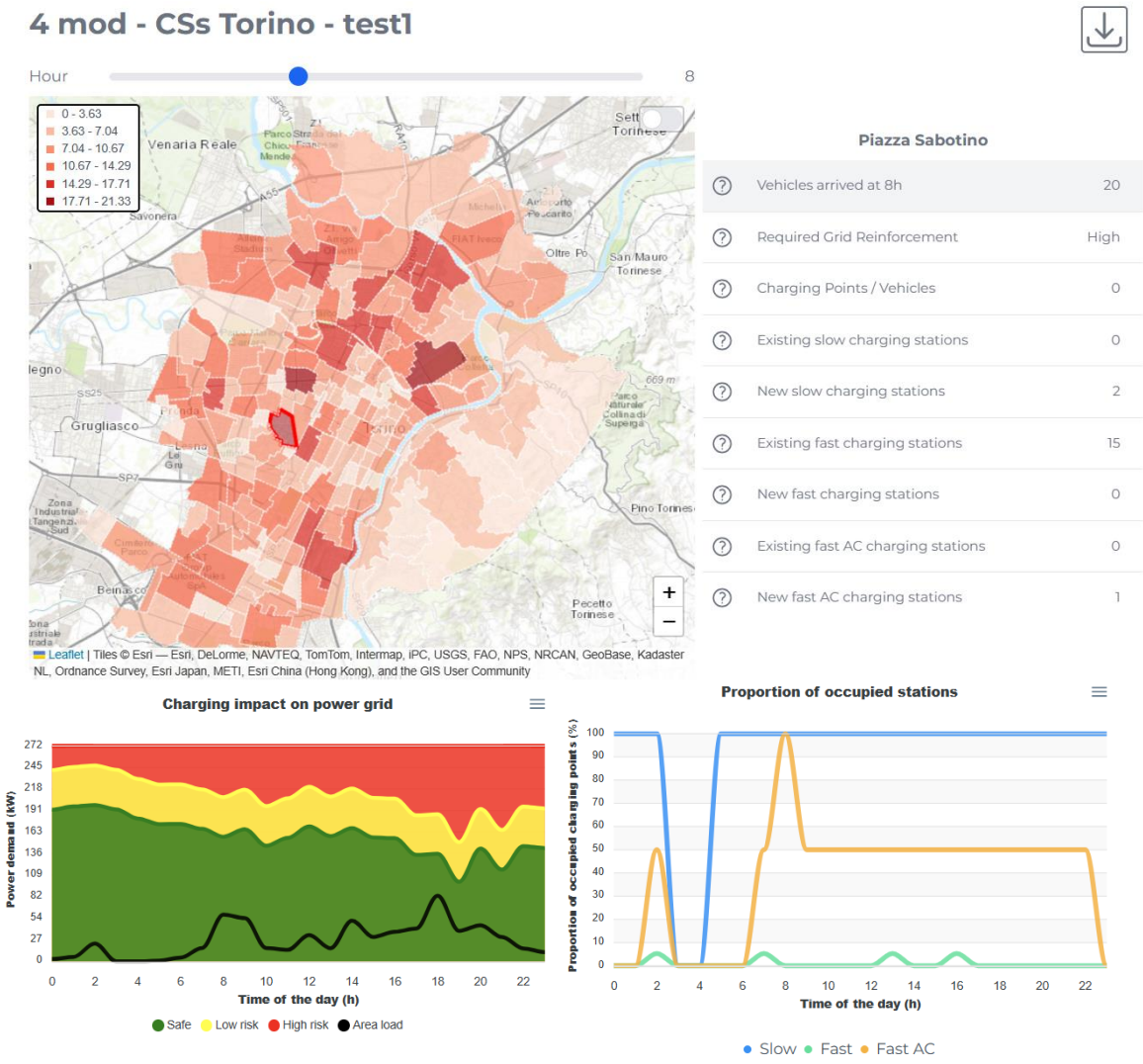

Figure 3 – Some examples of DSS results.

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5 RELEVANT RESULTS FROM WP9

Wark Package 9 (Wide replication of use cases and solutions: business models and exploitation strategies) aims to gather the experience from the INCITEV use cases demonstration to assess its replication, to subsequently apply the DSS to the project cities to support their stakeholders in the development of its particular action plans, and to ensure the replication of the results by identifying the most convenient ways for their market deployment.

Among the analyses and insights conducted in the various tasks, there are many of interest for the objectives of T2.5. Below the results and lessons learned considered useful for the purposes are summarized.

5.1 Barriers to e-mobility

In task 9.1 (D9.1 – Use cases value proposition) the stakeholders highlighted the barriers for what concern the permeation of EVs.

Interviews to the following nine stakeholders were conducted:

1. EV rental and sharing companies
2. Delivery service company
3. Association/Organization promoting electromobility
4. ICT/tech provider
5. Energy/Electric utility
6. Charging station manufactures
7. Regional and National Public authorities
8. Local public authority
9. Public transport company

The interviews showed the existence of three different types of barriers: technical, commercial, and political.

The answers, divided by category, are here summarized, and merged into standardized subcategories to facilitate comparisons and to analyse the frequency of a specific barrier because some of them are recurrent among different stakeholders. Frequency in this context means how many times a specific barrier was highlighted. Only frequency higher than 1 are plotted.

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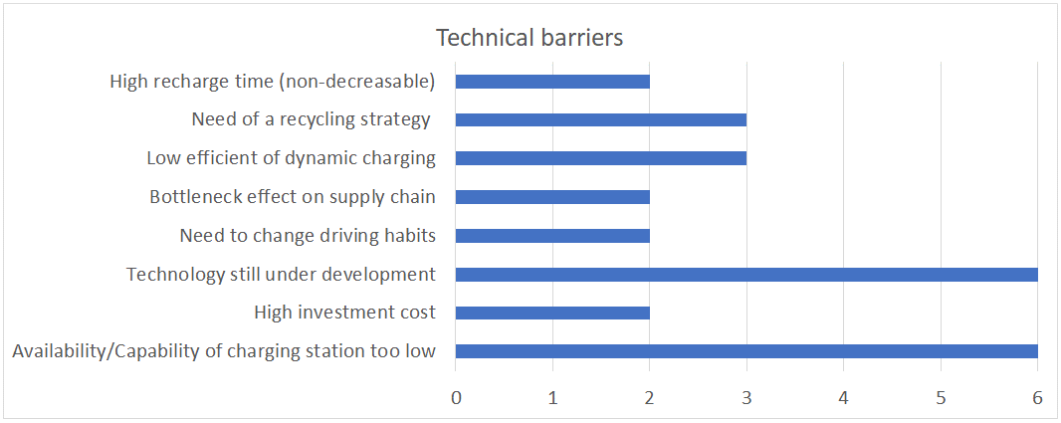

Figure 4 – Technical barriers highlighted by the stakeholders involved in the Task 9.1

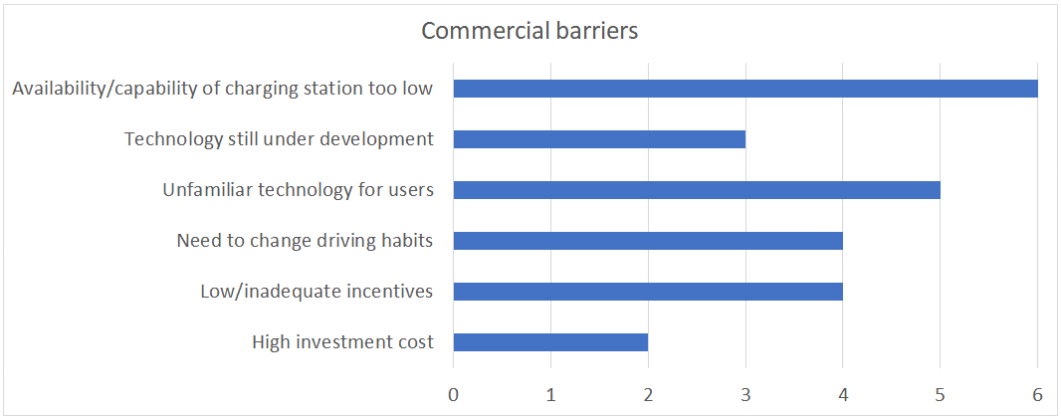

***Figure** 5 – **Commercial barriers** highlighted by the stakeholders involved in the Task 9.1*

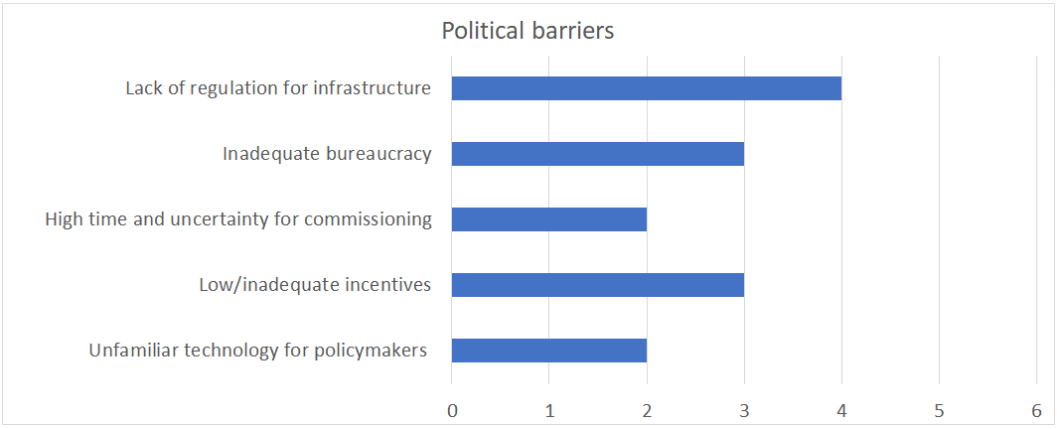

Figure 6 – Political barriers highlighted by the stakeholders involved in the Task 9.1

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Technical Barrier	• 8 barriers were mentioned with a frequency higher than 1, like the importance to have a recycling strategy or the high investment cost. • Technology still under development and an availability/capability of charging station too low were those mentioned more (six times each one).
Commercial Barrier	• 6 barriers were mentioned like low/inadequate incentives or need to change driving habits. • Availability/capability of charging station too low and unfamiliar technology for users were those mentioned more (six and five times each one).
Political Barrier	• 5 barriers were mentioned like inadequate bureaucracy or low/inadequate incentives. • Lack of regulation infrastructure was the most mentioned (4 times).

Analyzing all the subcategories it is possible to see that some of them are recurring within the three main categories. Taking this into account the three most highlighted barriers are: availability/capability of charging station too low, technology still under development, low or inadequate incentives, as represented in Table 4.

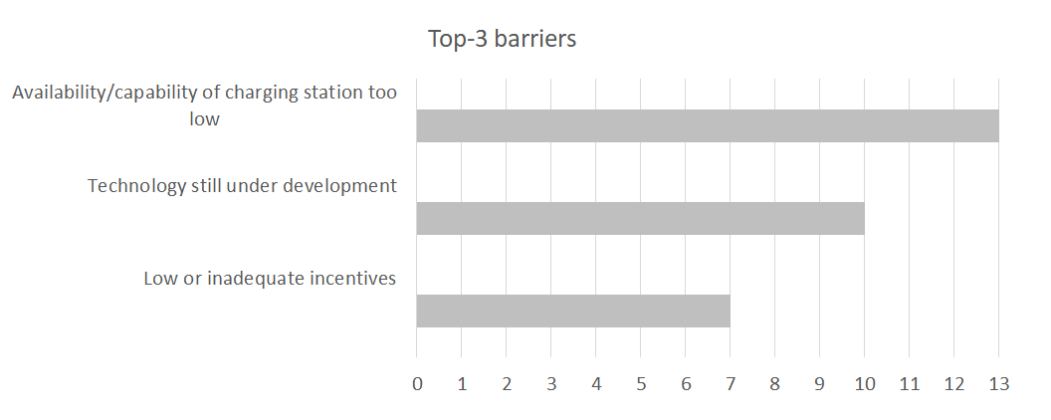

Figure 7 – Top-3 barriers

5.2 Factors influencing EV penetration

One of the results presented in D9.2 Demand Scenarios (Task 9.1) is the analysis of the factors that most affects the penetration of EVs in Paris, Turin, Utrecht, Zaragoza and Tallin. However, at the beginning, 10 factors where initially identified to explain the penetration of "all types of vehicles" in the given cities. For all factors, the quantification system used a "score" to determine the intensity that the factor takes in each country or city. E.g., the "population growth" factor can have a positive or negative score representing an increase or decrease respectively over the 2021 reference value.

In addition to the score, the rating system has a second variable, which is the "weight". Each factor has an estimated weight or level of influence on the vehicle registrations. The sum of all factors amounts to 100%.

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The 10 factors received a score (over 5) and a weight based on the bibliography and the experts' criteria. This is done for 2025, 2030 and 2035. In each year, the sumproduct of the score and weight of the factors determine the value of new registrations.

TABLE 1			REFERENCE INDEX	2022	2.50	CITY					
PROCEDURE TO CALCULTATE TRENDS IN NEW REGISTRATIONS OF CARS AND VANS			2025			2030			2035		
FACTORS AFFECTING YEARTLY REGISTRATIONS ALL TYPES OF VEHICLES			COUNTRY SCORE /5	WEIGHT /100%	SUMAPRODUCT	COUNTRY SCORE /5	WEIGHT /100%	SUMAPRODUCT	COUNTRY SCORE /5	WEIGHT /100%	SUMAPRODUCT
S	1	Percentage of Population Growth) (+)			0.00			0.00			0.00
E	2	Percentage of GDP growth, PPP (+)									
S	3	Degree of telepresence (hybrid offices) (-)									
T	4	Penetration of ride share options (ride-hailing by apps)(-)									
T	5	Micromobility (share bike, e-bike, e-scooter, e-moped)(-)									
T	6	Intermodal Public transport to the city center (bus train, tramp...) (-)									
T	7	Parking availability (city density) (-)									
S	8	Restriction of movement inside cities (pedestrian areas, green areas) (-)									
T	9	Penetration of the second hand market (-)									
S	10	Country policy in relation to health crisis (degree of lockdown policy) (-)									
				0.0%			0.0%			0.0%	

Table 3 – Template to evaluate sales of light vehicles in the use case cities.

This table was then converted in five estimated curves for the penetration of "all types of light vehicles", in the use case cities. After that, it was estimated, from them, how many could be electric vehicles, considering PHEV and BEV. To that end, the relevant factors for EV penetration were categorized it the 6 domains of PESTEL analysis: political, economic, technical, social, environmental, and legal. Each category has a variable number of sub-categories based on the evidence found in bibliography or on social norms or expert panels. Overall, 25 factors were considered.

For all factors affecting the penetration of electric vehicles, the quantification, or rating system aimed to determine two different aspects: the level and the weight. The level identified as "index level" was an indicator of the intensity that the factor takes in each country or city. E.g., the level of the "reduction of parking fees" can be permanent or temporary and can be applied to the whole city or just to a specific area. These differences in the intensity of the factor are used to rate it in a quantitative scale ranging from 0 to 4. This intensity could be also negative if a measure detracts sales of EVs in a city. The "weight" was an indicator of how much the factor affects the purchase decision of an EV or ICE vehicle. E.g., the "reduction of parking fees" can be very important for potential buyers of EVs because parking has a high relative weight on the cost of ownership of the car, or it can be of little relevance because most citizens own a parking slot and do not use the car in the city centre. The relative importance of a factor for potential EV buyers determines its weight and is independent of the index level of said factor. The scale is also quantitative, ranging from 0 to 4.

The table presented in Figure 8 summarized the state of the arts about the EVs penetration in each city.

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PROCEDURE TO CALCULTATE TREND IN NEW REGISTRATIONS OF EV IN A PLACE			PARIS		TURIN		ZARAGOZA		UTRECHT		TALLIN	
FACTORS AFFECTING PENETRATION OF EV (BEV+PHEV) /ALL CARS (2021)			INDEX /0-4	WEIGHT /100%	INDEX /0-4	WEIGHT /100%	INDEX /0-4	WEIGHT /100%	INDEX /0-4	WEIGHT /100%	INDEX /0-4	WEIGHT /100%
POLITICAL	1	Availability/Support to opportunity chargers in streets (+)	4	1,5%	2	1.2%	3	1.2%	4	1.3%	0	0.0%
	2	Availability/Support to chargers in private garages at home/offices (+)	3	4.5%	4	3.6%	4	4.6%	0	5.0%	0	4.0%
	3	Availability/Support to ultrafast chargers in main highways (+)	4	3.0%	3	2.4%	4	2.3%	2	2.5%	0	2.0%
	4	Tax reduction to EVs (purchase and charge) (+)	1	3.0%	4	2.4%	2	2.3%	3	2.5%	0	4.0%
	5	Reduction of parking fees applied to EVs (+)	0	3.0%	2	0,0%	1	2.3%	0	1.3%	4	6.0%
	6	Increased taxes for ICE cars (or elimination of incentives) (+)	3	3.0%	0	2.4%	0	2.3%	4	2.5%	0	4.0%
				18%		18%		15%		15%		20%
ECONOMICAL	7	Economic incentives for the acquisition of EVs different than taxes (+)	4	2.6%	1	5.9%	3	0.0%	2	2.6%	3	1.8%
	8	Upfront costs of EVs compared with average salary (-)	-3	5.2%	-4	5.9%	-4	10.9%	-2	5.1%	-4	7.1%
	9	Electricity costs compared with gasoline/diesel costs (-)	-1	2.6%	-2	2.9%	-2	5.5%	0	3.9%	-1	7.1%
	10	Total Cost of Ownership (including operation and maintenance) (-)	2	2.6%	3	2.9%	3	5.5%	3	2.6%	0	3.6%
	11	Trends in GDP in the country (global economic situation) (+)	1	3.9%	1	4.4%	1	8.2%	2	3.9%	4	5.4%
				17%		22%		30%		18%		25%
SOCIAL	12	Unemployment rate (-)	-2	5.5%	-3	8.3%	-4	5.1%	-1	4.1%	-2	7.7%
	13	Best user perception on quality and usability of EVs (including autonomy) (+)	1	3.6%	1	5.5%	2	5.1%	2	2.7%	0	10.2%
	14	Percentage of detached houses (+)	3	5.5%	1	8.3%	0	6.8%	4	5.5%	2	5.1%
	15	Percentage of ownership (+)	3	5.5%	0	0,0%	4	5.1%	1	2.7%	0	0.0%
				20%		22%		22%		15%		23%
TECH	16	Improvement of vehicle performance (fast charging, large autonomy) (+)	2	4.0%	2	1,9%	2	2.5%	2	2.6%	2	5.0%
	17	Availability of a competitive and large offer of EVs (+)	3	8.0%	3	7,5%	3	5.0%	3	10.3%	3	1.7%
	18	Penetration of hydrogen vehicles /gas vehicles (-)	-1	2.0%	0	1,9%	0	1.3%	-3	2.6%	-1	1.7%
	19	Critical material supply difficulties in the country for EV/batteries (+)	3	2.0%	2	1,9%	3	1.3%	4	2.6%	3	1.7%
				16%		18%		10%		18%		10%
ENVIRON	20	Bad air quality level in the city (+)	2	4.9%	3	3,8%	2	3.4%	1	6.3%	0	2.9%
	21	High GHG level in the city (episodes of bad conditions) (+)	3	4.9%	1	3,8%	1	3.4%	3	6.3%	4	2.9%
	22	High Environmental awareness of citizens (+)	4	4.9%	2	3,8%	4	3.4%	3	6.3%	1	2.9%
	23	High Noise due to city topology and vehicle congestions (+)	3	2.4%	3	1,9%	4	1.7%	1	3.1%	1	1.4%
				17%		14%		12%		22%		10%
LEGAL	24	Favourable regulation / Prohibition of ICE cars (+)	2	8.0%	4	7,5%	2	7.3%	4	8.0%	2	8.0%
	25	Restrictive emission's legislation for ICE car (+)	3	4.0%	4	3,8%	4	3.7%	3	4.0%	1	4.0%
				12%		12%		11%		12%		12%
				100%		100%		100%		100%		100%

Figure 8 – Factors effecting EV penetration.

Analyzing the factors affecting the EVs penetration, it's possible to notice that (Figure 8):

- The **political** category affects the 5 cities analyzed in a percentage between the 15-20%, Turin and Paris have the same percentage equals to 18%, another couple it's formed by Zaragoza and Utrecht with a 15%; the higher value aims to Tallin. The most important factor seems to be the "Availability/Support to chargers in private garages at home/offices" because it has the highest value of the category for each city except for Tallin.
- The **economic** category varies more markedly by city. In this case every city has put in first position the "upfront cost of EVs compared with average salary" factor which has negative effect in a range between -4 and -2 and it has an associated weight between 5.1% and 10.9%, Zaragoza has the highest value. The other factor inside the category that has a negative effect is the "electricity cost compared with gasoline/diesel costs".
- The **social** factor has approximately the same percentage value for each city, in particular the "Unemployment rate", that has a negative effect on EVs penetration, it's one of the most relevant.
- Inside the **technology** category Paris, Turin and Utrecht has almost the same percentage (16-18%) as well as Tallin and Zaragoza (10%). The first factor highlighted for every city except Tallin is "Availability of a competitive and large offer of EVs" with a weight of 5-10.3%.
- The **environmental** category presents a different percentage value for each city but each city presents the same behavior for what concern three factors: "bad air quality level in the city", "high GHG level in the city (episodes of bad conditions), "high environmental awareness of citizens": for all

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of these three factors each city presents the same own value. This happened as a result of assumptions in weight calculation due to lack of studies, for example: the bad air quality level has a moderate effect on EV sales on all EU countries.

- The **legal** category has basically the same relevance for all the cities with a percentage between 11-12%. This it's explainable by the fact that it was assumed in the weight calculation due to a lack of studies about the effects of legal barriers like prohibition of ICE cars.

Figure 9 and Figure 10 compare the five cities with respect to the relevance of each weight factors and each index factors.

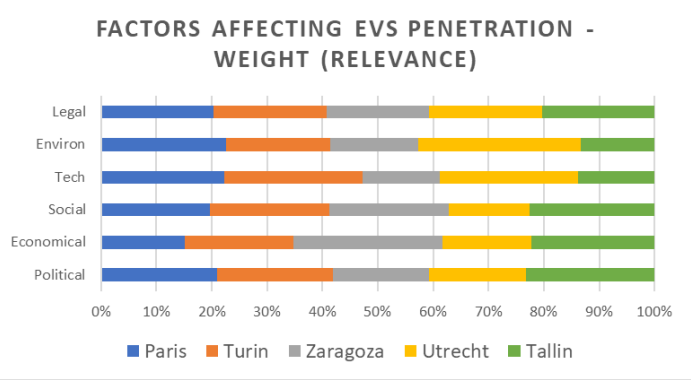

Figure 9 – Factors effecting EV penetration - weight

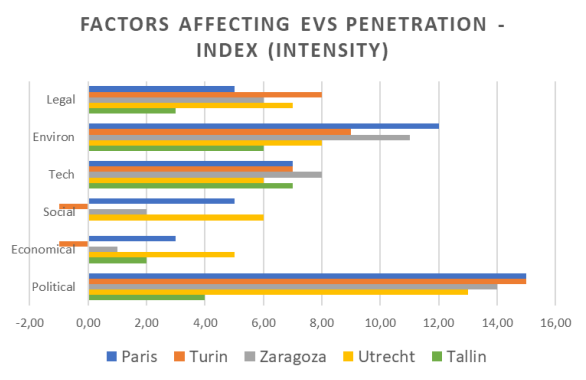

Figure 10 – Factors effecting EV penetration - index

Analyzing all the factors, the category considered more relevant for each city is (Table 4) are the following:

- Paris: Social
- Turin: Economical and social
- Zaragoza: Economical
- Utrecht: Environmental
- Tallin: Economical

Table 4 presents the *aggregated index* that shows how the factors affecting the penetration of electric vehicles and indicates the speed of penetration of electromobility. The highest value of aggregated index has been found in Utrecht, as the country presents many factors in favour of EV penetration.

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Paris	Weight	Aggregated Index
Political	18%	29%
Economic	17%	
Social	20%	
Technical	16%	
Environment	17%	
Legal	12%	
Turin	Weight	Aggregated Index
Political	12%	17%
Economic	22%	
Social	22%	
Technical	18%	
Environment	14%	
Legal	12%	
Saragoza	Weight	Aggregated Index
Political	15%	8%
Economic	30%	
Social	22%	
Technical	10%	
Environment	12%	
Legal	11%	
Utrecht	Weight	Aggregated Index
Political	15%	32%
Economic	18%	
Social	15%	
Technical	18%	
Environment	22%	
Legal	12%	
Tallin	Weight	Aggregated Index
Political	20%	7%
Economic	25%	
Social	23%	
Technical	10%	
Environment	10%	
Legal	12%	

Table 4 – Weight and aggregated index per city

5.3 Professional perspective

A group of 30 stakeholders, selected from those identified in Task 2.2 from the five use case regions (although finally there was no one from the Netherlands), were interviewed. These group can be considered "experts in the field" and consequently, their opinions are more informed and qualified than those from common users. They were classified by interest and power prioritizing those with high power and high interest.

Their responses were anonymized to induce a greater freedom to comment (T9.2). On each interview, there was a preliminary questionnaire to guide the conversation. The questionnaire goals were to implement an anonymized description of the entity, identify the technical, economic, and political barriers and identify the future opportunities for the sector and technology.

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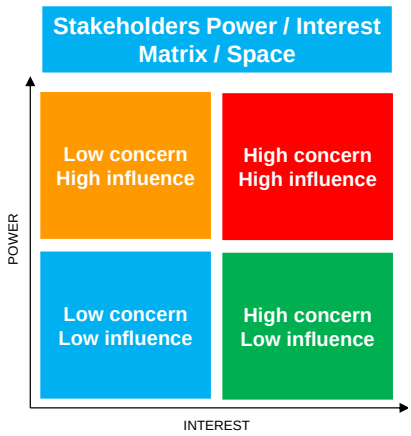

Figure 11 – Classification of Stakeholders

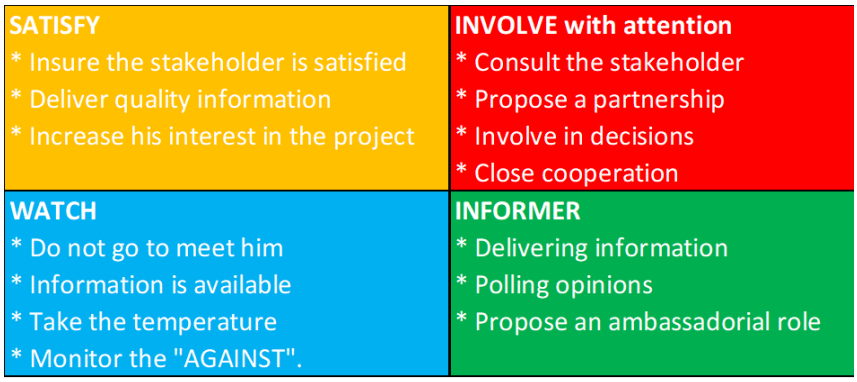

Figure 12 – Strategy to adopt with the Stakeholders according to their classification

Below, the profile of the respondent and the country of origin.

TYPE OF ORGANIZATION	Nº
1. Public Administrations or authorities	5
2. EVs Associations	1
3. EVs Operators (car sharing and ride hailing, waste, logistic, cabs, concessionaires..)	11
4. Public EVs Operators (buses, other electric)	2
5. DSOs and Energy distributors or providers	4
6. Equipment Suppliers (batteries or electric chargers)	3
7. Parking hub operators	1
8. Service Platform operators via App	2
TOTAL	30

Table 5 – Profile of the participant organizations

Country of Respondent	Nº
France	17
Spain	7
Estonia	2
Italy	4
TOTAL	30

Table 6 – Country of origin of participant organization

Following a summary of the main barriers per country aggregated by stakeholder category. For more details see Annex 5 – Barriers for stakeholders per country.

BARRIERS FOR STAKEHOLDERS INTERVIEWED IN FRANCE

DSOs and Energy distributors or providers

- Technical: Capacity constraints in the electrical grid may lead to bottlenecks in electric vehicle charging, necessitating innovative solutions for grid management. Additionally, evolving responsibilities in charging network maintenance require clear guidelines and collaboration among stakeholders.
- Commercial: While the potential for profitability exists, uncertainty about evolving market dynamics and technology standards creates hesitancy among investors. Addressing these concerns requires fostering a competitive yet stable market environment.

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- Political: Government incentives and regulatory clarity are essential to provide a supportive framework for investment and innovation in charging infrastructure, emphasizing the need for proactive policymaking.

EVs Operators (Car sharing and ride hailing, waste, logistic, cabs, concessionaires…)

- Technical: Challenges in ensuring compatibility between charging infrastructure and vehicle fleets underscore the importance of standardization and interoperability. Additionally, addressing operational constraints such as charging time and infrastructure availability is crucial for seamless service delivery.
- Commercial: Balancing operational costs with competitive pricing models is vital for sustainable growth in the shared mobility sector. Clear regulations and support mechanisms can facilitate market entry and ensure fair competition.
- Political: Aligning regulatory frameworks with sustainability goals and providing incentives for fleet electrification can incentivize operators to transition to cleaner vehicle technologies, contributing to overall emissions reduction efforts.

Public Administrations

- Technical: Overcoming logistical hurdles in infrastructure installation and maintenance requires strategic planning and investment in smart grid technologies. Enhancing vehicle autonomy and accessibility to charging infrastructure in public spaces is essential for promoting widespread adoption.
- Commercial: Optimizing financial models for infrastructure deployment and management can mitigate risks associated with long-term investments. Establishing transparent contractual frameworks fosters confidence among investors and ensures accountability in project execution.
- Political: Creating an enabling regulatory environment that incentivizes private sector participation and innovation is crucial for achieving long-term sustainability goals. Strengthening partnerships between public administrations and industry stakeholders can streamline decision-making processes and facilitate the implementation of effective policies.

BARRIERS FOR STAKEHOLDERS INTERVIEWED IN SPAIN

EV rental and sharing companies

- Technical: Predominance of slow charging stations, lack of connectivity for underground parking. Accessibility and compatibility for charging stations.
- Commercial: Small scale operations and limited financing, Fleet management including geographical restrictions to the vehicles movement. Consumer awareness.
- Political: Taxation disparities with other means of public transportation and limited support for increasing the fleet.

Delivery service companies

- Technical: Slow charging infrastructure. Sensitivity to extreme temperatures in battery efficiency. Lack of opportunities for charging within the city.

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- Commercial: Cost overhead due to non-optimized charging efficiency.
- Political: Slow and uncertain processes in the development of the charging network.

Association / Organization promoting electromobility

- Technical: Slow charging and limited fleet of high capacity rechargeable vehicles. Dependency on Asian markets and fragmentation of services. Lack of development of innovative solutions for charging.
- Commercial: Lack of full shift in mobility paradigm (education, combustion-centric perspective), misinformation around EV and charging infrastructures.
- Political: Need for incentives for infrastructure and agile permits for its development.

ICT/Tech provider

- Technical: Complexity in managing domestic charging, including installation in commune areas. Recylcing of batteries and efficiency of innovative game changing technologies for charging.
- Commercial: Limited options and cost for EV acquisition. Insuficient public charging network. Comparison to well established combustion vehicles. Planing for the infrastructure across different areas.
- Political: Limited suport for the development of the network, including parking.

Charging station manufacturers

- Technical: Lack of installation in publica streets and in commune areas of buildings. Most batteries still slow at charging. Charging technology limitations (obsolete chargers, availability of mudium voltage lines, innovative charging not ready).
- Commercial: Need of a simple to use and accessible charging point is a critical factor for EV purchase. Uncertainities on public charging stations at night and for opportunistic charging.
- Political: Interoperability regulation, complex procedures and bureaucratic procedures for deployment of infrastructure.

Public transport

- Technical: Charging speed during operation. Lack of data regarding EV for public transportation. Need for a phased gradual transition on fleets. Long term life span for technology.
- Commercial: Availability and opportunity charging in urban environments.
- Political: Regulation on parking and charging. Uncertain mix of technologies in the future.

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BARRIERS FOR STAKEHOLDERS INTERVIEWED IN ITALY

Public EVs operators (buses, other electrics)

- Technical: High electrical supply costs hinder electric vehicle adoption, despite 937 public charging points in the area, as there's uncertainty about their adequacy and type. Additionally, uncertainty persists regarding the optimal charging technology mix.
- Commercial: Charging solution mix: Charging operators are uncertain about the mix of charging solutions (in terms of supplied power) to implement and prefer to install mainly fast charge stations. Limited regional payment system: The current payment system used by GTT (the BIP) is restricted to Piedmont. However, there is a need to develop a national or international payment platform to cater to the needs of users from other regions or countries.

  Urban EV Charging Challenges: The uncertainty about regulations and the lack of clarity about integrating charging infrastructure in underground parking represent a commercial barrier to expanding electric vehicle charging infrastructure in urban and peri-urban areas.
- Political: Electric charging policies are marked by uncertainty: while national regulations mandate a 5% requirement for charging points in public parking spaces, Turin has raised this percentage to 25%, generating doubts about its suitability for future mobility needs. Integrating tariffs and payment methods for electric mobility services faces barriers at the national level.

BARRIERS FOR STAKEHOLDERS INTERVIEWED IN ESTONIA

DS OS and Energy distributors or providers

- Technical: Electricity Grid Expansion: Estonia's low population density means that each consumer must support a larger portion of the electricity grid, increasing network-related costs and making it challenging to expand infrastructure to meet demand.
- Commercial: Funding Uncertainty and Government Support: Uncertainty about the availability of funding and government support for grid expansion projects can hinder the organization's efforts to improve the electrical infrastructure and meet growing demand, especially regarding the adoption of electric vehicles.
- Political: Funding Shortage: The lack of funds or special grants from the EU or Estonian government for the construction of additional electricity networks along roads hinders overall grid reconstruction to increase capacity.

Equipment suppliers (batteries or electric charges)

- Technical: Time and cost of installation: Installing new charging points can be costly and time-consuming, posing a hurdle for rapid expansion of charging infrastructure.
- Commercial: Competition and market participation: In an emerging market like electric vehicle charging, competition can be intense. The company may face challenges in maintaining its position against emerging competitors or established firms in the sector.
- Political: Regulations on charging infrastructure: Despite efforts by the European Union to address the lack of charging infrastructure as a barrier to electric vehicle adoption, there may still be insufficient or inconsistent regulations in Estonia hindering the expansion of the charging network.

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5.4 Investments by administrations

To evaluate the contribution of public investments to promoting the e-mobility the results from the Deliverable 9.3. were analysed. In this work a Cost Benefit Analysis (CBA) was conducted to understand the cost and the results of public investment in Utrecht, Paris, Turin, Zaragoza and Tallin.

The aim of a CBA analysis was to identify: the best feasible alternative, the financial resources needed, the project impacts (the use case cities), the risk and the financial implications.

Specific policies can improve the electro mobility adoption acting as a shortcut accelerating the transition. A policy maker needs clear evidence of all the effects of the transition to be able to evaluate the positive and negative implications from a quantitative point of view.

There are important differences among the studied cities and it's possible to divide them in three categories, according to their state of progress in implementing e-mobility: **Leading**: Utrecht; **Follower**: Paris, Turin, Zaragoza; **Lagging**: Tallin.

In the following two tables are summarized, respectively, what has been done till now in the cities, and recommendation for the future.

Paris (Follower)	• Invest 890€/inhabitants from 2021 to 2035. • The need for a very dense network of public charging points would not be so necessary especially in the city centre due to mobility restrictions. • Support for the purchase of EVs would not be so necessary due to strongly reinforcement of public transport and micromobility. • Limit the investments and concentrate them in the charging points specially the private ones. • Upfront support for EVs must be kept maintaining the sales forecast as it is but reducing a bit it, to keep the overall balance under control. Charging points specially the private ones and some charging hubs.
Utrecht (Leading)	• Reduce supporting measures aligning them with other cities as the major effort has been yet done. • Citizens are environmentally aware so it's important to support the private infrastructures instead of the public in the streets. • Garages, offices, and public parking's must be equipped with the charging stations better than outside
Turin (Follower)	• Turin has a great opportunity to make the ecological transition toward electromobility and improve substantially the air quality with a positive balance even considering the negative externalities. • Continue reinforcing the support to electromobility. • Controlling a little bit the traffic inside the city by applying different measures to prevent large congestions.
Zaragoza (Follower)	• Zaragoza is the city with best results in the cost-benefit analysis due to a young flourishing electromobility policy. • Keep sustaining at least a base support. • Support to public but also private charging points as many cars sleep in the streets

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Tallin (Lagging)	• City with less public support to electromobility from the five analyzed. • The country doesn't barely charge taxes to the cars without substantial differences between ICE or EVs. • Support the transition with some basic aids to vehicles and chargers. • Measures providing clean mobility alternatives inside the city to reduce traffic density and consequently minimizing the congestion cost

Table 7 – What has been done up to date

Paris, Turin, Zaragoza **(Follower)**	**Low electric vehicle adoption but ambitious future investment plans.** Combine investments in electric mobility with traffic reduction measures. Concentrate public investments on fast or ultra-fast charging hubs, alongside incentives for workplace and residential charging infrastructure pre-installation. Incrementally diminish upfront investments as electric vehicle costs align with traditional vehicles.
Utrecht (Leading)	**Already characterized by clean mobility and high electric vehicle penetration.** Prioritize the electrification of private parking spaces, mandating regulatory modifications to enforce charging point pre-installation in new constructions and adaptation of existing structures. Focus public investments on fast or ultra-fast charging hubs distributed throughout the city and encourage workplace and residential charging through legal mandates. Gradually reduce upfront investments as electric vehicle costs normalize. Massive implementation of Smart Charging and Dynamic Tariffs.
Tallin (Lagging)	**Limited resources.** Prioritize investments in private charging infrastructure and electric vehicle acquisition, deferring public charging investments until later stages. In all cases, emphasize investments in proximity parking facilities and integrated clean mobility solutions.

Table 8 – Recommendation for the future for each city

5.5 The experiment in Tallin

During the III Steering Committee in Tallin (October 26th, 2023) QiA made an exercise with all the attendants (steering committee) with the following objectives:

1. Discuss the **best strategies among experts to recommend to policy makers; the most interesting options to promote electromobility and the deployment of public and private electric chargers** in the European cities depending on the socio-economic characteristics of citizens and the topology of cities.
2. The results obtained in the deliverables **D9.2 Demand Scenarios and penetration roadmaps and D9.3 Cost-benefit analysis from the point of view of the Administrations**, were taken into consideration. The exercise consisted in a presentation of the most relevant conclusions of the aforementioned deliverables (QiA), the formation of discussion groups (five per team) and the elaboration of proposals in the short, medium and long term. A delegate from each group will expose their conclusions.
3. An **active contribution from experts was expected.**

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Following, the key points used to start the discussion that were presented to the experts. In Annex 4 – The Tallin experiment we add the lesson learnt from T9.2 (D9.3) that were explained to the participants in advance to complete the exercise.

Definition of the exercise. Some definitions were provided to the experts to prepare the exercise; specifically, the following;

1. **Leading cities**. High public investments from long time ago in clean initiatives, high purchase power of citizens, high environmental awareness, large number of clean mobility options, dense traffic with high percentage of EVs. Negative CBA (from 2021 to 2035)
2. **Follower cities**. Recent intention to invest in electromobility measures, intermediate purchase power of citizens, medium environmental awareness, some clean mobility options, dense traffic with low percentage of EVs. Positive CBA
3. **Lagging cities.** No intention to invest by public administrations, low purchase power of citizens on average, low environmental awareness, low clean mobility options, dense traffic with negligent number of EVs. Slightly positive CBA.
4. **Vertical cities.** Prominence of vertical building with more than six floors, high population density, usually large cities, a large proportion of citizens live in the surroundings, large percentage of population with no private garage, large traffic jams and high pollution (noise, air quality, NOx, particles and CO2 emissions, good mobility options (micromobility, share car, bus, tramp, metro), restricted traffic areas).
5. **Horizontal cities.** Prominence of horizontal buildings with a maximum of three floors, a large percentage of citizens owns a garage or park in front of their house, daily commute to the inside city or factories, some public transportation (usually bus, tramp, or train), extended territory with clean atmosphere, some traffic congestions inside the city, low population density.

Then **some solutions** to promote electromobility were proposed:

1. Promote public transportation and Intermodality with e-micromobility /car sharing or car polling etc.
2. Eliminate parking places inside (garages) and outside (surface places).
3. Pedestrianization of the city or traffic restrictions
4. Promote hybrid offices or teleworking.
5. Opportunity parking hubs in the periphery with interchange with electrics and connection with public transportation
6. Charging hubs at the city center for professionals (delivery, taxis, people in transition, etc)
7. Promote low public chargers (less than 7 kW) in the streets (conventional or streetlights)
8. Promote low private chargers (less than 7 kW) at home, in offices, etc.
9. Promote quick chargers (between 7 to 22 kW) in streets, home, public garage, molls, offices.
10. Promote fast chargers (between 22 to 100 kW) in charging hubs
11. Promote ultrafast chargers (from 100 kW onward) in highways, hubs, etc.
12. Tax and upfront grants for EVs.
13. Public awareness campaigns
14. Regulatory mandatory to pre-install charging points in all parking places in new buildings /old one
15. Hotels mandator regulation to install charging points.
16. Accelerate grid adaptations.
17. Promote RES in cities (PVs, etc)
18. Others,

Table 9 – Measures to promote electromobility in cities

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The exercise consisted in selecting 38hich of the aforementioned measures should be applied to A leading, follower or lagging city with vertical or horizontal topology in 2025, 2030 and 2035. There were three independent groups, and a final agreement was reached at the end. The results were as follows (Table 10.

MOBILITY STRATEGY		2025	2030	2035
LEADING CITIES	VERTICAL	G1: 1,3,4,11,12,14,16,17 and 18	G1: 2	G1:
		G2: 1,3,7,8, 10,14	G2: 5,6,10,15,17	G2:17
		G3: 3,10,15,16	G3: 11	G3:2
		AGREEM: 1,3,4,7,8,10,14,15,16	**AGREEM: 5,6,11**	**AGREEM: 2,17**
	HORIZONTAL	G1: 1,3,4,8,9,14,16,17,18	G1: 2	G1:
		G2: 8,14	G2:	G2:17
		G3: 15,16	G3: 11,17	G3: 2
		AGREEM:1,3, 4, 15,17,18	**AGREEM: 11**	**AGREEM: 2,17**
FOLLOWER CITIES	VERTICAL	G1: 1,7,8,15,17	G1: 3,5,15,16,18	G1:
		G2: 1,3,8	G2:3,6,7,10,14,16	G2: 5,15,17
		G3: 1,4,5,7,9,12	G3: 3,7, 10,15,16	G3: 11
		AGREEM:1,3,4,8,12	**AGREEM: 6,7,10,14,15,16,18**	**AGREEM: 5,11,17**
	HORIZONTAL	G1: 7	G1: 3,5,18	G1:7,8
		G2:8	G2:16	G2:17
		G3:4,6,8,9,12	G3:15,16	G3:11,17
		AGREEM: 4,6,7, 8,9,12	**AGREEM:3,5,15,16,18**	**AGREEM:11,17**
LAGGING CITIES	VERTICAL	G1: 4,13	G1: 17	G1:3,16
		G2: 8,13	G2: 3,16	G2:17
		G3: 1,13,14	G3: 4,5,7,9,12	G3:10, 16
		AGREEM: 1,4,8,13	**AGREEM: 5,7,9,12**	**AGREEM:3,10, 16, 17**
	HORIZONTAL	G1: 4,13	G1: 17	G1:3,16
		G2: 8,13	G2:5,16	G2:17
		G3: 8,13	G3:4,6,9,12	G3:16
		AGREEM: 4,8,13	**AGREEM:5,6,9,12**	**AGREEM:3,16, 17**

Table 10 – Main measures recommended by experts to promote electromobility in cities according to the socio-economic situation and the city topology.

Main conclusions of the exercise

The allocation of support measures for electromobility fundamentally depends on the typology of the city and the socio-economic situation of its citizens and administration.

In general, **leading vertical cities** should focus short-term investment on reducing vehicle circulation by pedestrianizing areas, implementing hybrid offices, promoting public transportation, and installing slow public and private chargers and fast chargers in the city. They should initiate the pre-installation of charging systems in garages of new homes by law and undertake network adaptations. These cities no longer need to invest in incentives for EV purchases. If the city is horizontal, there is also no need to invest short-term in more chargers, neither public nor private, as citizens can afford these devices. Later on, investment should be made in ultra-fast opportunity chargers and parking hubs as well as in renewables and network adaptations.

If it's a **follower city**, short-term measures should follow the strategy that leading cities have previously implemented. That is, if the city is vertical, investment can be made in incentives for EV purchases, low-power private chargers, and public transportation, hybrid offices, and pedestrianization. If the city is horizontal, it can be accompanied by investments in low-power public chargers and quick chargers since the city's sprawl will be greater. In the medium term, in vertical cities, progress can be made with charging hubs in the city,

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fast chargers, pre-installation of chargers in new housing, mandatory chargers in hotels, etc. These measures are like those recommended in the short term for leading cities. There is thus a time lag. If the city is horizontal, it can be accompanied by hubs in the periphery and connection with public transportation and adaptation of the electrical grid. In the long term, investment can be made in ultra-fast chargers, renewables, and parking hubs in the periphery.

For a **lagging city** with lower purchasing power, the gap should be even wider. In the short term, for vertical cities, investment can be directed towards public transportation, hybrid offices, or telecommuting to reduce traffic, private chargers, and awareness campaigns. If the city is horizontal, supporting investment in private low-power chargers is unnecessary. Due to economic limitations, there will be no investment in public chargers. In the medium term, by 2030, support for EV purchases and investment in hubs in the periphery and low-power public chargers can be considered. If the city is horizontal and there is more space available, hubs can also be established in the city center. In the long term, by 2035, investment can be made in pedestrianization of city areas, fast chargers for vertical cities, and grid adaptations and renewables in both cases. The most expensive measures as super-fast chargers are not contemplated in this type of city.

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6 NATIONAL AD-HOC MEETINGS

In order to collect further material useful for the purposes of the Task, some countries organised *ad hoc* events with the participation of selected stakeholders. Events were organised all in December 2023 by Slovenia, France and Italy.

The minutes of meetings are presented in Annex 6 – National ad-hoc meetings.

The event that took place in Slovenia highlighted how important it is to:

- secure financial incentives (grants and loans) for both EVs and infrastructure from the ministry of Environment, Climate and Energy
- increase the diffusion of 22 kW charging and guarantee fast charging above 150 kW (to be increased, especially along motorways)
- ensure charging stations equipped with all supporting infrastructure (i.e. roof)
- allow payments with a simple credit card
- educate drivers not to occupy parking spaces dedicated to charging cars with conventional cars
- prepare a tool (in the form of a digital twin) that can help the different stakeholders in the electromobility ecosystem to correctly and timely implement investments.

In France, the main obstacles to be overcome are the price of vehicles and charging stations, the development of public charging stations (especially in cities, less in suburban areas) and the education and information for future users.

In the current state, it is necessary to deal with the ease of payment and connection, because there is a plurality of operators and charging cards, which causes many problems for users.

Deployment on motorways must continue and the implementation of 150kW charging stations must be consolidated, but it important also working on harmonization of tariffs and clear information for consumers.

Finally, the results coming from the Italy round table were the following:

- charging needs are very different and each need must be met with specific solutions
- it is important to be able to analyze data on the use of charging infrastructures to understand how best meeting user needs
- interoperability of infrastructures in necessary to simplify the charging process and avoid having to use multiple apps and cards to access the different charging networks
- education is needed on the correct use of parking spaces reserved for charging vehicles
- incentive policies are not enough to increase e-mobility: policies to disincentivize the use of unsustainable alternatives are needed
- a possible obstacle linked to the development of charging infrastructures is linked to the availability of electrical cabins.

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7 STRATEGIES AND RECOMMENDATIONS

This chapter constitutes the heart of the deliverable as it aims to present concrete recommendations and strategies, based on specific user needs and perceptions, to support and guide project partners, decision makers and other stakeholders in the improvement of electric recharging infrastructures and, more generally, in the electric mobility fostering.

Strategies for the integrated and sustainable development of electric charging infrastructures are first presented. Next, a series of measures are proposed to foster electric mobility acceptance. Finally, recommendations for setting up a common European methodology to assess users' perspective regarding e-mobility are reported.

7.1 Strategies to charging infrastructure network development

The promotion of electromobility in European cities is an enormously complex issue with numerous facets viewed from different perspectives. The effort in transitioning from petroleum-based technology to electric must involve all market actors in a public-private endeavour. The deployment of charging infrastructure must be synchronized with the deployment of electric vehicles in a strategy that must be perfectly defined from its inception. The socio-economic situation of countries, the typology of cities, and the level of environmental awareness among their citizens are aspects that can and will vary this strategy.

In any case, the most important aspect to mobilize citizens is the cost, both of the electric vehicle and the associated charging infrastructure. In addition to cost, there are, of course, the technical characteristics that should be as similar as possible to the equivalent combustion technology. Users want to enjoy similar benefits to traditional driving. To properly address the charging infrastructure problem, it is necessary to segment it into its different sub aspects.

Specifically, the problems have been divided as follows.

A. **Logistics for the distribution of electric chargers within cities and in the periphery.** What type of charger to install, where to install them, and how many to install? Some recurring questions are:
   1. Overnight charging infrastructure. Night-time public charger availability and usage conflicts
   2. Fast charging for daily operation
   3. Opportunity charging within cities. Insufficient interurban public charging infrastructure
   4. Increase accessibility and availability in the number of charging stations.
   5. Street Parking Solutions for EV Users without garages
   6. Insufficient private and /or public infrastructure. Charger Proximity
   7. Lack of Pre-Installation in Flat Building Garages
   8. Complexity of domestic charger infrastructure

B. Technical constraints of the e-chargers. Some recurring questions are:

   9. Compatibility and interoperability of charging stations specially AC
   10. Accelerated charging stations commissioning (provisioning the appropriate power supply)
   11. Vehicles with limited charging capacity (less than 50 kW)
   12. Limited battery lifespan and interoperability

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13. Obsolete Chargers Unfit for Reuse
14. Development of Payment Systems Integration
15. Raw materials for electromobility scarcity

C. What is the best way to incentivize the installation of electric chargers? Some recurrent problems are:

16. Volatility in subsidy programs
17. Need to incentive grid infrastructure update.
18. Insufficient Public Support for Charging Infrastructure Development

D. How can we reinforce the electrical grid to undertake the transition to electric vehicles? Some recurring aspects to address are:

19. Disparity on authorization bureaucracy according to voltage level.
20. Charging Speed Challenges
21. Uncertainty in Optimal Mix of Charging Technologies
22. Medium-Voltage Line Availability and Profitability
23. Smart and bidirectional charging (V2G)

E. **Business models.** Electric chargers are often public-private partnership models where the investor is awarded the service for a number of years and, in return, pays for the investment, the consumed grid energy, and compensates the contractor per kWh. In exchange, they receive the benefit of the charging process. Whether the service is public, private, or mixed, a minimum number of charging events per year must occur, otherwise the investment will not be recouped. There is a significant number of opportunity chargers in public areas that operate at a deficit. Some common problems associated with this subsection are**:**

24. Preference of investors for low power charging by costs
25. Atomization and dependency on Asian producers
26. Dynamic charging costly and inefficient
27. Guarantee technical feasibility and economic viability with a robust demand forecasting and strategic planning.
28. Population density affect profitability of charging stations.
29. Municipal Resistance to Electric Vehicles and Street Parking
30. Inadequate Offerings and Standards for Inductive Static Charging
31. Range Considerations for long Travel Charging
32. Pre trip recharge planning due to infrastructure scarcity.

F. Standardization and interoperability of different developed systems and their use in different geographies, especially on roaming.

33. Standardizing European Interoperability for Charging Infrastructure
34. Resolve connectivity problems in underground charging stations. Regulatory Gaps
35. Roaming charging solutions minimizing downtime

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Problem A. Logistics

In the next chart, the recommendations to allocate charging stations in cities according to their topology are depicted. The classification of e-chargers according to deliverable D9.2 has been considered (Table 11).

Category	Power range	Type of current	Typical type of connector
Slow	p < 22 kW	Single-phase AC	Type 1, Type 3
Quick	22 <= p < 50 kW	Three-phase AC	Type 2, Chademo
Fast	50 <= P <150 KW	DC	Combo
Ultrafast	150 <=P< 250 KW	DC	CCS, GB/T
Ultrafast (2nd gen)	p >=250 KW	DC	Tesla Supercharger

Table 11 – Classification of e-Chargers

	VERTICAL CITIES								HORIZONTAL CITIES							
TYPE OF CHARGER	Home garage	Office garage	Street Periphery	Street City Center	Commercial, hotels	Public garage	Hub city center	Hub periphery	Home garage	Office garage	Street Periphery	Street City Center	Commercial, hotels	Public garage	Hub city center	Hub periphery
Slow	✓	✓	✓						✓	✓	✓					
Quick		✓			✓	✓				✓		✓	✓	✓		
Fast							✓	✓							✓	
Ultrafast								✓							✓	✓

Table 12 – Recommendation of e-Chargers by city topology

Some conclusions:

- Priority should be given to low-power chargers in residential areas, offices, and the outskirts of cities where many people do not have garage spaces. In this case, solutions restricted to neighbourhood residents with systems integrated into lampposts should be sought.
- In the city center, there should be quick chargers in shopping centers, hotels, and public parking lots, and only on the street in horizontal cities where there is more available space. In vertical cities, there will be an issue for those who do not have a garage space adaptable to EVs, but this problem already exists today because these areas are often pedestrianized or have heavy traffic restrictions. Residents living here will have to charge at their offices if they do not have parking spaces available.
- However, there should be large hubs of fast or ultra-fast charging primarily aimed at professionals (delivery drivers, taxi drivers, etc.) both in the cities and in the periphery (in this case, also for regular users and connected to a good transportation network). In densely populated vertical cities with higher land prices, it will be more complicated to find a location in the city center, and if found, the grid may or may not be ready for ultra-fast charging. In horizontal cities, finding a location for ultra-fast will be simpler. In any case, the current medium-voltage networks of trams and metro systems operating in direct current should be used for this purpose.

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Problem B. Technical constraints

The entire sector of charger manufacturers and electric vehicle manufacturers must accelerate the development and compatibility processes of their systems, offering reasonable prices so that users perceive a value proposition equivalent to combustion vehicles. In this regard, authorities should facilitate assistance for innovation.

Problem C. Incentives

According to D9.3 the following types of incentives has been applied in the use case cities:

1. Direct Support to EV Upfront Costs: Public administrations are expected to provide financial support to reduce the initial costs of Electric Vehicles for consumers.
2. Tax Policy Support: Tax policy measures to encourage EV purchase or use will be considered as part of the cost calculations.
3. Support for E-infrastructure: This category includes upfront costs and fiscal measures related to supporting public, private, or semi-private EV charging infrastructure in the use-case cities.
4. Grid Modifications: Any modifications to the electrical grid necessitated by the deployment of EV chargers will be factored in, particularly if these modifications are funded by the administrations. Typically, larger-scale grid optimizations at the transmission level are the responsibility of administrations.
5. Renewable Energy Investments: The administrations may contribute to investments in renewable energy sources (REs) to supply electricity to new EV charging infrastructure, typically in the form of grants. While deploying REs in city centers can be challenging, an estimation of total energy requirements will be calculated.

The last three are related to the Charging points and the associated electric infrastructure (Renewables and grid adaptations).

According to the data obtained in D9.3, the cities invest on average per capita and year the amounts reflected in the next table. They have been grouped in segments to be associated to leading, followers, and lagging cities (Table 13).

€ /year/per capita	Upfront EV	Tax EV	CPs	RES	Grid
Leaders	>25	>50	>4.5	>3.5	>25
Followers	4-25	10-50	3-4.5	2.5-3.5	15-25
Lagging	0-4	0-10	0-3	0-2.5	0-15

Table 13 – EUR per capita and year of use case cities investment classified by leader (ex; Utrecht), follower (ex; Turin, Paris or Zaragoza) and lagging (ex; Tallin)

Charging points, renewables and grid adaptations must be implemented in parallel and prioritization must be given according to the following charging points (Table 14).

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Charging points	Priority	When
Home garage	1	Short term
Office garage	1	Short term
Street Periphery	2	Medium term
Street City Center	3	Long term
Commercial, hotels	2	Medium term
Public garage	1	Short term
Hub city center	2	Medium term
Hub periphery	3	Long term

Table 14 – Prioritization of charging points installation through incentives

Promoting the installation of charging points should first focus on the short term, on locations such as residential buildings, offices, and public garages. To achieve this, regulations should be promoted that require pre-installation of wiring in all parking spaces of new homes, office buildings, and a mandatory number of spaces in public parking lots. Partial financing should be provided for the installation of low-power points in these buildings for end-users who wish to have them preferably with an independent connection. Subsequently, in the medium term, low-power points should be installed in the periphery using systems integrated into public streetlamps or similar infrastructure for those users without garage. Additionally, they should be installed in parking lots of shopping centers and hotels (minimum number according to volume), and hubs with fast or ultra-fast chargers should be placed in the city center for professionals. Lastly, in the long term, opportunity chargers of the quick type could be installed on city centers streets or hubs with ultra-fast chargers on the outskirts, providing access to nearby public mobility services.

Wireless charging systems, whether dynamic, static, or stationary, are still at low Technology Readiness Levels (TRL) and should continue their process of optimization and improvement in efficiency and cost. Among them, static systems (charging during stops with a driver present) and especially stationary systems (charging while stationary without a driver present) are the closest to market readiness and should be implemented first, without requiring significant investments in either the vehicle or the charging pad.

Problem D. Grid adaptation

The adaptation of the grid should be done slightly ahead of or in parallel with the deployment of electric vehicles. In this regard, new housing developments should anticipate access to energy with independent connections and have the pre-installation of wiring for electric chargers in all or a significant portion of the parking spaces in newly constructed buildings. Incentives could also be provided to facilitate the adaptation of existing buildings. It is important to leverage existing medium-voltage lines that serve metros or trams in many European cities. The deployment of new renewable energies to supply this new energy should be a priority. The availability of locations in city centers and at the entrances of major roads for high-power hubs should be studied to provide service, especially to professionals who use electric vehicles continuously and require accelerated charging.

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Problem E. Business models concerns

It is important to understand that public opportunistic chargers, while they facilitate the decision to purchase electric vehicles by reducing range anxiety for users who live or work nearby, are often not profitable. Generally, people who decide to buy an EV seek to ensure daily charging safely and without surprises with a dedicated charger. Nowadays, electric cars have very high range, so they rarely encounter charging problems during daily city driving. Therefore, prioritizing the provision of low-power chargers in homes, offices with garages, and public parking lots and hotels for transient tourists is essential is a priority. However, professionals who use light vehicles intensively should have access to high-capacity hubs for faster charging within or on the periphery of cities. To make these hubs profitable, charging agreements should be made with these groups (taxi drivers, delivery vehicles, car-sharing services, etc.), so that investments are reasonably profitable and charging costs remain affordable. Public administrations should take responsibility for public opportunistic chargers within cities, knowing that they may not be profitable but are necessary to cover any charging incidents that may occur. Similarly, they should install chargers in low-density areas as a public service, also knowing that they may not be profitable. Surface chargers in city centers should provide quick or fast daytime charging and always be supervised by inspectors with a maximum charging time of two hours, while chargers in the periphery should be low power, intended for residents without garages, and assigned with a pre-reservation system in an area near their residence, located on streetlights or similar structures. These chargers should be dedicated to overnight charging, with an obligation to vacate them in the morning.

Ultra-fast chargers on highways can be a short-term solution, but they are often not profitable because they are mostly unoccupied during weekdays and excessively busy on weekends and holidays, resulting in long waiting periods and much frustration. Additionally, they require significant investment in renewables and/or electrical connection, making their implementation sometimes impossible. It is believed that in the coming years, clean mobility solutions will be developed to address long-distance travel, such as battery-fuel cell hybrid vehicles. These vehicles would operate on battery mode during weekdays and only charge hydrogen for long trips. There are already several pilots with this hybrid technology in development.[1]

Problem F. Standardization and interoperability

It is evident that there is growing competition among brands and even among countries to adopt the technologies and standards of pioneering companies. This fosters a captive market and makes difficult for new competitors to enter, which is counterproductive for users, especially during long-distance trips. This effect has always occurred with innovations until one or several technologies are adopted as standards. In any case, manufacturers need to agree on a standard as soon as possible and achieve interoperability of systems in key aspects such as roaming, payment methods, etc. In this regard, it is the responsibility of public administrations, based on the opinions of sector associations, to gradually adopt compatible systems among different brands. Competition among companies should be based on other advantages and capabilities rather than differences.

The best interoperability system is the plug&charge model which we highly recommend avoiding the need to be ascribed to any APP or similar system. Plug&charge is an automatic authentication system that allows

[1] https://www.pv-magazine.com/2022/05/24/the-hydrogen-stream-renault-presents-electric-hydrogen-hybrid-car-with-range-of-up-to-800-km/

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to charge electric cars without the need for an app, card or any identification. With this technology, electric cars and the charging stations are able to communicate and recognize each other through encrypted communication that uses the charging cable directly, without the need for further steps or interactions. All vehicle recognition operations are in fact carried out independently by the car and the charging station when the cable is inserted, and thanks to data encryption, payment can also become automatic. This technology can work on all types of charging stations, both alternating and direct current, but must be implemented both on the charging stations and on the cars.

7.2 Strategies to foster electric mobility acceptance

The spread of electric cars continues to grow internationally. The market has been growing strongly over the years, although the biggest increases are being recorded in China and the USA.

Europe is lagging behind in terms of sales growth but has already achieved a good level of market penetration, although the market is very nonuniform between countries, with the Nordic countries (Norway, Sweden and Denmark) dominating.

Much has been done to spread electric mobility, but much can still be done, especially for those countries where it is struggling to take off.

The analyses conducted in the project's different tasks, as well as those carried out in T2.5, of which this deliverable is the final output, have shown that although many countries have already a high level of uptake of e-mobility, there is still much to be done to foster e-mobility diffusion all over Europe.

In general, the study has highlighted how the acceptance and consequent diffusion of electric mobility are aspects strongly linked to the level of poor knowledge of the technologies, the diffusion of charging infrastructures, the possibility of having incentives to reduce the purchase price of vehicles and charging infrastructure. However, there are certainly other fronts on which to intervene, as detailed below.

Awareness and information

Electric vehicle (EV) technology has evolved exponentially in a very short period of time. The reliability and technical features of EVs compared to vehicles from just five years ago are completely different. However, some segments of the public are still unaware of these advancements and remain stuck in the concept of early electric vehicles, hesitant to transition. This is also the case with many diesel and gasoline engine enthusiasts, as well as some public administrations reluctant to adopt electricity in municipal services.

Therefore, awareness campaigns, technical and scientific articles, and field tests by specialized magazines and directly by users are necessary.

It's also essential to encourage a cultural change towards more sustainable lifestyles, to promote the benefits of electric mobility, to shift the mindset from filling a tank to its maximum capacity (as with internal combustion engine cars) to charging only what is necessary for daily use and making small daily or weekly charges.

The organization of exhibitions dedicated to electric mobility, with the participation of public bodies, suppliers, vendors and manufacturers of electric vehicles, supplier of services related to electric mobility, can be a can be a proposal of effect. In this context potential users and users can find answers to the most common questions about electric vehicles and discover all the benefits of using an electric vehicle. On these

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occasions it is important to make different types of electric vehicles (cars, light commercial vehicles, scooters, bicycles, …) available to visitors, to provide areas for testing vehicles and to supply for easily bookable test drives.

Another way of spreading knowledge is to organize, with the participation of public bodies and vehicle manufacturers, targeted awareness-raising campaigns, offering private users or companies the opportunity to experience alternative mobility by testing electric cars (both BEVs and PHEVs) for some days. In this way users can experience the driving mode and autonomy of the vehicles up close and in daily practice, as well as gain experience in recharging.

In addition to test drives, other "EV experience" opportunities can be created by partnering with taxi companies and shared mobility services (e.g., car-sharing and ride-hailing companies) to create the opportunity to immerse people in EV experience. Through these partnerships, people can learn firsthand about the experience of driving electric vehicles, and with car-sharing, they can also understand charging mechanisms.

In the end, interest in electric mobility could grow by providing free consultancy services to households and companies. Based on customer needs, the most suitable vehicles, charging systems and management of vehicle charging can be recommended, as well as estimated costs and expected benefits.

Education

One of the key elements to increase the acceptability of electric mobility among the population is to focus on the new generations, the most sensitive to sustainability and new mobility issues, involving them in specific educational projects brought directly to schools (high schools).

Classes can be involved sharing information material specifically designed for young people, with meetings to learn more about the electric driving and with initiatives to test electric vehicles accompanied by professional drivers.

Electric car-sharing diffusion

Insufficient knowledge and high uncertainty towards EV technology can represent a barrier to the acceptance of this form of mobility. Experience in using EV vehicles leads to higher acceptance of this new technology.

Electric carsharing can be seen as a promoter of electric mobility.

First of all, it offers a practical and accessible alternative to owning a private vehicle and the possibility of increase awareness and interest in electric technology among users. Since purchasing an electric vehicle can be expensive, especially initially, electric carsharing allows people to access electric vehicles without having to bear the full purchase cost.

Moreover, the success of electric carsharing requires a good charging infrastructure. Consequently, the growing demand for electric carsharing may encourage investments in the installation of charging stations, thereby helping to develop the charging infrastructure needed to further support the adoption of electric vehicles.

And finally, the increasing demand for electric carsharing can stimulate research and development of related technologies and infrastructures, such as more efficient batteries, faster charging solutions, and intelligent traffic management networks, which can then be used outside the context of carsharing.

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In summary, electric carsharing can play a significant role in promoting electric mobility by offering a practical, accessible, and sustainable solution to people's transportation needs in cities and beyond.

Standardization and interoperability

Delivering a seamless charging experience, both privately and publicly, addresses the primary concerns consumers have regarding electric vehicle use: battery life, charging accessibility, and driving range. Achieving this seamless experience entails enabling customers to effortlessly locate charging stations, utilize them without encountering technical hurdles, and conveniently manage billing through a unified customer account.

At the moment, a significant challenge lies in the lack of interoperability among various charging services as numerous providers enter the market and the difficulties increase when crossing borders and moving to other countries. In order not to hinder the drivers' experience, and therefore the EV market development, it is crucial to simplify this process and to make sure that drivers can easily access to all charging points.

The topic has been addressed in the section 7.1 – Problem F.

Roaming

With roaming agreements, EV drivers can use any charging station whether they have a subscription to that particular network or not. Drivers find an available EV charger to park, plug in, and pay as usual. A behind-the-scenes collaboration between roaming partners results in a smooth user experience

In conclusion, the roaming simplifies the charging process by eliminating the need for multiple cards or apps. Drivers can use a single card or app across various charging networks, reducing the hassle of managing different accounts and payment methods. Moreover it enhance the accessibility of EV charging infrastructure, allowing drivers to use charging points throughout the country. This expanded network ensures that drivers can embark on longer journeys with confidence, knowing they can recharge their vehicles at various locations.

Diffusion

The increase of e-mobility acceptance strongly hinges on ensuring accessibility to charging points for users unable to install home chargers, such as those who park on the street. The critical step is to make charging stations readily available and easily locatable to meet the different needs of EV drivers.

The charging point diffusion has been addressed in section 7.1 – Problem A.

Accessibility

The topic of accessibility of electric charging stations access for people with disabilities must be taken into consideration to aim for greater acceptability of electric mobility.

Investing in the accessibility of charging stations should involve both local administrations, manufacturers and the different sector operators.

It is important that accessibility is addressed with respect to these three main components:

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- Parking. Accessible parking with maneuvering space around the vehicle is already a major concern for disabled people. In a public charging environment, the ability to fully open doors, manoeuvre equipment and use low floors, lifts and ramps is crucial. In addition, it is crucial that parking spaces are level, smooth (no gravel, grass, mud, potholes, …) with level access (no kerbs, steps, …) or with low kerb access available nearby on pedestrian areas and nearby services. In addition, since parking spaces are often close to the road, provide a curb access ramp.
- Charging. Charging for disabled people is often complicated as it requires numerous movements between the vehicle and the electric columns, the use of often very heavy electric cables and the difficulty of inserting plugs into sockets. To limit problems and frustrations, it would be important to have the cable connection and the display of the columns not too high to ensure accessibility and visibility even when seated. It should be noted that innovative and inclusive solutions are emerging to recharge the batteries of electric wheelchairs, using the same infrastructure used to recharge electric vehicles. The main aim is to provide a service for people with disabilities and to expand their possibilities of recharging their electric wheelchair even if they are out of the house, thus allowing them greater autonomy of movement. However, such a service could also represent a plus for disabled people who recharge their electric vehicle and use part of the waiting time to recharge their wheelchair.
- Information. Knowing in advance whether a charging point is wheelchair-accessible, or whether it has space to maneuver around the vehicle, is crucial for successful charging and journey planning.

Regulation

One of the often-underestimated problems that affects those who use electric vehicles and worries those who might consider purchasing an electric vehicle is the abusive use of parking areas dedicated to charging electric vehicles.

This is an uncivil behaviour that is widespread not only among combustion engine vehicles users but also among EV users who leave their vehicles at the charging stations either without recharging them, or by leaving them for a long time after recharging has finished.

In order to limit the number of thermal vehicles parked improperly, more controls are needed in the area. The same thing can be done for electric vehicles, but in this case another possibility is to provide dedicated fares to encourage owners clearing the parking once charging is over.

Policies and measures

To foster the e-mobility acceptance and for the overall development of electric mobility, especially in those cities at the beginning of the transition process, incentive policies are not enough, but policies to disincentivize the use of unsustainable alternatives are needed.

Therefore, on one hand it is necessary to make electric vehicle purchase a viable and attractive option for consumers, for instance:

- provide incentives for the purchase of electric vehicles;
- subsidizing the purchase of domestic recharging infrastructure;
- lowering (or zeroing) ownership or circulation taxes;
- providing free recharging, exempting from “congestion charges”;

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- allowing free entry into limited traffic zones;
- allowing the use of bus lanes;
- providing e-mobility services in sharing that allow to test the technologies (sharing mobility);
- creating information opportunities

On the other hand, it is important to proceed with measures limiting the use of environmentally unsustainable vehicles, such as:

- introducing congestion charges, and or pollution charges;
- reducing parking spaces (especially in city centers);
- banning access to limited traffic zones.

7.3 Recommendations for setting up a common EU methodology to assess users' perspective regarding e-mobility

Through the activities performed in WP2 including surveys to users and public consultation with interviews and focus groups, a range of issues related to electric vehicle adoption and charging services that may be synthetized in a recommendation list has been identified. The following recommendations are shared during the project activities with main stakeholders involved in identify the views of users, including local authorities, charging operators and other private companies.

General recommendations

Clarification of the purpose of surveys

Before to start with the design of the survey, it is recommendable to clarify if the results will be used to calibrate a choice model and explore scenarios or only to obtain a statistical analysis of the responses and have a picture on users' preferences. In fact, the data collection methods can be different depending on the intended purpose. Stated or revealed preference surveys are useful to calibrate a choice model, conversely for data collection for statistical purposes, a simple questionnaire or focus groups or targeted interviews may be feasible choices. The goals to be achieved also guide the definition of the type of users to be involved in the survey, which is another important information in the experimental design.

User characterization

Preferences may change across users based on many different variables, such as their country of residence or their knowledge about the electric vehicles. Therefore, during data collection activities to explore the user needs and preference on electric mobility it is recommendable identify the specific categories of respondents and the variables that can affect the results. When available, user segmentations can also be used when modelling choices to better interpret user behaviour.

Socio-economic characteristics of the respondents, such as income level, age, gender, household size and education level may also help to define if some preferences can be related to population features. Socioeconomic characteristics should then be analysed with an intersectional approach during the statistical

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analysis for instance. Intersectional analysis means that factors should be approached as closely intertwined and mutually influential.

Understanding user preference to model their choice

Clarification of the choice situation

When proposing options to users to identify their preferences, the choice situation in which to explore the behaviour should refer to a well-defined case. If more than a case for charging is detected (e.g. Case 1- along a trip and Case 2 - systematic urban charging), each case needs to be analysed separately.

Particular attention requires the presentation of choices to the user. Ease of understanding of the alternatives and all related parameters by the respondent is crucial to the validity of the responses.

System requirements description

Considering that during the experiment options should be clearly described to respondents, relevant requirements of charging alternatives need to be known in advance and properly described in the questionnaire.

If some innovative features of the charging options (e.g. wireless charging) are in interest for the project, they should be examined in the preliminary phase of the experimental design to be evaluated for the inclusion as factor affecting the user choice.

Factor identifications

An iterative process for the definition of attributes and related levels is recommended involving different partners for discussions, which is related also to define and refine options. For instance, the attribute describing the waiting time before charging operations can be expressed by a defined scale of levels (low, medium, high) and converted in minutes when presented to respondents for clarifying the choice situations. Related work in scientific literatures can be helpful to identify the most common factors used in the field.

During the iterative design process of surveys, some pilots are needed to test the clarity and significance of attributes and their levels which can be updated and refined before the final survey. A good practice is to limit the number of levels (typically 4 or 5) to propose to users a simple scale.

Result verification

Preliminary analysis of the dataset coming from the results are suggested to ascertain that all alternatives have been adequately presented to respondents, that all the attributes have been explored homogeneously with all their levels defined.

Specific tools can be used to manage characteristics such as orthogonality, correlation structure, and balance of attribute levels during the design phase of the experiments.

Limitations of modelling application

Analysts should be aware that stated preference (SP) surveys are influenced by the proposed scenarios, which are hypothetical and therefore are affected by a bias in case of using models for comparing future scenarios. Revealed preference (RP) methods are generally more adequate to explore scenarios in which key

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features can be changed[2]. However, for innovative systems or service, RP are not always possible and therefore SP techniques are commonly adopted.

Observing user preference for statistical analysis via on-line surveys

To reach a large number of participants and estimate reliable features of the sample, the on-line method is recommended to perform surveys using dedicated software platforms to implement questions and collect results. Considering the experience of the project, the following recommendations can be reported.

Check the questions before to run on-line surveys

To increase the chance of obtaining answers from participants all of the texts used for the survey should be checked to verify their readability.

Consider the time budget of participants

During the preparation phase of the survey, considering the number of involved partners and the range of expectations, it is common that the number of questions could increase. However, a careful estimation of the time required for respondents should be performed to adjust the duration and limit it to an acceptable time for users.

Organize the questions

To better present the questions to respondents, it is recommended to divide the survey in homogeneous sections. For instance, three blocks were identified in the project: Sociodemographic information, Mobility habits and Specific EV questions.

Splitting the survey

In case the number of questions is high and cannot be reduced, the option of splitting the survey into sections to distribute them independently may be considered.

Extending the user profile coverage

Considering the aim to observe electric mobility and user preferences, participants should be involved from different countries and levels of experience with electric vehicles.

Focusing on key features for EV

The survey should include relevant questions to obtain key information on electric mobility and user habits, such as the available charging options and frequency of use at home, work and other places or the preferred time to charge vehicles.

[2] SP is a survey method based on presenting to respondents hypothetical situations to be selected as statements; RP follows an indirect approach that uses actual recorded behaviour provided by respondents.

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Obtaining qualitative information on user perceptions and expectations

To get information on feelings and emotions related to the usage of EVs and to connects them to specific characteristics of the service, such as parking facilities and charging solutions, face-to-face interviews can be used to integrate online surveys.

Adopting a more global approach during interviews

Although the main topic of interest is charging EV, the interviews will adopt a more global approach to mobility so as to capture relevant information about the users' expectations, their fears and their own experiences. Focusing too much only on charging could be counterproductive since:

- Users and customers are focused on global objectives on mobility objectives;
- Charging is usually linked to other considerations such as vehicle requirements (e.g., range) or the type of use (e.g., urban only).

Organizing small groups of participants

Some expectations, feeling and emotions will be based on personal or close people experiences, on personal perceptions that cannot be captured on a survey but can arise on a relaxed conversation with a small number of participants.

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8 CONCLUSIONS

The study identified strategies and recommendations to develop the charging infrastructure network in a sustainable and integrated way and to foster electric mobility acceptance.

In general, it highlighted that the most important aspect to mobilize people towards e-mobility is the cost, both of the electric vehicles and the associated charging infrastructures.

In addition to cost, the spread of e-mobility is held back by technical characteristics of vehicles that should be as similar as possible to the combustion technology, and by a general lack of knowledge as well as bad information leading to a lead to distrust.

However, other topics were key fundings, such as

- the charging station diffusion, for which the following recommendations are given: low-power chargers in residential areas, offices, and the outskirts of cities; quick chargers in shopping centers, hotels, and public parking lots, and only on the street in cities with more available space; large hubs of fast or ultra-fast charging both in the cities and in the periphery;
- the standardization and interoperability (roaming, payment methods, technological standards, …), to allow a simpler and more user friendly charging experience;
- the electric car-sharing diffusion, mainly to provide opportunities to experience electric vehicles;
- the charging station accessibility to people with disability.

In the end recommendations for setting up a common European methodology to assess users' perspective regarding e-mobility were identified. They are related to the importance of clearly defining the objectives of the evaluations, the users to involve, the aspects to investigate and the choices to be proposed, to make sure that a comprehensive and useful evaluation system was built to achieve identified objectives.

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9 ANNEX 1 – FORM TO COLLECT BEST PRACTICES

Introduction

This form has been developed for INCIT-EV EU project (https://www.incit-ev.eu/), within the Task 2.5 "Strategies to incentivize different categories of users in the use of EV"

The project aims mainly to foster charging network development, but also deals with the topic of electric mobility in general. Therefore, the intention is to gather firstly practices/actions/measures/policies aimed at charging infrastructure development, but interesting and innovative practices/actions/measures/policies related to electric mobility in general can be also of interest.

Please note that:

- the focus should be on electric vehicles (e.g. car, bike, scooter, …) for private or shared use, and not about public transport;
- actions described can be "to be started", "ongoing" or "completed".

The best practices analysis, together with participatory moments with selected stakeholders, will be the basis to draft the Deliverable 2.5 "Future strategies and recommendations to support e-mobility", a document that will represent a guide for European Community for the elaboration of strategies to foster electric mobility acceptance. Deliverable 2.5 will be public and it will be available on INCIT-EV web site, after mid-2024.

Please provide here your information. The material collected on best practices will be analyzed and reported in the Deliverable 2.5, but they will be treated anonymously. The named references may be useful in case it is necessary to request clarification or further details.

Note: in the case of more than one practices/actions/measures/policies, we would be grateful to have one form completed for each

Name and Surname	**Fare clic o toccare qui per immettere il testo.**
Company or Institution	Fare clic o toccare qui per immettere il testo.
e-mail address	Fare clic o toccare qui per immettere il testo.

What is your practice/action/measure/policy most focused on?

☐ Recharging infrastructure

☐ Electric vehicles

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Please mark the category that best applies to your practice/action/measure/policy in the table below.

	Category	Description	Examples
☐	**Engineering & product development**	All best practices related to technical aspects of e-mobility	• On-board recharge technologies • Recharge infrastructures • Batteries • Management and optimization of electrical grid • Maintenance • Safety and monitoring systems • Payment systems • Improvements to vehicle performance
☐	**Policies & measures**	All best practices at regulatory and organizational level to incentivize e-mobility development	• Local and European regulations • Incentives to the acquisition of EV • Regulation favourable to EV and/or against ICE vehicles • Availability and support to private charging (at home or at work) • Availability and support to opportunity chargers on the street and ultrafast charge along highways • Tax reduction • Integrated planning • Traffic management measures (e.g. dedicated traffic lanes for EVs, free parking, free access to traffic-restricted areas) • Tariffs • Interoperability and e-roaming agreements • Internal organization models for Public Administration and Local Public Transport companies • Training of personnel and HR strategies • Networks, platforms, and events for know-how sharing
☐	**Investments, funding and business models**	All best practices to promote investments on e-mobility	• Funding strategies • Private Public Partnership • Drafting of service contracts and concession contracts • Business models
☐	**Marketing & awareness promotion**	All best practices to commercially promote e-mobility and to disseminate EV culture and	• Marketing strategies • Promotions on tariffs and mobility packages (e.g. MaaS) • Organization events, talks, round tables • Organization of open days, free trials • Promotion of e-mobility for companies, mobility managers

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		technologies to potential users	• Strategies to increase garages and service points qualified for EV
☐	**Other (specify)**	Fare clic o toccare qui per immettere il testo.	

Section 1: General DESCRIPTION

Title

General description of the practice/action/measure/policy

Who are the main actors involved?

What has been the role of Public Administration, if involved? (you can select more than one option)

☐Promotion

☐ Governance

☐ Adoption

☐ Coordination

☐ (co)financing

☐ Design/planning

☒ Other: Fare clic o toccare qui per immettere il testo.

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Who is this practice/action/measure/policy addressed to?

	Category	Examples
☐	Government	local authorities, neighboring cities, local transport authority, traffic police, other local transport bodies, other local authority bodies, politicians, other decision-makers, partnering organizations, project managers, professional staff, emergency services, health & safety executives, European Union, Ministry of transport, other national ministries, regional government;
☐	Business	transport operators/providers, transport consultants, car- sharing companies, bike and e-scooter sharing service, bicycle rental operators, other mobility providers, national business associations, major employers, private financiers, international/national business, regional/local business, local business associations, small businesses, retailers, utility services (e.g., electric, telecoms), engineers/contractors;
☐	Civil society	national environmental NGOs, motorist associations, trade unions, media, local authority Forums, local community organizations, local interest groups, cycle/walking groups, public transport user groups, transport users, citizens, visitors, citizens in neighboring cities, landowners, transport staff;
☐	Research	research institutes, universities, training institutes, experts from other cities, research foundations

In which country(ies) has the practice/action/measure/policy been implemented?

At which territorial level?

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☐ Municipality

☐ Province/County/Department

☐ Region

☐ Country

☐ Europe

☒ Other: Fare clic o toccare qui per immettere il testo.

Current state

☐ To be started

☐ Ongoing

☐ Completed

Date or expected date of start [MM/YYY]

Date or expected date of conclusion [MM/YYYY]

Website and references

Section 2: evidence of success and difficulties

Achievements

What goals have been set at the project stage?

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Which of those have been achieved?

Which of those have NOT been achieved?

Barriers

Technology barriers

Policy barriers

Level of knowledge and training of public administration personnel

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Level of knowledge and awareness of local people and context barriers

Other comments about success and difficulties

Section 3: budget

Total budget (if any) in millions of Euros

Which type(s) of financial resources have been used?

- ☐ Company resources
- ☐ Grants from EU bodies
- ☐ Grants from national or local Government
- ☐ Grants from foundations
- ☐ Equity
- ☐ Debt capital
- ☐ Debt capital with guarantee of public body
- ☐ Other: Fare clic o toccare qui per immettere il testo.

Other comments about budget

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Section 4: scalability and future scenarios

To what extent could this practice/action/measure/policy be transferred (or applied) to other contexts (e.g., other cities, regions, countries…)?

☐HIGH: it is easily transferrable in other contexts with minor changes

☐MEDIUM: it is transferrable with adequate adaptations to the new context

☐LOW: it is strongly dependent on its original context

Are there further goals and improvements?

Final section: general comments

Other notes, comments, required/needed efforts or improvements

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10 ANNEX 2 – BEST PRACTICE DESCRIPTION

New charging stations in Turin	
Topic	Charging infrastructures
Typology	Policies & measures
Country	Italy
Year	2018-2019
Status	Closed
Jurisdiction	Municipality of Turin
Description	Between 2018 and 2019, the city of Turin launched an expression of interest to install new electric vehicle charging stations on the municipal territory. Specifications: - open to public and private companies - application to install at least 5 columns. Location to be indicated for 4 out of 5 columns. The fifth column to be installed in one of the points indicated by the Municipality of Turin as strategic for the development of electric mobility - maximum 200 columns per operator - the ground occupation fee for infrastructure and parking spaces is paid entirely by the companies. The concession lasts for 10 years. If charging points with 20kW-40kW power, free of charge for max. 3 years If charging points with >40kW power, free of charge for max. 5 years. The duration of the free-of-charge depends on the percentage of energy from renewable sources used To identify the areas where the recharging facilities will be located, the City Council considered the suggestions of residents (private citizens, commercial operators and professionals) who, already in possession of an electric car or about to buy one, could apply to the City to install an electric recharging point close to their homes/shops/offices.
Main actors involved	Municipality of Turin, recharging infrastructure providers
Who benefits	EV owners
Objectives	Promote electric mobility through the creation of a widespread electric vehicle charging network throughout the entire city area
Results	Five companies took part in the expression of interest: Recharge, Iren Mercato, Enel, Enermia, Duferco. 47 technical tables have already been held to examine over 600 projects
Financial sources	Private resources. Design, construction, maintenance and operation of the charging infrastructure is the responsibility of the companies
Total budget	//
Source	http://www.comune.torino.it/bandi/pdf/files/veicoli_elettrici_disciplinare_tecnico.pdf http://www.comune.torino.it/bandi/pdf/files/veicoli_elettrici_avviso_manifestazione_interesse.pdf

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Exploring the interoperability between public transport and electric vehicles infrastructures in Turin	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	Italy
Year	2023
Status	In force
Jurisdiction	Municipality of Turin
Description	It is one of the seven use cases of INCIT-EV project (Horizon EU). It aims to explores the interoperability between public transport and electric vehicles infrastructures, both at technical and regulatory levels. It originates from the strong belief that the future of electric vehicles charging lies in more synergy and cooperation between local stakeholders. The associated demonstrator is a charging station that includes ten bidirectional 3.6kW DC chargers and one 150kW DC charger whose architecture is modular (3x50kW modules) and that can be helped by the low-power chargers. It will be located in the Torino Caio Mario Park. Its hallmark innovation stems from the power source of the charging points: a direct connection to one of Torino's AC/DC conversion substations whose main purpose is to power part of Torino's tramway grid. Both sides of the equation will reap benefits: • the direct connection in DC makes the usual AC DC conversion stage unnecessary, making the overall infrastructure more efficient and more cost-effective; • thanks to an extra load, the tramway grid gains stability, resulting in a decrease of the voltage spikes. The civil works to build the demonstrator are expected to be completed by the end of summer 2023. Testing of the demonstrator should begin in early fall 2023
Main actors involved	Polito, GTT, Turin Municipality
Who benefits	EV users
Objectives	To explores the interoperability between public transport and electric vehicles infrastructures, both at technical and regulatory levels
Results	//
Financial sources	EU funds
Total budget	100K€
Source	https://www.incit-ev.eu/demonstrations/

Smart street lights in Verona	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	Italy
Year	2019
Status	Closed
Jurisdiction	Municipality of Verona
Description	In 2019, as part of the 'Electrify Verona' project, the first two smart streetlights with fast charging in Europe were installed in Verona.

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	They are called 'smart' because they are able to recharge connected electric cars with a maximum power of 22 kW, but also because they are connected to internet, have video surveillance connected with the municipal police, have sensors for monitoring air quality, and can be booked via App (Verona SmartApp). They therefore represent a real piece of the Internet of Things of the 'smart cities'. The plan is to arrive at a total of 100 charging points (by 2021), which will make Verona, compared to the largest Italian cities, the municipality with the highest number of fast charging points per inhabitant.
Main actors involved	Municipality of Verona, AGSM Verona, Volkswagen Group
Who benefits	EV owners
Objectives	Equip the city with fast charging infrastructure, even in less central areas
Results	The installation is part of the 'Electrify Verona' project, which includes other measures implemented in 2018. From 2017 to 2018, there was an increase of around 90 per cent in registrations of electric cars. The direct effect of the presence of smart lampposts cannot be measured.
Financial sources	Private/public
Total budget	//
Source	https://www.comune.verona.it/nqcontent.cfm?a_id=60963&tt=verona_agid https://www.volkswagengroup.it/Apps/WebObjects/VGI.woa/wa/viewSection?id=3959

'Electrify Verona' project	
Topic	Electric vehicles / Charging infrastructures
Typology	Engineering & product development / Policies & measures
Country	Italy
Year	2018
Status	Closed
Jurisdiction	Municipality of Verona
Description	The project represents a real mobility system dedicated to electric car owners. It envisages free access to the UVAR, free parking, electric fast-charging stations and the free installation of a Wall Box for home recharging of Verona residents who purchased a fully electric car (of all makes) between September 2018 and December 2019.
Main actors involved	Municipality of Verona, AGSM Verona, Volkswagen Group
Who benefits	EV owners
Objectives	Making Verona a smart city for electric mobility
Results	In 2018 registrations of electric cars in the municipality of Verona grew by 86% compared to the previous year
Financial sources	Private/public
Total budget	//
Source	https://www.comune.verona.it/nqcontent.cfm?a_id=60963&tt=verona_agid

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	https://www.volkswagengroup.it/Apps/WebObjects/VGI.woa/wa/viewSection?id=3959

A short- and long-term rental and maintenance service for electric vehicles in Reggio Emilia	
Topic	Vehicles
Typology	Investments, funding and business models
Country	Italy
Year	2001
Status	In force
Jurisdiction	Municipality of Reggio Emilia
Description	The start of the electrical experience of the city of Reggio Emilia dates back to 2001, when the Municipality decided to set up different pilot projects in order to promote and spread the use of electric vehicles as a realistic transport alternative. The Municipality set up a different business model characterized by a public-private partnership and the creation of a company (TIL s.r.l., a limited liability company with public capital whose main corporate mission is the organization and management of public and private mobility services in the territory of the province of Reggio Emilia) offering a complete service of short and long term rent and maintenance. Along with the replacement of the conventionally fuelled car fleets of local public institutions, a commercial electric vehicle fleet has been made available for small commercial operators. Commercial segment is indeed of particular interest: vehicles are used more regularly than private cars and deliveries are frequent and with short/mid distance.
Main actors involved	Municipality, TIL s.r.l.
Who benefits	Citizens, couriers
Objectives	To promote electric mobility in a concrete way
Results	great reduction of the impact of private cars and vans in terms of pollution, fuel consumption, noise and significant environmental and economic savings • creation of a high EVs acceptance level in the city • creation of a leading company at national level managing the long term rent
Financial sources	Public contribution for the 5 years, then the scheme runs with no public funding
Total budget	//
Source	https://www.interregeurope.eu/good-practices/reggio-emilias-experience-with-electric-vehicles https://www.til.it/

EV Access in Florence's Limited Traffic Zone	
Topic	Vehicles
Typology	Policies & measures
Country	Italy
Year	2023

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Status	In force
Jurisdiction	Municipality of Florence
Description	The city of Florence has chosen to allow access and circulation in the Limited Traffic Zone to: • 3-4wheel vehicles with pure electric traction registered for passenger transport (transit + parking). The authorization is free of charge, is valid for 5 years and must be requested to the municipality • electric vehicles with a mass of less than 3,5 t, for the transport of goods Using the "Tap&Park" parking App, non-residents in the Municipality of Florence with hybrid or electric vehicles can have the 50% discount on parking
Main actors involved	Municipality
Who benefits	EVs that need access to Limited Traffic Zone
Objectives	Facilitate EV users
Results	//
Financial sources	//
Total budget	//
Source	https://www.serviziallastrada.it/servizi-al-cittadino/autorizzazioni-circolazione-ztl-e-sosta-zcs-dei-veicoli/ztl/speciale-elettrico https://www.serviziallastrada.it/servizi-al-cittadino/autorizzazioni-circolazione-ztl-e-sosta-zcs-dei-veicoli/zcs/pagamento-sosta/tap-park

Access to reserved traffic lanes for EVs	
Topic	Vehicles
Typology	Policies & measures
Country	Spain
Year	2018 (year that the policy went into force)
Status	In force
Jurisdiction	Municipalities
Description	In Sevilla traffic lanes reserved for busses and taxis can be used by BEV's drivers. This does not apply to hybrid vehicles. In Madrid, given the new regulations on sustainable mobility, the High-occupancy vehicle traffic lane located on the A-6 and connecting Madrid with the northwestern area of the region can be used by a series of audiences. Its use is reserved for motorcycles, cars with more than one occupant on board (independently of the type of tag), mixed vehicles and buses. Cars with the "zero environmental badge" can circulate with a single occupant. These are 100% electric and plug-in hybrids with an electrical autonomy greater than 40 kilometres. Moreover, on the A-6, taxis and car-sharing cars can also travel on the High-occupancy vehicle lane with a single occupant
Main actors involved	Local PA
Who benefits	EV owners
Objectives	Increase EV diffusion
Results	//
Financial sources	//

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Total budget	//
Source	https://www.iea.org/policies/6679-access-to-reserved-traffic-lanes-for-evs https://www.sevilla.org/servicios/movilidad/documentos-pdf-normativa-movilidad/ordenanza-circulacion-sevilla.pdf

Street lights used to recharge electric cars in Valencia	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	Spain
Year	2021
Status	Pilot completed; new installations in progress
Jurisdiction	Municipality of Valencia
Description	From November 2021 Valencia, with the pilot project Humble Lamp Post, became the first Spanish city to use 12 street lights for charging electric vehicles. Each street light has two parking spaces, one for each charger, painted green and with the electric vehicle symbol. Electric vehicle users wishing to recharge at these spots can manage the entire process and payment via the Iberdrola Public Recharge app. Turning street lights into recharging points is a simple solution that avoids much of the installation work, as it can use the electrical energy infrastructure of the light itself or, at least, the channels and mechanical infrastructure for the cables. This type of charger, in addition to requiring easier installation and maintenance, does not involve the placement of an additional element on the pavement that could hinder the mobility of pedestrians and people with disabilities. The charging power (7 kW) does not reach fast or superfast charger one but it is enough for recharges made mostly at night or during long parking. The cost of installation is much lower than the placement of a traditional charging point, both in terms of the cost of its placement and the procedures and licenses required. The installation of a street lamp charging point costs about € 2500, compared to the € 50000 required for traditional charging points.
Main actors involved	EU Commission + Municipality + Iberdrola
Who benefits	EV owners
Objectives	Accelerating the process towards a carbon neutral city
Results	The initiative has been so successful that the initial 12 charging stations have been increased to over 150
Financial sources	EU Commission + Municipality
Total budget	Pilot: € 29.998 euro (of which € 18.000 from EU Commission)
Source	https://www.valencia.es/val/actualitat/-/content/puntos-de-recarga-de-veh%C3%ADculos-el%C3%A9ctricos-en-farolas-1 https://www.valencia.es/val/actualitat/-/content/farolas-puntos-de-carga-veh%C3%ADculos-el%C3%A9ctricos https://www.euronews.com/green/2022/12/06/valencia-uses-lampposts-to-charge-electric-vehicles-in-sustainable-project

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Sustainable electric charging stations in Segovia	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	Spain
Year	2017
Status	In force
Jurisdiction	Segovia Municipality
Description	The deployment of a charging infrastructure is essential for the development of electric vehicles. Even better if the charging network can be fueled from photovoltaic energy. In March 2017 Electrolineras Sostenibles installed in La Granja (Segovia) the first solar charging station for electric vehicles that is completely sustainable. It has ninety photovoltaic modules and 8 chargers that allow up to 20 electric vehicles to charge simultaneously. Charging is performed from alternate current (22kW each charger) and allows to fill 80% of the car battery within 20 minutes up to 1 hour. The vehicles will be directly charged by the solar panels when they produce electricity and by 100% certified renewable energy during the rest of the time (at night or in case of bad weather conditions). Charging costs around 4 euros, 40% less than the market average. Furthermore, for cars purchased through Electrolineras Sostenibles, the recharge is free during 5 years.
Main actors involved	Segovia Municipality, Electrolineras Sostenibles, Ingeworld
Who benefits	EV owners
Objectives	Increase the network of charging infrastructure at points of interest in the city
Results	It is a successful initiative as one year later, they are building 2 Sustainable electric charging stations, in Boceguillas (Segovia) and in Linares (Jaén) and by 2021-22 the installation of 200 additional photovoltaic stations were planned.
Financial sources	Private + crowdfunding
Total budget	The related investment has been 160.000 euros, partly supported with crowdfunding
Source	https://www.interregeurope.eu/good-practices/sustainable-electric-charging-stations https://www.ecrowdinvest.com/en/details/electrolinera-lagranja

The largest electric charging station in Spain	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	Spain
Year	2022
Status	Completed
Jurisdiction	Madrid Metropolis
Description	On 11 January, Madrid Region introduced a new charging station for electric vehicles with a capacity for 46 cars, the largest of its kind in all of Spain.

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	The station is located in Pozuelo de Alarcon, a municipality in the western periphery of the Madrid metropolis. The 6.350 square meter plot where it is located is owned by the Community of Madrid and is managed by Obras de Madrid, a public body attached to the Department of Local Administration and Digitization. It is next to the second metropolitan belt M-40 and the A5, M-502 and M-511 highways, and the Light Rail station. The station is available 24 hours a day, 7 days a week. It is also very simple to use thanks to an e-platform developed by EYSA for access, management and payment. The innovative system provides access by license plate or an app. Users do not need to obtain a ticket and pay manually, the payment is done automatically when they leave the station. Making the re-charging process faster, more accessible and more convenient is the approach that the authorities are choosing to encourage and boost more interest in purchasing and using hybrid and e-cars. Energy company Endesa X has been in charge of placing the power supply points for the 46 points, 20 of which are parking spaces with ultra-fast chargers (150 kW) and 26 operate on a semi-fast mode (up to 22 kW). The 20 charging points with Ultra-fast technology allow electric vehicle to charge 80% of their battery in just 10 minutes. The Madrid regional government is already researching other strategically located plots of public land to extend this initiative to the rest of the territory. The intention is that of creating a network of fast and ultra-fast charging points for e-vehicles to encourage and boost the diffusion of electric mobility.
Main actors involved	Two leading companies in the mobility and energy services sector: Eysa and Endesa X
Who benefits	EV owners
Objectives	The intention is that of creating a network of fast and ultra-fast charging points for e-vehicles to encourage and boost the diffusion of electric mobility
Results	//
Financial sources	Public / private
Total budget	//
Source	https://www.eltis.org/in-brief/news/madrid-region-opens-largest-electric-charging-station-country#:~:text=On%2011%20January%2C%20Madrid%20Region,periphery%20of%20the%20Madrid%20metropolis. https://www.comunidad.madrid/en/noticias/2022/01/11/diaz-ayuso-inaugura-pozuelo-alarcon-mayor-electrolinera-espana-46-puntos-recarga-rapida-ultrarrapida

The most powerful urban EV charger in Spain	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	Spain
Year	2022

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Status	Completed
Jurisdiction	Municipalities of Madrid
Description	In 2022 Madrid inaugurated Canalejas 360, a new and innovative electric mobility hub of the capital. It is located near the pedestrian Puerta del Sol in the section between Calle Alcalá, Sevilla and Plaza de Canalejas. The hub occupies floor -1 (about 5,500 m² of the surface), below Sevilla Street, adjacent to the Canalejas complex. This entire facility belongs to the Madrid City Council. The ambitious project promoted by the Madrid City Council and managed by the Municipal Transport Company (EMT) houses the most powerful urban EV charger in Spain. Located in the heart of the capital, the hub is a benchmark in this type of facility and responds to the city's growing demand for electric vehicle charging points. Canalejas 360 is part of the Madrid 360 Sustainable Mobility Plan, a key planning instrument that will structure the capital's mobility policies until 2030. It results from a 'public-private collaboration', which ratifies the commitment of the City of Madrid to continue working on electrification and the process of energy transition. The hub encompasses the integration of all mobility and last-mile distribution services in the capital. It will provide Madrilenians with the possibility to access the city centre in private or shared electric vehicles to pick up parcels, among other services. This EV charging station has a total of 12 charging points and an installed capacity of 2.5 MW. Four of these points are state-of-the-art ultra-fast chargers with a maximum power of 400 kW. The remaining points include four of 200 kW and four of 50 kW. This is the current standard of optimal loading for most commercial models and which have a special length compatible with logistics vans. Users charge their EVs through the Electro-EMT application, designed by the EMT for the entire recharging network. Recharge prices are the following: • 0.69 cents per kW/hour for the 400 kW chargers; • 0.49 cents kW/hour for the 200 kW chargers; • 0.40 cents kW/hour for the 50 kW chargers. In addition to electric recharging, Canalejas 360 offers electromobility and micro logistics services from companies that will carry out their operations within its facilities (car sharing, moto sharing, bike sharing, electric vehicles for last-mile logistics)
Main actors involved	Municipality of Madrid, Municipal Transport Company (EMT)
Who benefits	EV owners, users of the city center, logistic company
Objectives	Decarbonization of urban transport
Results	//
Financial sources	//
Total budget	Canalejas 360 involved a total investment of EUR 2,5 million and is supported by the EU Next Generation funds

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Source	https://www.polisnetwork.eu/news/madrid-launches-the-most-powerful-mobility-hub-for-electric-vehicles-in-spain/ https://www.madrid.es/portales/munimadrid/es/Inicio/El-Ayuntamiento/Todas-las-noticias/Abre-sus-puertas-el-hub-Canalejas-360-con-la-electrolinera-urbana-mas-potente-de-Espana/?vgnextfmt=default&vgnextoid=b040c38c06ee2810VgnVCM2000001f4a900aRCRD&vgnextchannel=e40362215c483510VgnVCM2000001f4a900aRCRD

Battery swapping in a car sharing service	
Topic	Charging Infrastructures
Typology	Engineering and product development
Country	Spain
Year	2024
Status	Planned
Jurisdiction	City of Madrid
Description	The project is planned to begin in 2024 in Madrid in order to test the battery swapping as charging method for a fleet of 100 Fiat 500e's. Specifications: • Stellantis and Ample planned in 2024 to test Ample's modular battery with Free2move the Stellantis car sharing service • They will use 100 Fiat 500e's • Ample's technology provides an alternative way to deliver energy to electric vehicles to accelerate the refueling
Main actors involved	Stellantis, Free2move, Ample
Who benefits	EV owners, Municipalities
Objectives	Decrease time for charging, greater energy efficiency, outstanding performance and lower range anxiety
Results	Improve E-mobility and reduce the upfront total cost of the vehicle and increase the lifespan of batteries
Financial sources	Private funds. Battery construction it's responsibility of Ample
Total budget	//
Source	https://www.stellantis.com/en/news/press-releases/2023/december/stellantis-and-ample-establish-partnership-to-leverage-ample-s-modular-battery-swapping-technology-for-use-in-stellantis-electric-vehicles

Concept of integral development of infrastructures for mass charging of electric vehicles	
Topic	Charging infrastructure
Typology	Marketing & awareness promotion
Country	France
Year	//
Status	Ongoing
Jurisdiction	Country

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Description	MODULO (Mobilité Durable Locale) is a public sector start-up serving the energy transition, in particular sustainable mobility. It brings together some local authorities and is responsible for the management, maintenance and supervision of more than 1400 public charging points, with an annual growth rate of +50%. It follows developments in mobility and its needs closely, so that we can continue to innovate (hydrogen solutions, electric bus terminals, etc.).
Main actors involved	The energy unions, shareholders of Modulo
Who benefits	Civil society; Government; Business
Objectives	The objectives is to increase the number of users and subscribers and to make known to the different unions energy
Results	Currently included about ten unions energy
Financial sources	Grants from national or local Government
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://modulo-energies.fr/

Web site of information for the public on electric mobility	
Topic	Vehicle/charging infrastructures
Typology	Marketing & awareness promotion
Country	France
Year	//
Status	Ongoing
Jurisdiction	Country
Description	Je-roule-en-electrique.fr is an initiative led by Avere-France, a national association for the development of electric mobility, and is supported by the Ministry of Ecological Transition. Nearly 30 public and private players, industrial and local authorities, are involved in this project. Together, they actively participate in the development of more sustainable mobility that is accessible to all. Many French people have questions about electric vehicles and that's normal: it's a real revolution at the heart of the automobile and beyond. While there is a lot of incomplete or even erroneous information circulating on this subject, we have decided to respond with one voice by bringing our expertise and that of independent actors. Above all, we want to offer personalized answers to each of you so that you can discover the benefits that await you.
Main actors involved	Avere-France, the Ministry of Ecological Transition, OEM, operators of charging infrastructure, Electrical Power Supplier.
Who benefits	Civil society; Government; Business
Objectives	The objectives are to increase the number of electric mobility users. Reliable source of information on electric mobility

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Results	Increase in electric car sales to the consumer
Financial sources	Grants from private company and local authorities and national Government
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://www.je-roule-en-electrique.fr/

Electric Vehicle Charging Station Financing Program (ADVENIR)	
Topic	Charging infrastructures
Typology	Investments, funding, and business models
Country	France
Year	Since 2016 to 2025
Status	Ongoing
Jurisdiction	Country
Description	the Advenir program, led by Avere-France, has supported the installation of electric vehicle charging stations. Through the mechanisms of energy certificates, it contributes to the development of electric vehicle charging by complementing the ongoing public initiatives to support and encourage electric mobility. The aim of the scheme is to remove the obstacles to the development of electric mobility by offering users different subsidies depending on their project to install a charging station, whether at home, at work or on the road.
Main actors involved	AVERE France, the Ministry of Ecological Transition and energy suppliers
Who benefits	All byer of electric vehicles, municipalities, charging operators, energy suppliers
Objectives	The objectives are to increase the number of electric charging stations
Results	Funding of 175,000 charging points at the end of the program
Financial sources	CEE
Total budget	320 million €
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://advenir.mobi/programme-advenir/

National incentives to buy electric vehicles (“bonus écologique”)	
Topic	Electric vehicles
Typology	Investments, funding, and business models
Country	France
Year	Fiscal year 2023
Status	Ongoing
Jurisdiction	Country

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Description	The ecological bonus for the purchase of a new electric car. There have been many changes as of January 1, 2023, especially in the affected vehicles. These must no longer have an acquisition price that exceeds €47,000. In addition, the unladen weight of the vehicle must be under 2.4 tons. The purchase subsidy is still available to all drivers. The amount is €5,000. However, for people who have a reference tax income per unit below €14,090, the bonus is increased to €7,000. For legal entities, the bonus is €3,000. Please note that in all cases, the bonus cannot exceed 27% of the purchase price.
Main actors involved	Ministry of Ecological Transition
Who benefits	All byer of electric vehicles
Objectives	The objectives are to increase the number of electric mobility users
Results	Increase in electric car sales
Financial sources	Grants national Government
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://jechangemavoiture.gouv.fr/jcmv/

Social Leasing for electric vehicles	
Topic	Electric vehicles
Typology	Investments, funding, and business models
Country	France
Year	Fiscal year 2024
Status	Ongoing
Jurisdiction	Country
Description	In order to accelerate the ecological transition of vehicles, and in accordance with the promise of the President of the Republic, the Government is setting up a long-term rental offer for electric cars at 100 euros per month to enable the most modest households to switch to electric.
Main actors involved	Ministry of Ecological Transition
Who benefits	Modest household's byer of electric vehicles
Objectives	The objectives are to increase the number of electric mobility users
Results	Increase in electric car sales
Financial sources	Grants national Government
Total budget	25 000 Vehicles for 2024
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://www.ecologie.gouv.fr/mon-leasing-electrique

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Regional incentives for electric vehicles (Ile de France)	
Topic	Vehicles
Typology	Investments, funding, and business models
Country	France / Ile de France
Year	2023
Status	Ongoing
Jurisdiction	Ile de France Region
Description	This aid is in addition to national aid. For the purchase of an electric car (less than €50,000) and scrapping of an old car, a subsidy of €1500 to €6000 depending on the resources of the tax household. Free parking for electric and plug-in hybrid vehicles in Paris
Main actors involved	Region ile de France, ville de Paris
Who benefits	All byer of electric vehicles
Objectives	The objectives are to increase the number of electric car
Results	Increase in sales of Electric Vehicles
Financial sources	Regional budget
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://media.roole.fr/transition/territoires/le-point-sur-les-aides-locales-pour-acheter-une-voiture-electrique

Regional incentives for electric vehicles (Auvergne Rhône Alpes)	
Topic	Vehicles
Typology	Investments, funding, and business models
Country	France / Auvergne Rhône Alpes
Year	2023
Status	Ongoing
Jurisdiction	Auvergne Rhône Alpes region
Description	This aid is in addition to national aid. For the purchase of an electric car (less than €50,000) and scrapping of an old car, a subsidy of €1500 to €6000 depending on the resources of the tax household. For light duty vehicle and small truck, the amount of aid can be reached 12000€.
Main actors involved	Region Auvergne Rhône Alpes region
Who benefits	All byer of electric vehicles
Objectives	The objectives are to increase the number of electric vehicles
Results	Increase in sales of Electric Vehicles

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Financial sources	Regional budget
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	//

Regional incentives for electric vehicles (Normandie)	
Topic	Vehicles
Typology	Investments, funding, and business models
Country	France / Normandie
Year	2023
Status	Ongoing
Jurisdiction	Normandie region
Description	This aid is in addition to national aid. For the purchase of an electric car (less than €50,000) and scrapping of an old car, a subsidy of €2500 to €4000 depending on the resources of the tax household.
Main actors involved	Normandie region
Who benefits	All byer of electric vehicles
Objectives	The objectives are to increase the number of electric vehicles
Results	increase in sales of Electric Vehicles
Financial sources	Regional budget
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://media.roole.fr/transition/territoires/le-point-sur-les-aides-locales-pour-acheter-une-voiture-electrique

Regional incentives for Electric vehicles (Gand Est)	
Topic	Vehicles
Typology	Investments, funding, and business models
Country	France / Grand Est
Year	2023
Status	Ongoing
Jurisdiction	Grand Est region
Description	This aid is in addition to national aid. For the purchase of an electric car (less than €50,000) and scrapping of an old car, a subsidy of €1500 to €6000 depending on the resources of the tax household. This aid also applies to the retrofitting of an internal combustion engine vehicle to an electric one

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Main actors involved	Grand Est region
Who benefits	All byer of electric vehicles
Objectives	The objectives are to increase the number of electric vehicles
Results	Increase in sales of Electric Vehicles
Financial sources	Regional budget
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://media.roole.fr/transition/territoires/le-point-sur-les-aides-locales-pour-acheter-une-voiture-electrique

Regional incentives for Electric vehicle (Occitanie)	
Topic	Vehicles
Typology	Investments, funding, and business models
Country	France / Occitanie
Year	2023
Status	Ongoing
Jurisdiction	Occitanie region
Description	This aid is in addition to national aid. For the purchase of an electric car (less than €30,000) a subsidy of €1000 to €2000 depending on the resources of the tax household. If you scrapping of an old car, a subsidy of €2000 to €5000 depending on the resources of the tax household.
Main actors involved	Grand Est region
Who benefits	All byer of electric vehicles
Objectives	The objectives are to increase the number of electric vehicles
Results	increase in sales of Electric Vehicles
Financial sources	Regional budget
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://media.roole.fr/transition/territoires/le-point-sur-les-aides-locales-pour-acheter-une-voiture-electrique

Municipality incentives for electric vehicles (Saint Maur city Centre Val de Loire)	
Topic	Vehicles
Typology	Investments, funding, and business models
Country	France / Saint Maur City
Year	2023
Status	Ongoing

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Jurisdiction	Saint Maur city
Description	This aid is in addition to national aid. For the purchase of an electric car and live in Saint Maur City a subsidy of €1000
Main actors involved	Saint Maur City
Who benefits	All byer of electric vehicles
Objectives	The objectives are to increase the number of electric vehicles
Results	Increase in sales of Electric Vehicles
Financial sources	Municipal budget
Total budget	//
Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://media.roole.fr/transition/territoires/le-point-sur-les-aides-locales-pour-acheter-une-voiture-electrique

Developing the purchase of EVs during the process of renewal of the university's vehicle fleet	
Topic	Electric vehicles
Typology	Policies & measures
Country	France
Year	2022-2026
Status	Ongoing
Jurisdiction	Université Gustave Eiffel – all campuses throughout France
Description	Replacing thermal vehicles in the university's fleet with electric vehicles, while reducing the size of the fleet.
Main actors involved	Head of logistics department and heads of campus general resources departments.
Who benefits	University staff (service vehicles)
Objectives	Replacing the university's combustion-powered vehicles with EVs or hybrids
Results	The operation is underway. This is an initiative of the "General Services" management, relying on the financial resources customarily available annually. The measure consists of replacing each year a few rather old vehicles (aged more than 7 years or driven more than 120,000 kms), possibly by a lower number (so as to optimize the fleet size in view of its habitual utilization) of which some are BEVs or HEVs. It is worthy of note that the university did purchase electric vehicles in the past, but the current operation is part of a thoughtful and consistent orientation. The total budget available and its allocation to the different campuses through the country are determined each year at the university level. However, the decisions as to the number of vehicles to be replaced and the types of vehicles to purchase are taken at the level of each campus, according to the local situation and the mobility needs of the staff.

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	The aim is to reach the target gradually as the budget allows. Thus, in 2024 for instance the purchase of 4 vehicles in total is planned for all the university. There is an obligation to make the acquisitions through a public central buying service. On average a petrol vehicle would cost about €15,000, a BEV about €30,000 and a utility vehicle (such as a van Renault Trafic) up to €50,000. As of February 2024, BEVs and HEVs represent about 25% of the university's total fleet (cars + utility vehicles): - cars: 65 units, of which 9 BEVs, 8 HEVs and 48 ICE vehicles; and - utility vehicles: 50 units, of which 11 BEVs, 1 HEV and 38 ICE vehicles. Two main factors are holding back the pace of completion: - a lack of support from the university's governing body - a low level of knowledge and training among public administration staff.
Financial sources	Own funds
Total budget	100k€ for vehicle purchases per year (at the university level)
Transferability	MEDIUM: it is transferable with adequate adaptations to the new context
Source	Response to questionnaire form + interview with the respondent

Purchase of electric or hybrid vehicles when replacing service vehicles	
Topic	Electric vehicles
Typology	Policies & measures
Country	France
Year	Expected date of completion: March 2024
Status	Ongoing
Jurisdiction	Université Gustave Eiffel – all campuses accros France
Description	Replacing combustion-powered service vehicles with electric or hybrid vehicles, in accordance with State regulations. This practice has been in place for several years. It is worth noting that purchases of BEVs were made well before the current practice of systematically considering the possibility of replacing ICE vehicles with electric or hybrid ones. The first such acquisitions date back to 2009, 2016 and 2018.
Main actors involved	The general services directorate along with: – the general resources division, which deals with UGAP (a purchasing centre for public entities) to draw up cost estimates given the optional characteristics of a vehicle – the garages, which handle the vehicle registration mandate.
Who benefits	Staff of the camps of Nantes, on their professional trips.
Objectives	Replacing combustion-powered service vehicles with electric or hybrid vehicles
Results	Overall, the fleet of service vehicles on the campus of Nantes includes 14 BEVs and 2 hybrid vehicles. There are two main impediments to the process: – very long delivery times for the vehicles (more than a year)

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	– lack of financial resources to comply with the government regulations.
Financial sources	Own funds: annual endowment + other funds available (if any)
Total budget	About 50 k€ per vehicle
Transferability	LOW, for several reasons: – necessity of compliance with the rules governing the renewal of a vehicle fleet (in a public entity) – the task is complicated to plan, implement, and then manage afterwards (fleet usage organization, e.g. ensuring there are enough vehicles sufficiently charged so as to be available for use, and putting the vehicles to charge when back to the campus) – budget approval becomes more complicated, because of the vehicles' cost (higher than for petrol or diesel vehicles) – long manufacture and delivery times
Source	Response to questionnaire form + interview with the respondent

Installation of electric charging stations available for private vehicles of the staff and of external visitors	
Topic	Charging infrastructure
Typology	Policies & measures + Investments, funding and business models
Country	France
Year	September 2022 – January 2023
Status	Ongoing
Jurisdiction	Université Gustave Eiffel – campus of Nantes
Description	As part of our DDRS (Sustainable Development & Corporate Social Responsibility) policy, deploy access to all through the purchase of recharging stations.
Main actors involved	The general services directorate along with the general resources division, which deals with the holders of procurement contracts for the purchase and installation of the stations, and for the implementation of the management contract.
Who benefits	University staff and external visitors
Objectives	Charging points devoted to private vehicles of staff members and of visitors
Results	There are 8 charging points in use for the service vehicles only. As part of the ongoing program, the charging points (14 in total) are already installed. These charging points (of an intermediate speed of charging) are intended to be made available for private vehicles of the staff and of visitors. However, the stations and the management system are not yet operational, due to a lack of approval of a pricing scheme by the general services directorate. It is envisaged a billing at cost price of the electricity used by private vehicles of staff members or visitors. For the time being, this has not been approved by the general services directorate. The subject should be put again on the agenda soon (during the year 2024).
Financial sources	Own funds (obtained in the frame of the national energy transition policy, after application for a financing as part of the government's *Plan de résilience*)
Total budget	100 k€

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Transferability	INTERMEDIATE. Even if the government is incentivizing such actions, decisions depend crucially on how to ensure the funds needed.
Source	Response to questionnaire form + interview with the respondent

Energy efficiency campaign with charging station prize in Azores	
Topic	Charging Infrastructures
Typology	Marketing & awareness promotion
Country	Portugal
Year	2020
Status	In force
Jurisdiction	Azores islands
Description	Electric mobility suffers from several barriers, from the generalized lack of information to the lack of charging infrastructure. In order to counter it, the Azorean Government has set a campaign where entities representing different sectors receive training and prepare a report on energy efficiency measures for their installations which also has to include mobility aspects. The best reports receive technical assistance for their implementation and are awarded an EV charging station. So far, 4 different campaign have been launched targeting tourist installations, companies, industry and schools. The campaign involves three steps: 1. Participation in a training session (4 hours) adjusted to each targeted sector. Among others, the Azorean energy policy, energy production, energy efficiency plan, illumination and funding sources 2. Submission of an energy efficiency plan to be implemented in participants facilities composed by the points discussed during the training sessions. 3. Possibility of winning an electric charging station to be installed at the winners' facilities as well as technical support in the implementation of energy efficiency measures. Winners should provide two public parking places to EV's charge. The promotion and eligibility material was made widely available through social media. The campaign is managed by a multidisciplinary team composed of communication and energy specialists and based on FAQs by the general public.
Main actors involved	Azorean Government
Who benefits	Entities representing different sectors (i.e. schools, industries, tourism companies, …)
Objectives	Counter the lack of information in e-mobility and charging infrastructure
Results	4 training sessions was carried out. 67 participants (30 entities) found them useful and were engaged in writing the reports and in implementing the energy efficiency measures identified. 18 charging infrastructures won and installed.
Financial sources	Public
Total budget	Multidisciplinary team with energy and communication specialists (20k€/year); Energy charging stations (5k€/charging station).

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Source	https://www.interregeurope.eu/good-practices/energy-efficiency-campaign-with-charging-station-prize

Real use cases connected to smart charging	
Topic	Charging infrastructure
Typology	Engineering & product development
Country	Slovenia
Year	2019
Status	Ongoing
Jurisdiction	Nation
Description	With its activities ELES is enabling real use cases connected to smart charging. Mostly with respect to private, long duration-controlled charging at locations where electric car are parked for longer time. Activities include integration of controlled charging power into ancillary services for the power grid, cost optimised charging, simplicity of connection, use friendly access to charging services. The final has not achieved yet but currently an ongoing activity is a preparation of the national platform for integration of smart charging infrastructure to motivate and enable ancillary market uptake and monetize smart charging services. Some barriers: • Preparation of a common interconnected platform to include various stakeholders. Definition of services, rules, prequalification standards, ... • Level of knowledge of public administration personnel is still low to medium. Events, publications and demonstration pilots are prepared to improve this level of knowledge • Local people and users are moderately interested and are currently more focused on reaching charging services of any kind. Slow acceptance of needed change of charging behavior and the need for diligent connection • Number of electric vehicles is still too low for a higher impact. Potential smart charging service market in not yet liquid
Main actors involved	Energy sector (TSO, DSO), aggregators (ancillary services), end users (mostly companies), CPO's
Who benefits	Business, Civil society
Objectives	Slow charging at private charging stations that will be integrated in the electric power system will bring benefits to owners of electric vehicles and society, as well as to the entire electric power system
Results	Technical feasibility of a concept and real live demonstration of controlled smart charging has been demonstrated.
Financial sources	Company resources, Grants from EU bodies, Grants from national or local Government
Total budget	4 mio€

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Transferability	HIGH (best practice easily transferrable in other context with minor changes)
Source	https://www.e8concept.com/

35.000 new smart chargepoints in 3 provinces / 74 municipalities	
Topic	Vehicles
Typology	Policies & measures
Country	The Netherlands
Year	2024
Status	In force
Jurisdiction	Municipalities and Provinces
Description	From 2024 onwards, 3 CPO's will install a total amount of 35000 charge points in the provinces of North-Holland, Flevoland and Utrecht. On all stations, smart charging is applied. This means that charging takes place mainly in off-peak hours in the grid, at times when a lot of green energy (solar or wind energy) is generated, and the electricity price is low. This happens automatically, without bothering the EV driver. Thanks to smart charging, the charging session is shifted to a more favorable one: for example, from the evening to the middle of the night. All three CPO's allow e-drivers to benefit from this through variable charging rates, making it cheaper for e-drivers. The tender also anticipated grid congestion. Just as with DC fast chargers (which require a heavy grid connection), the congestion on the grid also plays a role with low-power AC charging stations. The new charging stations are suitable for 'grid-proof charging'. Together with the grid operators, a grid-proof charging guideline was presented at the end of 2023 to resolve bottlenecks on the grid. At those locations on the grid where the demand for electricity is temporarily too heavy, the charging station operators can temporarily reduce the capacity.
Main actors involved	• Dutch provinces North-Holland, Flevoland and Utrecht • Alfen: charging station supplier • CPO's: TotalEnergies, Vattenfall, Shell
Who benefits	EV drivers in 74 municipalities
Objectives	Increase the public charging network
Results	//
Financial sources	//
Total budget	//
Source	https://www.mra-e.nl/35-000-nieuwe-publieke-laadpunten-in-noord-holland-flevoland-en-utrecht/

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Amsterdam's demand-driven charging infrastructure	
Topic	Charging infrastructures
Typology	Investments, funding and business models
Country	The Netherlands
Year	2019
Status	Finished; new contract granted in 2021 to TotalEnergies and in 2023 to Equans
Jurisdiction	Amsterdam Municipality
Description	The city of Amsterdam has studied a very pragmatic model for expanding the network of electric charging infrastructure. It consists of the following 10 steps: 1. The electric driver makes a request online for expansion of the public charging network 2. The charging operator check that the request meets the requirements and whether a new charge point is needed in the area concerned. Their considerations include the walking distance to the nearest existing or planned available charge location, the occupancy rate of the nearest charge locations, previous requests which have been turned down. 3. Amsterdam City Council ultimately decides whether a new location cab be installed 4. If a new charge point is going to be installed, the charging operator draws up an installation plan in consultation with the grid operator and the relevant city district 5. As the road authority, Amsterdam Council formally gives permission for the installation plan and publish its decision. Then a six week period to challenge or amend the decision starts 6. The location and the plan are published online on a map and communicated to electric drivers in the area 7. The contractor requests connection to the network from the grid operator 8. Amsterdam Council instructs the installation of the charge point and the design of the location 9. Following a soil survey, the grid operator allocates the connection to the charge operator and release the location for installation

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	10. The contractor installs the charge point, set up the location and connect it to network Key elements: • All stakeholders must be part of the decision-making and implementation activities to speed-up the installation process • The city has set a maximum price that suppliers are allowed to charge electric drivers in order to make electric driving attractive and affordable • the interoperability of charging stations is required for ensuring any car can be charged at any station with a standard plug • data coming from charging points must be shared with Municipality Process takes maximum 2 months. All parties are included in discussions (legal obligations, responsibilities and limitations). The municipality is the owner of the public EV infrastructure, through a long term innovative procurement (won by Nuon/Heijmans) Amsterdam has expanded fast at low cost.
Main actors involved	Amsterdam Council, charging operator, EV owners
Who benefits	Amsterdam citizens
Objectives	Expand the network of electric charging infrastructures
Results	2009: first public charging point installed but only little demand from electric drivers so Amsterdam took a proactive approach: provide charging points to raise confidence in electric driving and increase the demand 2011: the City went on a tender with 1000 new charging points. The Amsterdam model was replicated by other Dutch cities. 2018: the City of Amsterdam has more than 3800 public charging points across the city
Financial sources	Private and public
Total budget	//
Source	https://www.interregeurope.eu/good-practices/amsterdams-demand-driven-charging-infrastructure https://issuu.com/gemeenteamsterdam/docs/plan_amsterdam_4-2018_the_electric_

Pro-active preparation & demand-driven installation	
Topic	Charging infrastructures
Typology	Policies & measures
Country	the Netherlands
Year	//
Status	Ongoing
Jurisdiction	North West Region (North Holland, Flevoland and Utrecht)
Description	The rapid rise of e-mobility requires an extensive network of charging stations. However, charging infrastructure is expensive and a solid business case is crucial to enable large-scale installations. Furthermore, the installation of charging points that are not used, instead of being a symbol of a climate measure, becomes a symbol of misapplied public investment and poor use of scarce public

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	space. To achieve both great scale and profitability, a combination of proactive site preparation and demand-driven installation must be applied. The objective is to plan new locations of charging infrastructure within a time frame of about three years. Using a demand prognosis, map layers and location criteria, exact locations are selected. Subsequently, the necessary formal decision-making process is prepared. The pre-selected locations are published on our public MRAE map (http://laadkaart.mrae.nl). Once a citizen or company submits a request to have a charging point in their neighbourhood, it is first checked whether there are already charging points and how they are used. If the request is valid, the nearest point is selected and the implementation phase can be quickly moved on. Currently, the network is expanded using only data on the utilization of existing charging points, without waiting for a citizen's request to start the expansion in a specific neighborhood or commercial area. Some barriers: • Not all local authorities apply pro-active preparation, this requires a lot of capacity. MRA-E covers most external costs • Automation of the location search using algorithms still gives a too high amount of low quality locations, a lot of hand-work is still needed to find the best spots • Local authorities only revise their EV policy every few years, while new ways of working have to be integrated in policy • The region takes on the most specialised work, so capacity building at regional level is crucial. Local authority needs expert knowledge on what are good charging point locations
Main actors involved	Municipality/city, regional government (MRA-E), citizen or business
Who benefits	Civil society; Business; Government
Objectives	Pro-active preparation and demand-driven/data-driven installation is the normal way of working in all local authorities cooperating within MRA-E
Results	100% install demand or data-driven. About 50% now have proactive preparation and this is increasing
Financial sources	//
Total budget	1 million Euros
Transferability	MEDIUM (best practice transferrable with adequate adaptations to the new context)
Source	https://laadpaal.mrae.nl/ https://www.mra-e.nl/hoorn-zet-laadbeleid-letterlijk-op-de-kaart-uw-gemeente-ook/ https://www.mra-e.nl/heeft-uw-gemeente-al-een-laadkaart/

Battery swapping in 5 minutes	
Topic	Charging Infrastructures
Typology	Engineering and product development
Country	Netherlands

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Year	2022
Status	Ongoing
Jurisdiction	City of Tilburg, Harmelen
Description	• 312 swaps per day (per station) • The station can recharge up to 13 batteries and it has a capacity among 20 and 80 kW in order to avoid electricity peaks on the grid • Battery replacement takes 5 minutes with a minim charge of 90% (this value is both satisfactory for users and also safeguards battery life) • NIO initially aimed to reach 120 Power Swap Station in Europe by 2023 but in the end only 30 were installed.
Main actors involved	NIO Inc.
Who benefits	EV owners, Municipalities
Objectives	Decrease time for charging, greater energy efficiency, outstanding performance and lower range anxiety. Stabilize the electric grid thanks to the possibility to use batteries as storage during energy peaks
Results	Improve E-mobility and reduce the upfront total cost of the vehicle and increase the lifespan of batteries
Financial sources	Private funds
Total budget	//
Source	https://www.nio.com/nl_NL/news/202212020000 https://www.quattroruote.it/news/industria-finanza/2023/12/11/nio_battery_swap_station_europa_.html

"Fleetalyzer" – Analyzing the potential of substitution of vehicles in fleets with electric cars	
Topic	Vehicles
Typology	Engineering & product development
Country	Germany
Year	2021
Status	In force
Jurisdiction	//
Description	A switch to electromobility is associated with great uncertainty for many fleet operators due to the complexity of actual ranges, the required charging infrastructure, the expected acquisition and follow-up costs. The software tool "Fleetalyzer", developed by the University of Kempten and its spinnoff Monalysis GmbH, analyses the performance of a fleet. The tool, optimized and extended in the funded project E-MoMo: Electromobility on Business Trips, allows to determine the individually required mobility as it check which of vehicles can be replaced by electric versions: • Recording the movement patterns of conventional vehicle fleet • Simulation of movement patterns as an electric vehicle fleet • Determining which vehicles in fleet can be replaced by electric vehicles • Recommendations for necessary charging infrastructure • Optimization of fleet utilization • Cost and usage analysis including CO2 savings

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	• Operating electric rental vehicle E-MoMo project was funded by the Hessian Ministry (budget: 400.000 €). If a municipality/company wishes to learn more on the development and application costs of Fleetalyzer, they may contact the University of Kempten. The costs are individual and depend on the number of cars that should be analysed.
Main actors involved	University of Kempten and its spinnoff Monalysis GmbH
Who benefits	Vehicle fleet owners/managers
Objectives	The application of the tool offers the possibility to individually analyse the technical, economic and environmental advantages of electric cars and public transport of municipal and company fleets.
Results	//
Financial sources	//
Total budget	//
Source	https://www.interregeurope.eu/good-practices/fleetalyzer-analyzing-the-potential-of-substitution-of-vehicles-in-fleets-with-electric-cars https://www.monalysis.de/en/electromobility/

Pop-up EV charging points in Oxford	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	UK
Year	2018
Status	Completed
Jurisdiction	Oxford Municipality
Description	In 2020 the British EV charging startup Urban Electric Networks has announced the completion and results of the trial of their UEone prototype on-street charging hub in Oxford. Urban Electric Networks had involved the Oxford City Council, Co-wheels Car Club and product design agency Duku in the trial launched in 2018. The partners fitted a street with six charging points delivering 7 kW that retract underground when not being used for charging. The test is a part of a £600,000 initiative to encourage UK residents to make the switch to electric vehicles (EVs). The project is co-funded by Innovate UK, following a successful £474,000 bid led by Urban Electric. Urban Electric claims that the device is suitable for more than 90% of residential streets and comes with a grid demand management capability to allow whole streets to be electrified simultaneously. The idea is to unobtrusively integrate chargers to provide on-street charging opportunities for people who do not park in a garage (in the UK 43% of households have to park their car on-street). At the same time, the solution is designed to minimize the street clutter usually associated with traditional charging points.
Main actors involved	Oxford City Council, Co-wheels Car Club, Urban Electric Networks, Innovate UK
Who benefits	EV drivers who do not have private parking spaces

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Objectives	Provide EV drivers with on-street charging points, without cluttering streets with permanent charging posts
Results	In a survey the Oxford council conducted after the trial, the points were rated highly by those using the chargers, and interestingly also by residents who didn't actually use the points. All residents were 'very happy' with the installation of a charging hub on their street, validating the pop-up hub concept as a breakthrough in on-street charging for electric vehicles. Overall, the message from the responses to the trial was the importance of access to on-street charging. Qualitative feedback indicated that reliability, access and availability were the most important factors to consider when providing electric vehicle charging infrastructure, quotes Urban Electric. Respondents scored the chargers 4.3 out of 5 when asked if they would recommend them to family or a friend.
Financial sources	//
Total budget	£600,000
Source	https://www.electrive.com/2020/05/04/urban-electric-successfully-completes-charging-trial/

Hidden EV charging points in Barnet	
Topic	Charging infrastructures
Typology	Engineering & product development
Country	UK
Year	2022
Status	Completed
Jurisdiction	London Borough of Barnet
Description	Barnet Council (London) will see the installation of over 500 charging points, designed to be flat-and-flush with the pavement, that will enable residents without driveways to charge their EVs easily and locally, and embrace a move towards cleaner transport. The flat-and-flush charging point design leaves the pavement entirely clear of clutter and fully accessible to other pavement users when not in use, reducing also the impact on the streetscape. Customers use a lance which they keep in their possession to connect their vehicle to the charging point at the roadside. These points are linked via underground cables to cabinets, located up to 100m away, which send power to 15 charging units at any one time. Barnet Council has awarded a contract to Trojan Energy to deliver the £4.65 million project, £3.5 million of which was secured in Government grant funding, to boost the number of EV charging points in the borough. The funding is one of the largest amounts provided through the On-Street Residential Chargepoint Scheme, open to local authorities in the UK. Trojan on-street EV charging points involve 34 streets.
Main actors involved	Barnet Council, Trojan Energy
Who benefits	EV drivers

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Objectives	Provide EV drivers with on-street charging points, without cluttering streets with permanent charging posts
Results	//
Financial sources	//
Total budget	£4.65 million, £3.5 million of which secured in Government grant funding
Source	https://www.barnet.gov.uk/search?search=chargin+point https://trojan.energy/media-room/barnet-council-opts-for-pioneering-flat-and-flush-technology-in-innovative-ev-scheme https://www.designweek.co.uk/issues/10-15-october-2022/pdd-trojan-energy-hidden-ev-charging-points/

On-Street Residential Chargepoint Scheme guidance for local authorities	
Topic	Charging infrastructures
Typology	Investments, funding and business models
Country	UK
Year	2017
Status	In force
Jurisdiction	UK
Description	The On-Street Residential Chargepoint Scheme (ORCS) is a program that aims to increase the availability of on-street chargepoints in residential streets where off-street parking is not available, thereby ensuring that on-street parking is not a barrier to realizing the benefits of owning an EV. The scheme gives local authorities access to grant funding that can be used to part-fund the procurement and installation of on-street EV chargepoint infrastructure for residential needs, in line with the minimum technical specifications. Since 2017, ORCS has supported applications from more than 140 local authorities, leading to the installation of nearly 4,000 chargepoints. This funding boost hopes to double that number. Every fiscal year a funding is allocated. This funding is available to local authorities for eligible projects. In 2022-2023 funding was for up to 60% of eligible capital costs. Total funding provided did not exceed £7,500 per chargepoint unless electrical connection costs were exceptionally high. In these cases, funding up to £13,000 per chargepoint could be provided.
Main actors involved	UK government
Who benefits	Local authorities and EV drivers
Objectives	To increase the availability of plug-in vehicle charging infrastructure for residents who do not have access to off-street parking
Results	From 2017 to 2020: more than 140 local authority projects have benefitted from the scheme, which has supported applications for nearly 4,000 chargepoints across the UK
Financial sources	//
Total budget	£20 million (2021-2022)

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	£30 million (2022-2023) £15 million (2023-2024)
Source	https://www.gov.uk/government/publications/grants-for-local-authorities-to-provide-residential-on-street-chargepoints/grants-to-provide-residential-on-street-chargepoints-for-plug-in-electric-vehicles-guidance-for-local-authorities

Battery swapping near to borders	
Topic	Charging Infrastructures
Typology	Engineering and product development
Country	Denmark
Year	2023
Status	Ongoing
Jurisdiction	City of Slagelse
Description	Swap station with a strategic placement near the highway in because it is located center of five different European countries: Denmark, Sweden, Norway, Germany the Netherlands.
Main actors involved	NIO Inc.
Who benefits	EV owners
Objectives	Decrease time for charging, greater energy efficiency, outstanding performance a range anxiety. Due to the border location makes travel outside the country possibl owners
Results	Improve E-mobility and reduce the upfront total cost of the vehicle and incr lifespan of batteries
Financial sources	Private funds
Total budget	//
Source	https://electrek.co/2023/03/06/nio-first-ev-battery-swap-station-denmark/

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11 ANNEX 3 – TAX BENEFITS/PURCHASE INCENTIVES FOR EVS IN THE 27 EU MEMBER STATES (2022)

BEV	Battery electric vehicle	**FCEV**	Fuel cell electric vehicle (hydrogen)
PHEV	Plug-in hybrid electric vehicle	**LPG**	Liquefied petroleum gas
HEV	Hybrid electric vehicle	**CNG**	Compressed natural gas
EREV	Extended-range electric vehicle	**E85**	Blend of 85% ethanol fuel and 15% petrol, or other hydrocarbon

M1	Passenger car	**N1**	Vehicle for carriage of goods, mass ≤ 3.5 t
M2	Vehicle for carriage of passengers, mass ≤ 5t	**N2**	Vehicle for carriage of goods, mass > 3.5t and ≤ 12t
M3	Vehicle for carriage of passengers, mass > 5t	**N3**	Vehicle for carriage of goods, mass > 12t

× No benefit or incentive available

TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	**Ownership**	**Company cars**	
AUSTRIA			
VAT deduction and exemption from tax for zero-emission cars and N1 vehicles (eg BEVs and FCEVs).	Tax exemption for BEVs and FCEVs.	Tax exemption for zero-emission cars.	Bonus (until the end of 2022) for the purchase (private use) of new cars and vans with fully-electric range of ≥ 50km and gross list price of ≤ €60,000: • €3,000 for BEVs and FCEVs • €1,250 for PHEVs and EREVs Additional incentives granted by provinces and communities. For more details: www.umweltfoerderung.at
BELGIUM			

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	**Ownership**	**Company cars**	
• Brussels and Wallonia: minimum tax rate (€61.50) for BEVs and FCEVs (M1). • Flanders: BEVs and FCEVs (M1) are exempt.	• Brussels and Wallonia: minimum rates for BEVs and FCEVs (€85.27/year for M1 and €38.64/year for N1). • Flanders: BEVs and FCEVs (M1 and N1) are exempt. • 6% VAT (instead of 21%) for electricity consumption.	• Brussels, Flemish and Walloon tax benefits for BEVs and FCEVs apply to company cars as well. • Maximum deductibility (100%) of expenses for M1 with ≤ 50g CO2/km (NEDC) and battery capacity ≥ 0.5kWh per 100kg of vehicle weight. • Minimal annual benefit in kind for BEVs, FCEVs and PHEVs (M1): 4% of the list value.	• Federal level: 35% deduction of investment in new BEVs and FCEVs (N1-N3) and in related charging and fuelling infrastructure. • Brussels: for micro or small companies, up to €15,000 to replace max. 3 N1 vehicles/year. For more details: https://economie-emploi.brussels/prime-lez • Flanders (for SMEs): – 40% of additional cost of up to €400,000/ vehicle for max. 2 BEVs (N2 and/or N3). – 27.5% of additional cost of up to €600,000/vehicle for max. 2 BEVs (M2 and/or M3). – 22.5% of additional cost of up to €350,000/vehicle for max. 2 FCEVs (N2 and/or N3). For more details: Ecology premium plus | Agentschap Innoveren en Ondernemen (vlaio.be)
BULGARIA			
✕	Exemption for electric vehicles.	✕	✕
CROATIA			
No excise duties for electric vehicles.	Exemption from special environmental tax for electric vehicles.	✕	Incentive scheme (once a year, limited funds): • € 9,333 for BEVs • € 5,333 for PHEVs
CYPRUS			
Exemption for vehicles emitting ≤ 120g CO2/km.	Minimum rate for vehicles emitting ≤ 120g CO2/km.	✕	• Up to €12,000 to scrap and replace with a vehicle emitting < 50g CO2/km and costing ≤

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	Ownership	Company cars	
			€80,000. • Up to €19,000 to buy a BEV (≤ €80,000) + €1,000 to scrap an old car. • Up to €100,000 for e-buses. • €20,000 for e-trucks.
CZECH REPUBLIC			
BEVs and FCEVs emitting ≤ 50g CO2/km exempt from registration charges (with a special number plate).	• BEVs and HEVs exempt from road tax. • Vehicles emitting ≤ 50g CO2/km exempt from road toll. • Reduction of the depreciation period for charging stations for electric vehicles from 10 to 5 years (wallboxes and stand- alone charging stations).	• Road tax exemption for alternatively-powered vehicles (ie BEVs, HEVs, FCEVs, CNG, LPG and E85). • Reduction of the taxable amount for BEVs and PHEVs (from 1% to 0.5% of the gross catalogue price per month).	Purchase incentive of low- and zero-emission vehicles for state and local government bodies.
DENMARK			
Zero-emission vehicles: • Pay 40% of registration tax • Additional DKK 167,500 registration tax deduction • DKK 1,300 deduction of taxable value Low-emission vehicles (emitting < 50g CO2/km): • 50% of the full registration tax • Additional DKK 48,750 registration tax deduction • DKK 1,300 deduction of taxable value Further deductions for LCVs.	• Taxes on ownership are based on CO2 emissions. • Zero-emission cars pay the minimum semi-annual tax rate of DKK 340.	×	×
ESTONIA			
×	×	×	×
FINLAND			

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	**Ownership**	**Company cars**	
Zero-emission passenger cars and vans are exempt from registration tax as of 1 October 2021.	✕	• Tax deduction of €170 per month from taxable value (income tax) for BEVs in 2021-2025. • Charging of electric vehicles at workplace is exempt from income tax (2021-2025).	• Purchase incentive of €2,000 granted for households to purchase or lease a new BEV in class M1 and M1G, provided value ≤ €50,000. Incentive is valid in 2018-2023. • Purchase incentive of €2,000 to €6,000 for electric vans in 2022-2025. • Purchase incentive of €6,000 to €50,000 for electric trucks in 2022-2025.
FRANCE			
• Regions provide an exemption (either total or 50%) for alternatively-powered vehicles (ie electric, HEVs, CNG, LPG and E85). • BEVs, FCEVs, PHEVs (with a range of > 50km) are exempt from the mass-based malus.	✕	Exemption from CO2-based tax component ('TVS') for vehicles emitting less than 60g CO2/km (apart from diesel vehicles).	Bonus to buy car or van with ≤ 20g CO2/km: • €6,000 for households, if vehicle ≤ €45,000 • €4,000 for legal persons, vehicle ≤ €45,000 • €2,000 for households and legal persons: – Vehicle between €45,000 and €60,000 – FCEV vans and cars, or vans > €60,000 Bonus cars or vans > 21 and ≤ 50g CO2/km: • €1,000 for households, vehicle ≤ €50,000 Bonus BEV or FCEV heavy-duty vehicles: • €50,000 for N2/N3 vehicles • €30,000 for M2/M3 vehicles Scrappage scheme for purchase of second- hand or new vehicles with ≤ 50g CO2/km, price ≤ €60,000: • Cars: up to €5,000, based

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	Ownership	Company cars	
			on income • Vans: up to €9,000, based on the weight
GERMANY			
✕	• 10-year exemption for BEVs and FCEVs registered until 31 December 2025. Exemption granted until 31 December 2030 at the latest. • Exemption from the annual circulation tax for vehicles emitting ≤ 95g CO2/km.	• Reduction of the taxable amount for BEVs and PHEVs (from 1% to 0.5% of the gross catalogue price per month). PHEVs must meet further requirements, which become more stringent over time. • Additional reduction of taxable amount for BEVs with gross list price up to €60,000 (1% to 0.25% of gross catalogue price per month).	Until 31 December 2022, the 'innovation bonus' temporarily increases the environmental bonus for new and used BEVs, PHEVs and FCEVs. • Bonus for cars with net list price ≤ €40,000: – €9,000 for BEVs and FCEVs – €6,750 for PHEVs • Bonus for cars with net list price > €40,000: – €7,500 for BEVs and FCEVs – €5,625 for PHEVs Note: stricter requirements under discussion.
GREECE			
• 75% reduction in RT for PHEVs up to 50g/km. • 50% reduction in RT for HEVs and PHEVs emitting ≥ 50g CO2/km. • RT exemption for electric trucks.	• HEVs with engine capacity ≤ 1,549cc and registered before 31 October 2010 exempt from circulation tax. • 60% of the circulation tax for HEVs with engine capacity ≥ 1,550cc registered before 31 October	• Exemption of the benefit in kind tax for BEVs and PHEVs emitting ≤ 50g CO2/km (NEDC or WLTP) with net retail price (NRP) ≤ €40,000. • Deductible of €40,000 in the NRP for BEVs and PHEVs up to 50g CO2/km with higher NRP value.	• 15-20% cashback on NRP of BEV cars, with a maximum cashback of €5,500- 6,000. Max NRP to receive incentive: €50,000. Extra €1,000 if car of ≥ 10 years is scrapped.

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	Ownership	Company cars	
	2010. • Exemption for cars emitting less than 90g CO2/km (NEDC) or 122g (WLTP). • BEVs are exempt from the personal income presumption system.		• 25% cashback for BEV taxis of up to €8,000 (15% for PHEVs with ≤ 50g CO2/km), plus extra €2,500 when old taxi is scrapped. • 15% cashback for vans (up to €5,500 for BEVs; €4,000 for PHEVs), plus €1,000 for scrapping.
HUNGARY			
Tax exemption for BEV and PHEV cars.	Exemption for BEV and PHEV cars	Exemption for BEV and PHEV cars.	From 15 June 2020, purchase incentives for electric cars: • €7,350 for gross price of up to €32,000 • €1,500 if price between €32,000-44,000
IRELAND			
• €5,000 relief for BEVs up to €40,000. The relief tapers off after €40,000 and ends at €50,000. • BEV cars are exempt from NOx tax.	• Minimum rate (€120 per year) for BEVs. • Reduced rate (€140 per year) for PHEVs ≤ 50g CO2/km.	0% of benefit in kind applies to the first €50,000 for BEVs.	Purchase incentives for individuals in 2021: • Up to €5,000 for BEVs • Up to €5,000 for PHEVs with ≤ 50g CO2/km and full-electric range of ≥ 50km • Up to €3,800 for BEV vans
ITALY			
×	• Five-year exemption for BEVs and HEVs from the date of first registration. • After this period, 75% reduction of the tax rate applied to equivalent petrol vehicles (BEVs only).	×	• €3,000 (€5,000 with scrappage) for an electric car (M1) emitting ≤ 20g CO2/km and with a selling price of ≤ €35,000 + VAT. • €2,000 (€4,000 with scrappage) for an electric car (M1) emitting 21-60g CO2/km and with a selling price of ≤ €45,000 + VAT.
LATVIA			

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	**Ownership**	**Company cars**	
Exemption from registration costs for BEV vehicles (first registration).	Exemption for M1 and N1 vehicles emitting ≤ 50g CO2/km.	Minimum rate (€10) for BEVs.	✕
LITHUANIA			
Exemption for electric vehicles (first registration only).	✕	Purchase incentives (bonus) for vehicles ≤ six months: • M1 or N1 electric vehicle: €4,000 • M2 or N2 electric vehicle: €10,000 • Additional €1,000 for scrapping an old diesel or petrol M1, owned for at least 12 months, with a valid MOT Maximum subsidy is €400,000 per company.	Purchase incentives (bonus) for individuals in 2021: • €2,500 for used M1 electric vehicle with first registration after 2 April 2016, or model year 2016 and after • €5,000 for new M1 electric vehicle not older than six months from the first registration • Additional €1,000 for scrapping old diesel or petrol M1, owned for at least 12 months, and with a valid MOT for the dates: 2 February 2021 or 13 March 2020
LUXEMBOURG			
Only 50% of administrative tax.	Minimum rate of €30 per year for zero emission vehicles.	Monthly benefit in kind: from 0.5% to 1.8% depending on CO2 emissions.	• BEVs ≤ 8 kWh: €8,000 > 18 kWh: €3,000 • PHEVs ≤ 50g CO2/km: €2,500
MALTA			
Minimum rate for vehicles emitting ≤ 100g CO2/km.	Minimum rate for vehicles emitting ≤ 100g CO2/km.	✕	✕
NETHERLANDS			
Exemption for zero-emission cars.	Exemption for zero-emission cars. 50% tariff for PHEVs.	Minimum rate (16%) for zero- emission cars. Cap at €35,000 for BEVs. No cap for hydrogen cars.	• Subsidy scheme (SEPP) for individuals to buy/lease a small or compact BEV car, new or used. • Subsidy scheme (SEBA) for entrepreneurs to buy/lease a new commercial vehicle (N1 or N2 weighing

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	Ownership	Company cars	
			up to 4,250kg). • Environmental investment deduction (MIA) for BEV and FCEV light commercial vehicles and BEV taxis. • Arbitrary depreciation of environmental investments scheme (Vamil) for FCEV cars or taxis and BEV cars equipped with solar panels. For more details: https://www.rvo.nl/subsidie-en-financieringswijzer
POLAND			
Exemption for BEVs and PHEVs ≤ 2,000cc (until end 2022).	Depreciation: • Up to PLN 225,000 for BEVs and FCEVs • Up to PLN 150,000 for vehicles emitting 0-50g CO2/km • Up to PLN 100,000 for vehicles emitting > 50g CO2/km	✕	Purchase incentives for individuals: • From PLN 18,750 to PLN 27,000 for BEVs and FCEVs of a max price of PLN 225,000 Incentives for legal persons (purchase, leasing): • From PLN 18,750 to PLN 27,000 for M1 BEVs and FCEVs of a max price of PLN 225,000 • Up to PLN 70,000 for N1 BEVs and FCEVs
PORTUGAL			
Car tax: • BEVs: complete exemption • PHEVs: 75% reduction if range in all-electric mode ≥ 50km and < 50g CO2/km • HEVs: 40% reduction if range in all-electric mode	Exemption for battery electric vehicles (BEVs).	Autonomous corporate income tax: • Exemption for BEVs • Reduction for PHEVs if range in all-electric mode ≥ 50km and CO2 emissions < 50g/km VAT deduction for M1 and N1:	• Private users: €3,000 to buy a new BEV (M1 vehicle), with purchasing price of up to €62,500, limited to one vehicle per person. • Companies (limited to N1 vehicles): €6,000 to

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	**Ownership**	**Company cars**	
> 50km and CO2 emissions ≤ 50g/km		• 100% for BEVs ≤ €62,500 + VAT • 100% for PHEVs ≤ €50,000 + VAT	buy a new BEV.
ROMANIA			
✕	Exemption for electric vehicles.	✕	Renewal scheme (RABLA) for cars: • Up to €3,300 for an HEV (≤ 160g CO2/km) • Up to €6,400 for a PHEV (≤ 78g CO2/km) • Up to €11,500 for a BEV
SLOVAKIA			
• BEV registration is subject to a maximum charge of €33. • BEVs, or PHEVs combined with other fuel types or energy sources, are depreciated for two years.	• Exemption for BEVs. • 50% for FCEVs and HEVs.	✕	✕
SLOVENIA			
Minimum additional tax rate (0.5%) for BEVs.	✕	✕	Incentive scheme: • Up to €4,500 for BEVs (cars)
SPAIN			
• Exemption from 'special tax' for vehicles emitting ≤ 120g CO2/km. • Canary Islands: VAT exemption for alternatively-powered vehicles (eg BEVs, FCEVs, PHEVs, EREVs, HEVs) emitting ≤ 110g CO2/km.	Reduction of 75% for BEVs in main cities (eg Madrid, Barcelona, Zaragoza, Valencia, etc).	The use of a company car for private purposes is regarded as a payment in kind and included in the calculation of personal income tax: • 30% reduction for BEVs and PHEVs ≤ €40,000 • 20% reduction for HEVs ≤ €35,000	Incentive scheme (MOVES III) in 2021-2023: • Cars (M1): €4,500-7,000 for BEVs and FCEVs, and €2,500-5,000 for PHEVs, for private individuals, depending on whether a vehicle is being scrapped • Vans (N1): €7,000-9,000 for private individuals, depending on

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	Ownership	Company cars	
			scrapping • Different incentives for SMEs and large companies (+ MOVES FLOTAS) For more details: • https://www.idae.es/ayudas-y-financiacion/para-movilidad-y-vehiculos/programa-moves-iii • www.idae.es/ayudas-y-financiacion/para-movilidad-y-vehiculos/programa-moves- flotas Incentive scheme (MOVES MITMA) for N2, N3, M2 and M3 vehicles: • Scrappage of a vehicle registered before January 2019 (€25,000-2,500 depending on Euro class and type of vehicle) • Acquisition of new alternatively-fuelled vehicles (BEV, PHEV, HEV, and also gas for buses) • Incentives from €190,000 to €15,000, depending on the vehicle type and the size of the company For more details: https://www.mitma.gob.es/el-ministerio/sala-de-prensa/noticias/mar-16112021-1646
SWEDEN			

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TAXT BENEFITS			PURCHASE INCENTIVES
Acquisition	**Ownership**	**Company cars**	
✕	Low annual road tax (SEK 360) for zero-emission vehicles and PHEVs.	The private use of a company car is taxed on benefits. For some green cars, there is a permanent tax reduction of the benefit value.	Climate bonus for light vehicles: • SEK 70,000 BEVs. • SEK 44,417 for PHEVs with 1g CO2/km down to SEK 10,020 for ≤ 60g CO2/km. • Premium for purchase of new electric buses and trucks. Proposals for 1 July 2022: • SEK 19,700 for PHEVs with 1g CO2/km down to SEK 5,000 for ≤ 50g CO2/km. • Price cap to receive a bonus at SEK 700,000 for a new vehicle (M1 or N1).

Source: ACEA, www.acea.auto/fact/overview-electric-vehicles-tax-benefits-purchase-incentives-in-the-european-union-2022/

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12 ANNEX 4 – THE TALLIN EXPERIMENT

Lessons learned from T9.2 (D9.3):

- The number of **new car registrations (all types) are being reduced in a continues trend**. There are at least 10 reasons explaining this tendency: general economic crisis, lower purchasing power of families, disruptions in supply chain, aging of population and low rate of new birth, teleworking or hybrid offices, improvement of public transportation means, car sharing and micromobility options, urban protection policies (Zero o low emission areas), pedestrianization of streets, reduction of surface parking places or health crisis (Covid among others)
- The **stock of vehicles is slightly being reduced but not so much because the second-hand market is blooming keeping vehicles in the streets sometimes very old**. Although **the penetration of EVs is growing, it is not as accelerated as expected**. 25 factors have been evaluated being the economics the first aspect affecting the transition speed and the convenience to charge easily the second. As **topology in cities is different** (large or short, vertical, or horizontal, etc.) and **the purchase power of citizens and public administration as well**, the penetration of electric vehicles is not homogeneous. Consequently, the cities have been divided among **leading, followers and lagging.**
- **Ultrafast charging in highways represents a challenge**. Chargers over 150 kW implies a large investment requiring a critical mass of vehicles charging daily. This is not the case during long periods of the year. On the other hand, during holiday trips, there is an avalanche of cars generating jams in the chargers.
- **The major problem of the car electrification** must be found in the large mass of population **that lives very tightly and need cheap and comfortable solutions** or will not take the plunge.
- **Large investments in electromobility promotion** (upfront grants for EVs and e-chargers, tax policies, awareness campaigns, grid adaptation, Renewables, …) **do not invariable translate economic benefits for a city (monetizing all externalities)**
- **The topology of a city is very relevant for the Cost-Benefit Analysis (CBA)**. **Vertical cities with high population density** and traffic volumes that invest in electromobility promotional measures will improve air quality but **will incur in substantial expenses** when deploying public charging stations; **Horizontal cities will make the transition cheaper**, as citizens can easily install a private charger at home although the air quality will not be improved too much because it is already clean.
- **CBA depends also on the socio-economic situation of the cities**. **Leading cities** have administrations that already have invested in clean solutions and count with environmentally awareness citizens. If they continue strongly investing in EVs and charging infrastructures, they will not receive an offset in environmental benefits as they are already clean societies. **Follower cities** have administrations that start to invest in clean solutions with intermediate environmentally awareness citizens. Consequently, the environmental benefits relay on the investments but they receive more environmental benefits, and their negative externalities are not so pronounced as in the leading cities' cases. **Lagging cities** have administrations that doesn't invest in electromobility by economic reasons and where citizens are low environmentally aware and has a low power purchase power. The market inertia allows some penetration of the electromobility in these cities among the wealthiest citizens but not in the general population.

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- A key question **is how to promote the transition among the poorest people** once the richest have done. That people usually live in the surroundings of a city and has not private parking places. They must commute daily to the inside and cannot afford an electric vehicle. Due to the low presence of private parking in suburbs one solution could be to prepare opportunity parkings hubs close to the cities well connected with public transport and multi-mobility electric options to park there and get an electric solution. Another option could be to install low power charger at the streetlights only for residents. Wireless charging is still at very early stages although could be applied initially in stationary type.

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13 ANNEX 5 – BARRIERS FOR STAKEHOLDERS PER COUNTRY

This annex provides detailed information about the different barriers encountered by stakeholders involved in the development of electrical mobility and the corresponding charging infrastructures. The analysis has been carried out in four different countries: Spain, France, Italy and Estonia. For each stakeholder, we have analysed technical, commercial and political barriers.

FRANCE	
DS Os and Energy distributrors or providers	
Technical	1.**Grid Capacity Challenges:** The increase in energy demand due to electric vehicle charging may pose challenges to the capacity of the electrical grid, especially if charging is concentrated at specific times of the day. 2.**Managing of Charging Infrastructure Responsibilities:** Challenges in defining and allocating responsibilities among the different actors involved in the operation and maintenance of the charging infrastructure, which can complicate implementation and lead to contractual disputes.
Commercial	1. **Profitability of Charging Stations**: The business model for charging stations is not yet profitable, which may be a barrier to private investment in this sector. **2. Evolution of Charging Networks**: Uncertainty about how the charging market will evolve, with potential differences in access to charging networks based on the vehicle brand and communication protocols used. This may create barriers for users wishing to access certain charging networks without owning the appropriate vehicle. **3.Viability Concerns in Transport Projects**: Doubts about the economic viability of the project, including investment costs, impact on transportation costs, and long-term profitability, which can hinder obtaining financing and investor participation. **4.Charging Technology Competition**: Competition between different charging technologies and service providers, as well as the need to balance the commercial interests of the various actors involved in deploying charging infrastructure, which can slow down the adoption process.
Political	**1. Incentives for EV Adoption**: The absence of adequate government incentives can hinder the adoption of electric vehicles and associated charging infrastructure. **2. Policy Concerns in Inductive Charging**: Concerns about regulations and policies related to charging frequencies in inductive charging technology, particularly regarding interference with other communication systems. **3. Legislative Uncertainty in Charging Infrastructure**: Uncertainty about existing and future legislation related to charging infrastructure, including safety standards, liability in case of failures, and permits for deployment, which can create obstacles to effective implementation.
EVS OPERATORS (CAR SHARING AND RIDE HAILING, WASTE, LOGISITC, CABS, CONCESSIONAIRES..)	
Technical	**1.Charging Infrastructure Constraints:** Implementing effective charging infrastructure mandates faces obstacles due to limited control over privately managed parking lots. Deployment of a large number of slow-recharge parks for night cycle charging presents land and power constraints. **2.Vehicle Range and Infrastructure Compatibility:** The actual range of electric vehicles varies based on factors like season and driver behavior, impacting delivery routes. Concerns arise regarding the adequacy of infrastructure, especially in peri-urban areas, where battery size reduction may necessitate expanded urban space networks. **3.Technology Adoption Challenges:** While inductive charging presents opportunities, technical complexities exist. For instance, integrating dynamic inductive charging requires addressing concerns like the impact on vehicle autonomy and driver anxiety, necessitating thorough planning and infrastructure development. 4.**Complexity of Electorate Engagement:** The complexity of the electoral procedures and paperwork involved can deter participation, especially among merchants who may lack awareness or understanding of the process. Mobilizing merchants to vote requires extensive efforts in education and outreach to underscore the significance of their participation.

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FRANCE	
	5. Apathy or Electoral Disinterest Among Merchants Additionally, overcoming apathy or disinterest towards electoral engagement poses a significant hurdle that needs to be addressed through targeted initiatives aimed at increasing awareness and motivation among merchants. **6. Vehicle Specifications:** The organization uses hybrid transport solutions combining heavy truck and light commercial vehicle features for deliveries. However, finding electric vehicles suitable for the organization's needs, especially in terms of payload and range, poses challenges. There's a lack of upfront calculation on necessary WLTP for electric vehicles, leading to uncertainty about current electric vehicle offerings' adequacy for operational demands. **7.Route Optimization and Traffic:** The organization relies on route optimization tools to plan deliveries, making adjustments according to traffic conditions. However, dynamic traffic conditions, particularly in urban areas like Paris, introduce uncertainty in route planning. Traffic congestion emerges as a major challenge, affecting delivery schedules and overall efficiency. **8.Charging Station Availability and Reliability:** The limited availability of charging stations impedes the vision of seamless electric vehicle integration, particularly in urban environments like Paris. Customers face challenges in locating accessible charging points, hindering the ease of vehicle recharging. Furthermore, reliability issues plague existing public charging stations, leading to concerns about their functionality and trustworthiness. This unreliability extends to stations operated by Belib, exacerbating the overall complications in the charging infrastructure. **9. Vehicle Autonomy and User Experience:** Adapting to user expectations and concerns regarding electric vehicle technology is crucial for widespread adoption. Users often express apprehension about the limited range of electric vehicles and fear running out of charge during trips, impacting their overall experience and confidence in electric mobility. The absence of effective trip planners further exacerbates these concerns, leaving users feeling uncertain about the feasibility and convenience of electric vehicle usage. To mitigate these challenges, strategies for improved communication and user education are essential. **10.Fleet Diversification and Vehicle Availability:** Organizations managing vehicle fleets encounter difficulties in diversifying their inventory while navigating leasing contracts and agreements. This challenge is particularly pronounced in certain locations where the availability of desired electric vehicle models is limited. Overcoming these hurdles necessitates flexibility in procurement strategies and collaboration with multiple manufacturers to ensure adequate vehicle availability across different operational areas. **11.Recharging Constraints and Operational Challenges:** Operational constraints arise from limitations on user recharging options and the absence of systematic recharging protocols during fleet rebalancing activities. These constraints contribute to inefficiencies in fleet management and service delivery, impacting operational effectiveness and customer satisfaction. Additionally, issues with the functionality of charging stations, including delays or malfunctions, further compound operational challenges and increase downtime for electric vehicles. **12. Parking Technology Limitations and Management Issues:** The utilization of underground parking facilities is hindered by technological limitations, such as challenges with GSM and Bluetooth connectivity, and imprecise geolocation systems in underground lots. These limitations impede efficient vehicle management and exacerbate operational complexities, particularly in urban environments where parking space is limited. **13.Cleanliness and Maintenance Concerns:** Ensuring vehicle cleanliness and maintenance remains a critical aspect of fleet management, especially in shared mobility services. Operational complexities arise from the need to maintain cleanliness standards during frequent rentals and address suspicions about vehicle dirtiness effectively. Developing streamlined processes and protocols for vehicle cleaning and maintenance is essential to uphold service quality and customer satisfaction. **14.Taxi Driver Concerns and Charging Infrastructure:** Taxi drivers express concerns about the limited range of electric vehicles and the time required for battery recharging, particularly during peak operating hours. These concerns are amplified by the inadequate availability of charging infrastructure, leading to prolonged waiting times at charging stations and insufficient routes for rapid daytime recharging. Addressing these challenges requires significant investment in charging infrastructure and strategic planning to meet the unique needs of taxi operators. **15.Technical Challenges in Charging Infrastructure Deployment:** Installing electric charging infrastructure in rural areas presents technical challenges due to energy capacity limitations and logistical constraints. Overcoming these challenges need innovative solutions and collaboration between stakeholders to expand charging infrastructure coverage and support electric vehicle adoption in underserved areas. **16. Security and Transaction Authentication:** The use of RFID-based charging terminals introduces vulnerabilities that raise concerns about security and transaction authenticity. Instances of fraud, where the same RFID number is duplicated multiple times, highlight the need for robust authentication mechanisms to ensure the security and integrity of charging transactions. Implementing secure authentication protocols is essential to instill confidence in the charging infrastructure and protect user data and transactions.

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	17.Communication and Billing Complexity: Establishing efficient communication between vehicles and charging stations is critical for authorizing charging sessions and facilitating seamless billing processes. However, the technical complexity involved in communication protocols and transaction authentication introduces challenges in ensuring reliable and secure interactions between vehicles and charging infrastructure. Addressing these challenges requires the development of standardized communication protocols and billing systems to streamline the charging process and enhance user experience. **18. Battery Maintenance and Replacement Costs:** Long-term financial and operational challenges stem from battery maintenance and replacement costs associated with electric vehicles. Battery degradation over time necessitates periodic maintenance and eventual replacement, adding to the total cost of ownership for electric vehicle operators. Managing these costs effectively requires proactive maintenance strategies and investment in battery technology research to extend battery lifespan and reduce replacement expenses.
Commercial	1**. Parking Challenges and Mobility for Business Operations:** Merchants struggle to find street parking near stores, leading to increased costs and operational disruptions. Rising surface parking rates drive them towards underground options, yet limited availability, especially for delivery trucks, hampers supply chains. This scarcity complicates logistics for quick restocking, navigating traffic constraints between stores, and unloading goods efficiently during delivery operations, ultimately impacting customer satisfaction. **2.Fleet Transition to Electric:** Limited availability and suitability of alternatives, with manufacturers unable to meet demand. Organizations relying on gasoline-powered vehicles face constraints in adopting alternative fuels, raising concerns about meeting the 2024 deadline for full electric vehicle transition. **3.Subcontractor Adaptation:** Subcontractors with older vehicles face challenges in shifting to cleaner options due to limited availability, hindering alignment with sustainability goals. Coordination between the organization and subcontractors is vital for effective fleet transition. **4.Operational Constraints and Parking Limitations:** The operational challenges, particularly evident with electric vehicles in Paris, lead to user dissatisfaction stemming from parking limitations. Issues such as confusion surrounding car-sharing zones, difficulties in user education, and misunderstandings about vehicle return locations exacerbate operational inefficiencies. Mitigation strategies entail adapting to user expectations, employing digital approaches, and exploring diverse offerings to address these challenges effectively. **5.Billing Methods and Economic Feasibility:** The sector faces economic hurdles in developing billing methods aligned with car-sharing dynamics, impacting profitability and sustainability. Strategies to ensure economic feasibility while maintaining competitiveness are essential for continued growth. **6.User Acceptance and Communication:** Challenges in user acceptance stem from concerns about electric vehicle technology and autonomy. Effective communication strategies, such as emphasizing kilometers, defaulting to eco-mode, and continuous user education, are pivotal in overcoming these concerns and fostering greater acceptance. **7.Rental Model Limitations:** Constraints within the rental model, including restrictions on rental durations and pricing structures, pose obstacles to sector expansion and profitability. **8.Autonomy Concerns:** Issues related to limited vehicle autonomy, potential drawbacks associated with smaller batteries, and the necessity to balance autonomy with battery size present barriers to electric vehicle adoption and usage. **9.Evolution of Car-Sharing Sector:** Sector evolution is influenced by factors like reliance on municipal support, the need to compete with personal vehicles, and the impact of city council roles on shared mobility initiatives. **10.Financial Challenges for Taxi Drivers:** Taxi drivers face significant financial barriers due to the high initial acquisition costs of electric vehicles, particularly impacting those operating with tight profit margins. **11.Uncertainty about Used Electric Vehicle Resale:** Uncertainty surrounding the resale value of used electric vehicles and potential asset depreciation may deter drivers from investing in this technology. **12.Profitability of Charging Stations:** The profitability of charging stations remains uncertain, dissuading private investment in this sector despite its critical role in infrastructure development. **13.Uncertainty in the Charging Market:** Market uncertainty regarding the future evolution of charging infrastructure poses challenges for users seeking access to specific charging networks without owning compatible vehicles. 14.I**nfrastructure Investment Challenges:** Financial challenges associated with the investment required to adapt existing infrastructure to new technologies hinder infrastructure development. **15. Management of Electric Vehicle Recharging Stations (ERS):** The lack of clarity regarding the financing and management of ERS creates uncertainty and potential disagreements among involved parties, hindering implementation.

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FRANCE	
	16.Vehicle Ownership and Financing Challenges: Challenges related to vehicle ownership and financing, including regulatory constraints favoring larger vehicles and limited driver choices, impede electric vehicle adoption. **17.Adoption of Electric Mobility Among Drivers:** Slow adoption of electric vehicles due to concerns about autonomy, recharging, and cost highlights the necessity for incentives to encourage drivers to transition to electric mobility.
Political	**1.Regulatory and Policy Constraints**: Regulatory limitations on charging technology deployment impact experimentation and operationalization. Policy frameworks must evolve to support innovative solutions like inductive charging, requiring collaboration between governmental bodies and industry stakeholders. **2.Urban Planning and Infrastructure Development**: Infrastructure installation in urban areas requires navigating complex regulatory environments and stakeholder interests. Political support for maintaining prototype infrastructure beyond initial testing phases is crucial for long-term technology validation and adoption. **3.Interdisciplinary Collaboration**: Addressing technical and regulatory challenges necessitates interdisciplinary collaboration. Coordination between transportation, energy, and regulatory authorities is essential to overcome barriers and facilitate the adoption of innovative technologies like inductive charging. **4.Engagement with Public Authorities**: Coordinating with public authorities like the City of Paris and Prefecture of Police is essential to address merchant concerns and advocate for policy changes. However, challenges exist in building relationships and influencing decision-making within bureaucratic structures. Effective advocacy efforts are needed to shape policies in favor of merchant interests, overcoming bureaucratic inertia and resistance to change. **5. Regulatory Challenges for Merchants:** Merchants face imminent regulatory changes like the Low Emission Zone (LEZ), influencing their vehicle choices and potentially causing financial strain. However, lack of awareness about upcoming regulations such as the 2024 diesel ban underscores the necessity for effective education and communication efforts. Ensuring merchants are informed and compliant presents challenges in disseminating accurate information and fostering stakeholder compliance. **6.Infrastructure Limitations**: Insufficient infrastructure for electric vehicle charging, especially in delivery areas, hinders widespread adoption, emphasizing the need for significant investment and better communication on available charging solutions. Regulatory hurdles further impede the establishment of dedicated parking spaces tailored to merchant needs. **7.Infrastructure Readiness**: Adapting to infrastructure changes presents a multifaceted challenge, encompassing considerations like payload, autonomy, and sector redesign. Particularly concerning is the uncertainty surrounding the availability and accessibility of charging stations, especially for electric vehicles. To address these challenges effectively, collaboration and support from authorities are essential to facilitate the development of adequate infrastructure necessary for transitioning to cleaner vehicles. **8.Regulatory Challenges and Autonomous Vehicles**: The process of navigating regulatory changes and integrating autonomous vehicles into existing frameworks necessitates close collaboration with governmental authorities and manufacturers. Strategies aimed at addressing these challenges involve leveraging comprehensive data insights and deep understanding of customer needs to effectively guide regulatory solutions. This approach ensures that new regulations are not only compliant but also conducive to fostering innovation and sustainable mobility practices. **9.Public Support and Policy Considerations**: The limited support for car-sharing initiatives in public policies, particularly concerning incentives and regulatory frameworks, presents significant hurdles compared to individual electric vehicle adoption. To counteract this, proactive advocacy efforts are crucial, emphasizing the vital role of car-sharing services in alleviating traffic congestion and reducing emissions. This involves engaging with policymakers to highlight the societal benefits of car-sharing and advocating for supportive policies that incentivize its growth. **10.City-Specific Development and Integration**:A cohesive strategy is crucial to accommodate diverse urban landscapes and varying development speeds of car-sharing services across cities. Collaborative partnerships between industry stakeholders and local governments are vital to tailor solutions addressing specific urban challenges and needs. **11.Regulatory and Traffic Zone Issues**: Challenges related to regulatory compliance, particularly in restricted traffic zones, pose operational constraints for car-sharing services. Issues such as adapting to evolving regulations and navigating limited traffic areas require agile and adaptive strategies. Overcoming these challenges involves proactive engagement with regulatory authorities to advocate for flexible frameworks that support innovative mobility solutions while ensuring compliance with local regulations. **12.Service Expansion and Policy Challenges**: Factors such as weak demand and regulatory constraints on vehicle types hinder the expansion of car-sharing services. Addressing these challenges necessitates a multifaceted approach that combines targeted policy advocacy with strategic business planning. This may involve advocating for regulatory reforms that enable greater flexibility in service offerings and incentivize demand for car-sharing among consumers.

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	13.Government Incentives and Regulatory Support: Despite existing regulations and incentives aimed at promoting electric vehicle adoption, challenges persist due to taxi-specific regulations and inadequate infrastructure development. Overcoming these barriers requires concerted efforts to advocate for targeted policy reforms that address the unique needs of taxi operators and facilitate the deployment of charging infrastructure. This involves engaging with governmental authorities to secure funding and regulatory support for infrastructure development projects. **14.Charging Infrastructure and Government Policies:** The insufficient charging infrastructure and policy uncertainties hinder electric vehicle adoption. Addressing these challenges necessitates coordinated government, industry, and infrastructure provider action to accelerate charging infrastructure deployment, with essential government support. **15.Regulatory Compliance and Infrastructure Readines**: Meeting regulatory requirements for emission standards and vehicle electrification mandates challenges fleet operators, necessitating investments in infrastructure readiness and coordination between stakeholders. **16.Technological Innovation and Adoption**: Innovative charging solutions hold promise for electric vehicle adoption, but they face challenges related to scalability and compatibility. Collaboration among stakeholders is essential to develop standardized solutions that seamlessly integrate into existing infrastructure networks, facilitating widespread adoption.
PUBLIC ADMINISTRATIONS	
Technical	**1.Charging Infrastructure Installation:** Taxi drivers and ride-hailing services struggle to install charging stations, especially in condominiums, and face limited access to airport infrastructure. The lack of adequate infrastructure and limited urban planning may result from deficient or insufficient government policies in terms of developing the charging network and integrating electric vehicles into public transportation systems. **2.Charging Infrastructure Implementation:** Slow-charge electric and biogas buses face challenges due to infrastructure upgrades, while concerns arise about the durability of dynamic inductive charging systems, particularly in high-traffic areas, posing issues related to technology waste, reliability, and maintenance. **3.Infrastructure Maintenance:** Logistical hurdles related to vehicle maintenance and refueling outside Paris, and ensuring adequate recharging infrastructure, pose challenges due to regulatory aspects and logistical constraints. **4.Vehicle Autonomy and Charging Time:** Professionals, including light commercial vehicle operators like Darty, face challenges due to insufficient vehicle autonomy and limited recharging time during short stops. Difficulty finding parking equipped with charging stations contributes to companies' reluctance to implement solutions. **5.Vehicle Technology and Compatibility:** Implementing dynamic inductive charging presents challenges in infrastructure installation, interoperability protocols, and limitations in electric buses' autonomy and recharging rates. Concerns persist about battery availability and compatibility for fast charging, alongside technical considerations for alternative fuel vehicles like hydrogen. **6.Vehicle Motorization Requirements:** Specific motorization requirements for the waste management fleet, favoring alternatives like Compressed Natural Gas (CNG) or electric, affect heavy vehicles like garbage trucks, ensuring adherence to environmental standards and reducing emissions. **7.Operational Limitations:** Restricted access to certain lanes affects waste collection efficiency, creating operational inefficiencies and safety concerns, compelling the organization to seek permissions or alternative routes.
Commercial	**1.Cost and Investment Concerns:** Dynamic inductive charging requires substantial financial investment, particularly for buses and infrastructure. Operational costs for managing fleet vehicle charging, like light commercial vehicles, are also a concern. Moreover, limited control over privately managed public parking lots hampers the city's ability to enforce charging infrastructure requirements. Concession contracts for public charging stations carry financial risks, with co-contractors assuming industrial and investment risks, adding complexity to infrastructure deployment. **2.Vehicle Fleet Transition:** Incompatibility with the 2030 target set by the City of Paris for 100% electric vehicle (BEV) usage for professionals using light commercial vehicles (LCVs), posing a barrier to compliance. The transition to cleaner vehicle technologies, such as electric or hydrogen, entails higher costs compared to conventional options like gasoline or CNG. **3.Market Competition and Operator Diversification:** Managing competition and diversification among electric shared mobility service operators poses challenges, including potential oversaturation and regulatory issues. Consultation processes are essential to control the number of operators and promote sustainable market growth, as seen with electric mopeds and carsharing services. The transition to cleaner vehicle technologies affects decision-making regarding fleet modernization and the allocation of financial resources for procurement.

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	4.Regulatory Compliance and Political Obstacles: Meeting regulatory requirements for vehicle technology and emissions standards influences the choice of clean energy vehicles and charging infrastructure, while political obstacles from local authorities, including concerns about visual disruptions and technology preferences, further complicate the implementation process. **5.Regulatory Constraints, Contractual Frameworks, and Financial Considerations:** Shared mobility service operators, such as those providing electric scooters and bicycles, face challenges stemming from regulatory constraints and contractual frameworks. Agreements like CODP and AOT impose restrictions, limiting operational flexibility and influencing discussions on pricing, service quality, and ownership rights to charging infrastructure. The procurement process imposes strict clauses on fuel types, impacting vehicle motorization choices. Acquiring clean vehicles, upgrading depots, and ensuring energy independence present significant financial burdens. Moreover, managing the lifecycle of vehicles, including disposal and replacement, poses further challenges in optimizing asset utilization and minimizing financial losses.
Political	**1.Cost and Investment Concerns:** Dynamic inductive charging requires substantial financial investment, particularly for buses and infrastructure. Operational costs for managing fleet vehicle charging, like light commercial vehicles, are also a concern. Moreover, limited control over privately managed public parking lots hampers the city's ability to enforce charging infrastructure requirements. Concession contracts for public charging stations carry financial risks, with co-contractors assuming industrial and investment risks, adding complexity to infrastructure deployment. **2.Vehicle Fleet Transition:** Incompatibility with the 2030 target set by the City of Paris for 100% electric vehicle (BEV) usage for professionals using light commercial vehicles (LCVs), posing a barrier to compliance. The transition to cleaner vehicle technologies, such as electric or hydrogen, entails higher costs compared to conventional options like gasoline or CNG. **3.Market Competition and Operator Diversification:** The potential market saturation and regulatory issues can arise due to the lack of clear policies or inconsistent implementation of regulations, hindering the entry and operation of new competitors and potentially stalling sustainable market growth. **4.Regulatory Compliance and Political Obstacles:** Meeting regulatory requirements for vehicle technology and emissions standards influences the choice of clean energy vehicles and charging infrastructure, while political obstacles from local authorities, including concerns about visual disruptions and technology preferences, further complicate the implementation process. **5.Regulatory Constraints, Contractual Frameworks, and Financial Considerations**: Shared mobility service operators, such as those providing electric scooters and bicycles, face challenges stemming from regulatory constraints and contractual frameworks. Agreements like CODP and AOT impose restrictions, limiting operational flexibility and influencing discussions on pricing, service quality, and ownership rights to charging infrastructure. The procurement process imposes strict clauses on fuel types, impacting vehicle motorization choices. Acquiring clean vehicles, upgrading depots, and ensuring energy independence present significant financial burdens. Moreover, managing the lifecycle of vehicles, including disposal and replacement, poses further challenges in optimizing asset utilization and minimizing financial losses.
PUBLIC EVS OPERATORS (BUSES, OTHER ELECTRICS)	
Technical	**1.Limited Battery Technology Supply:** Articulated buses face a challenge in the supply of batteries, especially for night-time charging. Availability of batteries for inductive charging while driving is limited. **2.Charging Infrastructure Compatibility:** The decision not to consider opportunity recharge at the terminal is influenced by the industrial capacities and the need for 200 km autonomy. The challenge of standardizing and integrating inductive charging technologies for buses from different providers. **3.Complexity of Pantograph Systems:** Reluctance to install pantograph systems everywhere in Paris due to complexity, particularly on lines with endpoints in different towns.
Commercial	**1.Limited Market for End-of-Life Buses**:There is uncertainty about selling buses at the end of their life, and if there is no market or customers, they may be scrapped. **2.Hybrid Bus Availability**: The transition to electric buses involves the replacement of hybrid buses before 2030, posing a challenge in ensuring an adequate supply of electric buses. **3.Competitive Bidding for Charging Solutions:** The need for a broad offer and competition in the market for inductive charging while driving, considering the complications of having a single supplier.
Political	**1Regulatory Changes and Diesel Ban Anticipation**: of questions arising from 2029 onwards regarding the possible ban on diesel buses, indicating a sensitivity to regulatory changes. **2. Competition Impact on Bus Centers:** Concerns about the competition leading to changes in operating bus centers after January 1st, 2025, indicating the influence of political decisions on operational strategies.

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	3.Decision-making Authority: The authority of the Mobility Organizing Authority (AOM) in making decisions on technologies and purchasing, highlighting a political influence on the adoption of sustainable practices.

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EV rental and sharing companies	
Technical	**1. Charging Infrastructure**. *Predominance of Slow Charging Infrastructure*: The prevalent deployment of slow chargers is attributed to the prohibitive costs associated with fast charger installation. Despite cost constraints, the organization has successfully managed to facilitate electric vehicle charging operations predominantly employing slow-charging infrastructure. **2. Parking Infrastructure**. *Suboptimal Underground Parking Considerations*: The technical challenge arises from concerns regarding signal connectivity losses when electric vehicles are parked underground. This issue persists unless a technology solution is implemented to mitigate connectivity disruptions in such environments. **3. Charging Station Accessibility** *Charging Station Availability Concerns*: The technical hindrance revolves around the accessibility and availability of charging stations. Ensuring a consistent and reliable network of charging infrastructure is imperative for the seamless operation of the electric vehicle fleet. **4. Charging Compatibility:** *Decreasing Adaptability to AC Charging Standards*: The evolving landscape of electric vehicle models exhibits diminishing compatibility with AC (Alternating Current) charging standards. This trend is expected to persist in future models, thereby rendering AC charging solutions increasingly inadequate to meet the operational requirements of the organization. These technical barriers highlight the challenges faced by companies in the electric vehicle rental sector, emphasizing the need for advanced charging solutions, improved parking infrastructure technologies, and considerations for evolving charging standards.
Commercial	**1. Company Scale**: *Small-Scale Operations:* The company operates within a compact organizational framework, characterized by a limited scale and resource base. **2. Financial Constraints**: *Challenges in Securing Financing*: The startup status of the company presents hurdles in securing necessary financing, impacting its ability to expand and optimize operations effectively. **3. Fleet Management**: *Resilience through Reserve Vehicles*: A key operational challenge lies in securing financing for one or two reserve electric vehicles, amounting to 20-30% of the fleet. This ensures operational continuity in the event of breakdowns within the limited-sized fleet. **4. Geographical Restrictions**: *Constraint on Vehicle Movement*: Some companies impose restrictions on the geographical movement of vehicles, hindering operational flexibility. Addressing this barrier requires strategic negotiations and collaborations to expand operational boundaries. **5. Urban Parking Challenges:** *Urban Parking Accessibility Issues*: Navigating complex urban parking dynamics poses a challenge for carsharing operations. The accessibility of parking spaces within cities impacts the feasibility and efficiency of the carsharing service. **6. Market Disparities**: *Regional Disparities in Carsharing Demand*: Disparities in the attractiveness of carsharing services are observed across cities and countries. Analyzing and understanding this market behaviour is crucial for strategic decision-making and market expansion efforts. **7. Consumer Awareness**: *Understanding Electric Vehicle Autonomy*: There is a notable lack of awareness regarding electric vehicle autonomy, often expressed in kilometers. Addressing this informational gap is essential for enhancing consumer understanding and promoting the adoption of electric vehicles in the carsharing ecosystem. These commercial barriers highlight the intricate challenges faced by a small startup in the electric vehicle rental sector, emphasizing the need for strategic financial planning, operational resilience, and a nuanced understanding of regional market dynamics.

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Political	**1. Financing Challenges:** *Insufficient Funding for Vehicle Acquisitions*: A pressing political challenge arises from inadequate financial support for the acquisition of electric vehicles. Securing funding for fleet expansion is crucial for the sustainable growth of the electric vehicle rental service. **2. Taxation Disparities:** *VAT Discrepancy for Users*: Users are burdened with a 21% Value Added Tax (VAT), representing a 13% increase compared to public transport. Advocating for regulatory adjustments to align the taxation structure with public transport services becomes a central political objective to level the playing field. **3. Regulatory Classification:** *Advocacy for Public Transport Regulation*: A political contention lies in the claim for the service to be classified and regulated on par with public transport. This entails navigating regulatory frameworks to gain recognition and associated benefits, thereby addressing disparities in taxation and operational considerations. These political barriers underscore the challenges faced by the electric vehicle rental service in navigating financial constraints, tax structures, and regulatory classifications within the political landscape. Advocacy and strategic engagement with relevant authorities become pivotal in addressing these barriers.
Delivery service company	
Technical	**1. Temperature Sensitivity:** *Impact of Temperature on Battery Efficiency*: The autonomy of electric vehicles is significantly influenced by temperature variations. Technical challenges arise as extreme temperatures can affect the efficiency of the vehicle's battery, leading to fluctuations in overall driving range. **2. Overnight Slow Charging Infrastructure:** *Requirement for Overnight Slow-Recharge Infrastructure*: To optimize charging during off-peak hours, there is a technical need for dedicated slow-recharge infrastructure at specific locations. This ensures the gradual replenishment of electric vehicle batteries overnight, aligning with the operational downtime. **3. Fast Charging for Daily Operations:** *Integration of Fast Charging for Daily Fleet Operations*: Implementing fast-charging solutions becomes imperative for daily operational needs. The technical strategy involves ensuring swift and efficient charging capabilities to support the continuous use of electric vehicles in demanding delivery service operations. **4. Opportunity Charging within City Limits:** *Strategic Deployment of Opportunity Charging Points in Urban Areas*: Addressing driver anxiety and optimizing electric vehicle use within urban settings involve strategically placing opportunity charging stations. These points enable quick top-ups during short stops, reducing concerns related to battery range while navigating city routes. These technical considerations highlight the nuanced challenges associated with temperature impacts, the necessity for diverse charging infrastructures, and the implementation of fast-charging solutions to optimize the performance and reliability of electric vehicles in delivery service operations.
Commercial	**1. Roaming Charging Efficiency:** *Optimizing Roaming Charging Duration*: An essential commercial consideration pertains to the efficiency of roaming charging, as it directly impacts the allocation of non-productive time. The technical challenge involves determining the optimal duration for roaming charging sessions to minimize downtime and ensure the productivity of electric vehicle fleets during charging intervals.
Political	**1. Charging Station Commissioning Uncertainty**: *Ambiguity in Power Provision for Charging Points*: A notable political challenge revolves around the uncertainty in commissioning charging stations, particularly in providing the appropriate power supply to meet the requirements of charging points. This technical hurdle entails potential delays spanning several months, emphasizing the need for streamlined processes and clear regulatory frameworks to expedite the establishment of charging infrastructure.
Association / Organization promoting electromobility	
Technical	**1. Limited High-Capacity Rechargeable Vehicles:** *Scarce Availability of Vehicles Exceeding 50 kW Charging Capacity*: A significant technical barrier lies in the scarcity of electric vehicles equipped with charging capacities surpassing 50 kW. This limitation impedes the ability to leverage higher charging speeds, impacting the efficiency and speed of the recharging process. **2. Market Dependency and Atomization:** *Elevated Reliance on Asian Markets with Fragmented Entrants*: The electromobility sector faces a technical challenge rooted in its high dependency on Asian markets. The market structure is characterized by fragmentation, with numerous new entrants, contributing to complexities in technology standardization and market predictability. **3. Costly and Inefficient Dynamic Charging Systems:**

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	Economic and Efficiency Challenges of Dynamic Charging Technology: The implementation of dynamic charging presents a technical obstacle due to perceived high costs and suboptimal efficiency. The dynamic charging infrastructure, while promising, encounters challenges in terms of economic feasibility and achieving the desired level of efficiency in real-world applications.
Commercial	**1. Infrastructure Perception and Information Overload:** *Misinformation Regarding Infrastructure Adequacy*: A prevalent commercial barrier arises from misinformation surrounding the perceived inadequacy of infrastructure. Despite the completion of the primary grid, technical challenges persist due to widespread misperceptions, hindering informed decision-making regarding electric vehicle adoption. **2. Combustion-Centric Perspectives:** *Perceiving Electric Mobility through Combustion Paradigm*: A notable commercial challenge stems from the inclination to view electric mobility through the lens of traditional combustion vehicles. This perspective, characterized by the expectation of a "full tank" without considering the nuanced charging dynamics of electric vehicles, contributes to misaligned expectations and adoption hurdles. **3. Lack of Electric Vehicle Education in Schools:** *Educational Gap in Electric Vehicle Knowledge at Educational Institutions*: A commercial obstacle lies in the absence of formal training on electric vehicles within school curricula. The lack of educational emphasis on electric vehicle technology contributes to a knowledge gap, hindering widespread understanding and acceptance of electric mobility concepts among future consumers. **4. Cost Disparity, Excluding TSO Considerations:** *Cost Differential of Electric Vehicles, Excluding TSO Considerations*: A commercial barrier pertains to the persistent cost disparity, with electric vehicles remaining 15% more expensive when not considering Transmission System Operator (TSO) factors. Addressing this challenge involves a nuanced evaluation of the total cost of ownership, considering both upfront expenses and long-term operational efficiencies.
Political	**1. Critical Need for Infrastructure and EV Incentives:** *Imperative for Incentivizing Infrastructure and Electric Vehicles*: A crucial political challenge revolves around the necessity for incentives directed towards both electric vehicle (EV) adoption and the development of supporting infrastructure. The technical complexities of fostering widespread adoption demand strategic incentives to accelerate the transition to electric mobility. **2. Protracted License and Permit Approval Processes:** *Languid Approval of Licenses and Permits Across Administrative Tiers*: A political obstacle stems from the sluggish pace and multifaceted administrative layers involved in granting licenses and permits for electric mobility initiatives. Addressing this challenge requires streamlining and expediting the approval processes through technical enhancements in administrative workflows and coordination mechanisms.
ICT/tech provider	
Technical	**1. Raw Material Extraction and Processing Constraints:** *Insufficient Capacity for Raw Material Extraction and Processing - Bottleneck Effect*: A notable technical challenge arises from the bottleneck effect caused by inadequate extraction and processing capacity of raw materials essential for electromobility technologies. Addressing this challenge necessitates advancements in raw material supply chain management to meet the increasing demand. **2. Limited Battery Lifespan and Degradation:** *Finite Battery Lifespan with Capacity Degradation*: The technical barrier stems from the finite lifespan of batteries and the inevitable decrease in their capacity over time. Developing strategies to extend battery life and mitigate capacity degradation becomes crucial for enhancing the sustainability and efficiency of electric vehicle power storage systems. **3. Regional Retention of Raw Materials for Second-Life Applications:** *Preventing Export of Raw Materials Arriving in Europe for Second-Life Utilization*: A technical challenge involves ensuring that raw materials entering Europe for electromobility applications remain within the region for second-life purposes. Implementing technical solutions for tracking and managing raw material flows contributes to sustainable resource utilization. **4. Battery Interoperability Challenges**: *Divergence in Battery Technologies and Incompatibility*: Companies face technical hurdles due to the inherent differences among batteries, requiring specific technology systems for compatibility. The development of standardized protocols and interoperability solutions is pivotal to facilitate seamless integration and operation across diverse battery technologies. **5. Standardization Protocols for Battery Identification and Health Monitoring**: *Need for Standardized Protocols to Identify Batteries and Monitor Health Status*: A technical requirement emerges for standardized protocols enabling the identification of batteries through serial numbers and the monitoring of their

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	health status. The implementation of such protocols would contribute to efficient battery management and diagnostics within the electromobility ecosystem.
Commercial	**1. Exclusive Focus on Lithium-Ion Batteries:** *Sole Emphasis on Lithium-Ion Battery Technology*: A prevailing commercial challenge lies in the exclusive concentration on lithium-ion batteries. The technical limitation of this focus may hinder the exploration of alternative battery technologies with potentially advantageous features, necessitating a broader approach to battery research and development. **2. Consumer Adoption Psychology as a Commercial Barrier:** *Suboptimal Consumer Mindset Impacting Electric Vehicle (EV) Adoption*: A commercial hurdle is the suboptimal mindset of consumers, presenting a notable adoption barrier as discussed in the interviews. Addressing this challenge requires targeted strategies, possibly involving technology-driven campaigns and educational initiatives to reshape consumer perceptions. **3. Economic Incentives for Recycling Chinese Batteries:** *Low Economic Value of Raw Materials in Chinese Batteries Diminishing Recycling Interest*: A commercial challenge emerges from the reduced economic value of raw materials in Chinese batteries, deterring interest in recycling initiatives. Implementing advanced recycling technologies and establishing economic incentives could address this issue, facilitating sustainable material recovery. **4. Proprietary Battery Software Development (Non-Saleable):** *Internal Development of Non-Saleable Battery Software*: A commercial constraint involves the development of proprietary software tailored for batteries, which is not intended for external sale. Exploring avenues for leveraging this proprietary software to create value within the organization or through strategic collaborations becomes a technical consideration for optimizing commercial operations.
Political	**1. Volatility in Subsidy Programs:** *Fluctuations in Subsidy Program Stability*: A notable political barrier stems from the fluctuations and instability observed in subsidy programs supporting electromobility. The technical challenge involves the need for sustained and predictable subsidy frameworks, requiring technical measures for program stability and long-term planning. **2. Insufficient Public and Private Infrastructure:** *Inadequacy in Public and Private Infrastructure Support*: A political challenge arises due to the insufficient support in both public and private infrastructure for electromobility. Addressing this technical barrier requires strategic planning, technological advancements, and collaborative efforts to enhance the infrastructure network, facilitating widespread adoption of electric vehicles.
Energy / Electric utility	
Technical	**1. Technical Complexity of Domestic Charger Infrastructure:** *Complexity of Infrastructure Installation for Domestic Chargers*: Technical challenges arise due to the intricacies associated with installing domestic chargers, often falling within the purview of electricians rather than electric utility companies. Overcoming this barrier involves addressing the technical intricacies inherent in domestic charging infrastructure deployment. **2. Challenges in Community Pre-Installation**: *Obstacles in Community Pre-Installation for Building Charging Infrastructure*: A technical impediment is encountered in scenarios where not all members of a residential community are inclined to undergo pre-installation measures for building-wide charging infrastructure. This diversity in resident preferences complicates the installation process for individual users. **3. Demand Assurance for Charging Hub Deployment**: *Ensuring Demand Viability for Charging Hub Establishment*: The technical challenge in establishing a charging hub involves the need to guarantee a certain level of demand. Ensuring the technical feasibility and economic viability of a hub requires robust demand forecasting and strategic planning by electric utilities. **4. Advancements Needed in Battery Recycling, Anticipating Solid-State Technology**: *Necessity for Enhanced Battery Recycling, with Solid-State Technology Anticipated in 3 Years*: The technical barrier in battery recycling calls for improvements, particularly with the expectation that solid-state batteries might become prevalent within the next three years. Enhancing recycling processes and infrastructure is imperative to align with evolving battery technologies. **5. Efficiency Challenges in Dynamic Charging:** *Suboptimal Efficiency in Dynamic Charging Technology*: A technical challenge emerges in the perceived inefficiency of dynamic charging systems. Addressing this barrier involves technological advancements to enhance the efficiency and effectiveness of dynamic charging, making it more suitable for widespread adoption in the electric vehicle ecosystem.
Commercial	**1. Upfront Cost as a Commercial Barrier for EV Acquisition:**

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	Challenges in Electric Vehicle Acquisition Due to Upfront Pricing: A commercial hindrance arises from the upfront pricing associated with electric vehicle (EV) acquisition. The technical challenge involves addressing the cost dynamics to make EVs more economically accessible, possibly through innovative financing models and cost reduction strategies. **2. Limited Availability of Electric Vehicle Models:** *Constrained offer of Electric Vehicle Models*: A commercial obstacle lies in the limited variety of electric vehicle models available. Overcoming this technical challenge involves expanding the range of available models to cater to diverse consumer preferences and requirements. **3. Insufficient Interurban Public Charging Infrastructure:** *Limited Availability of Interurban Public Charging Options*: A commercial barrier is encountered due to the insufficient number of interurban public charging options. Addressing this technical challenge requires strategic planning to enhance the density and accessibility of public charging infrastructure for electric vehicles. **4. User Expectations for EVs Comparable to Internal Combustion Vehicles:** *Consumer Expectations for EVs to Mirror Internal Combustion Vehicle Usage*: A commercial challenge stems from user expectations for electric vehicle usage to closely align with the convenience of internal combustion vehicles. Technical solutions involve advancements in battery technology, charging infrastructure, and user experience to bridge this expectation gap. **5. Pre-Trip Recharge Planning Due to Infrastructure Scarcity:** *Necessity for Pre-Trip Recharge Planning in Response to Infrastructure Scarcity*: Commercial challenges arise as electric vehicle users need to plan recharging strategies before embarking on long trips due to infrastructure scarcity. Technical solutions involve improving infrastructure density and providing tools for effective trip planning to enhance user convenience. **6. Population Density Impacting Profitability of Interurban Chargers:** *Population Density Influence on Interurban Charger Profitability*: A commercial barrier is observed in the significance of population density for the profitability of interurban charging stations. Addressing this technical challenge involves strategic planning and optimization to ensure the economic viability of interurban charging infrastructure in areas with varying population densities.
Political	**1. Authorization Disparity for Chargers Based on Voltage Levels:** *Disproportionate Authorization Ease for Low Voltage Chargers Impacting Urban Installations*: A political challenge is observed in the unequal authorization process, favoring low voltage chargers, leading to a scarcity of installations with other voltage levels in urban settings. Addressing this technical barrier requires revisiting authorization procedures to encourage a more balanced deployment of chargers in cities. **2. Insufficient Public Support for Charging Infrastructure Development:** *Inadequate Political Backing for Expanding Public Access Charging Infrastructure*: A political barrier stems from the insufficient support for the development of public access charging infrastructure, which falls short of eliminating existing barriers. Technically addressing this challenge involves policy reforms, increased funding, and strategic planning to enhance the effectiveness of charging infrastructure expansion initiatives. **3. Municipal Resistance to Electric Vehicles and Street Parking:** *Municipal Resistance to Electric Vehicles and Street Parking*: Political challenges arise from municipal reluctance towards electric vehicles, coupled with an aversion to street parking. Technically navigating this barrier involves fostering dialogue, implementing awareness campaigns, and developing policies that encourage the integration of electric vehicles into municipal environments, including street parking.
Charging station manufacturers	
Technical	**1. Lack of Pre-Installation in Flat Building Garages:** *Insufficient Pre-Installation in Garages of Multi-Unit Buildings*: A technical challenge arises from the absence of pre-installation for electric chargers in the majority of garages within multi-unit flat buildings. Addressing this barrier requires technological solutions to retrofit existing garages and enforce legal provisions for pre-installation in new constructions. **2. Street Parking Solutions for EV Users Without Garages:** *Addressing Street Parking Challenges for EV Users Without Garages*: A technical challenge emerges in finding solutions for electric vehicle users without garages who need to park on the street. Technological innovations and infrastructure development are required to provide accessible and convenient charging options for street-parked electric vehicles. **3. Technological Limits of Batteries Impacting Charging Speed:** *Batteries at Technological Thresholds Limiting Charging Speed*: The technical barrier involves batteries reaching technological limits, impeding faster charging capabilities. Overcoming this challenge requires advancements in battery technology to enable quicker and more efficient charging processes. **4. Range Considerations for Travel Charging:**

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	Criticality of Exceeding Required Range during Travel Charging: A technical challenge is observed in the need to charge electric vehicles to cover more distance than the immediate travel requirement. Addressing this challenge involves developing technologies and strategies that allow users to charge their vehicles to a range beyond their current travel needs. **5. Medium-Voltage Line Availability and Profitability:** *Dependency on Medium-Voltage Line Presence and Profitability Challenges*: A technical challenge is posed by the requirement for a medium-voltage line in the charging area. Establishing charging infrastructure becomes complex when a medium-voltage line is not readily available, necessitating technological solutions such as line extensions to ensure profitability. **6. Obsolete Chargers Unfit for Reuse:** *Obsolete Chargers Unsuited for Reuse due to Mechanical Obsolescence*: The technical barrier involves chargers that, once removed from use, cannot be repurposed due to mechanical obsolescence. Addressing this challenge requires designing chargers with modular components to facilitate upgrades and reusability. **7. Inefficiency of Dynamic Charging Technology:** *Suboptimal Efficiency of Dynamic Charging Systems*: A technical challenge is identified in the perceived inefficiency of dynamic charging systems. Overcoming this barrier involves technological enhancements to improve the efficiency and attractiveness of dynamic charging solutions.
Commercial	**1. Home Proximity as a Purchase Decision Factor:** *Impact of Charger Proximity on Electric Vehicle Purchase Decisions*: A commercial challenge is observed where the absence of a charger near one's residence may lead some individuals to dismiss the idea of purchasing an electric car. Addressing this technical barrier involves strategic deployment of residential charging infrastructure to enhance accessibility and encourage electric vehicle adoption. **2. Nighttime Public Charger Availability and Usage Conflicts:** *Insufficient Nocturnal Public Chargers and Usage Conflicts*: Commercial challenges arise due to the inadequacy of public chargers during nighttime hours, leading to usage conflicts where users must unplug in the middle of the night to accommodate others. Technical solutions involve optimizing charging station scheduling and expanding infrastructure to meet nighttime demand. **3. Limited High-Power Charging Model Compatibility:** *Restricted High-Power Charger Relevance due to Limited 120 kW+ Charging Models*: The commercial challenge involves the limited number of electric vehicle models capable of charging above 120 kW, impacting the practicality of installing high-power chargers, especially given their current high costs. Technical solutions require a balance between charger capabilities and the charging capacity of available electric vehicle models. **4. Insufficient Charging Points for On-Demand Stops:** *Scarcity of Charging Points Hindering On-Demand Stops*: Commercial barriers emerge as there are not enough charging points, hindering the ability to stop and recharge whenever needed. Technical solutions involve leveraging user-friendly applications to optimize charging point utilization and addressing infrastructure gaps to meet the demand for spontaneous charging stops.
Political	**1. Complex Procedures for Government Financial Support:** *Complexity in Procedures for Government Financial Support*: A political challenge arises from the intricacies involved in obtaining financial support from the government. Both the application procedures for subsidies and the legalization processes for installations are deemed overly complex. Addressing this technical barrier requires streamlining application processes and simplifying regulatory requirements for effective implementation. **2. Bureaucratic Hurdles in Charging Infrastructure Deployment:** *Predominant Bureaucratic Barriers in Mass Deployment of Charging Infrastructure*: Political challenges are observed wherein the primary hindrance to the widespread deployment of charging infrastructure is bureaucratic rather than technological. Technical solutions involve reforming bureaucratic procedures to facilitate efficient and rapid deployment of charging stations. **3. Standardizing European Interoperability for Charging Infrastructure:** *Necessity for European-Level Interoperability Standardization*: A political barrier involves the lack of standardized interoperability at a European level, necessitating individual testing for each vehicle model. Addressing this technical challenge requires the establishment of standardized protocols to ensure seamless interoperability, preventing the need for individual testing for every vehicle model on the market.
Regional and National Public authorities	
Technical	**1. Divergent Charging Standards:** *Existence of Disparate Charging Standards*: A technical challenge is identified in the persistence of divergent charging standards. This presents a barrier to the seamless integration of electric vehicles into the infrastructure, requiring efforts towards standardization to ensure compatibility and interoperability across various charging systems.

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Commercial	**1. Escalating Costs of Electric Power Supply:** *Rising Costs in Electric Power Supply Perceived as High by Users*: A commercial challenge is identified in the escalating costs of electric power supply, which users already perceive as high. The technical consideration involves addressing the factors contributing to the cost increase and implementing solutions to optimize the efficiency and affordability of electric power for electric vehicle charging. **2. Insufficient Publicly Available Charging Infrastructure :** *Inadequate Availability of Public Charging Points*: A commercial barrier is recognized due to the insufficient number of publicly available charging points, leading users to face difficulty in finding convenient charging locations when needed. Addressing this technical challenge involves strategic planning and infrastructure development to enhance the accessibility and coverage of public charging points.
Public transport company	
Technical	**1. Charging Speed Challenges:** *Optimizing Charging Speed for Electric Vehicles in Public Transport*: A technical challenge is identified in the need to optimize the charging speed for electric vehicles used in public transport. Addressing this involves advancements in charging infrastructure and technologies to minimize charging durations and enhance operational efficiency. **2. Development of Payment Systems Integration:** *Advancing Integration of Payment Systems for Electric Transport*: A technical barrier is recognized in the requirement for further development in integrating payment systems for electric transport. This involves technical enhancements to ensure seamless and efficient transaction processes within the electric transport infrastructure. **3. Data Deficiency Regarding EV Users:** *Insufficient Data Availability on Electric Vehicle Users in Public Transport:* A technical challenge arises from the lack of comprehensive data on electric vehicle users in public transport. Technical solutions involve implementing robust data collection and analytics systems to gather insights into user behavior and preferences. **4. Gradual Technology Transition in Bus Centers:** *Managed Transition to New Technologies in Bus Centers*: A technical consideration is the gradual adoption of new technologies within bus centers rather than an immediate transition. This involves technical planning and phased implementation to ensure a smooth integration of electric vehicle technology within existing bus center infrastructures. **5. Inductive Charging Lifespan and Infrastructure Development:** *Ensuring Longevity and Infrastructure Advancements for Inductive Charging (15/20 years)*: A technical barrier is identified in the lifespan limitation of inductive charging, lasting 15 to 20 years, and the need for concurrent infrastructure development. Technical solutions involve innovations in inductive charging technologies and infrastructure planning for extended service life.
Commercial	**1. Charging Infrastructure Availability:** *Ensuring Widespread Availability of Charging Infrastructure*: A commercial challenge lies in the need to ensure the widespread availability of charging infrastructure. This involves addressing technical aspects related to infrastructure planning, deployment, and accessibility to meet the increasing demand for electric vehicle charging. **2. Placement Challenges for Opportunity Chargers in Urban Environments**: *Optimizing Placement of Opportunity Chargers Amid Unpredictable Urban Traffic*: A commercial barrier is identified in the difficulty of placing opportunity chargers in urban settings due to unpredictable traffic patterns. Addressing this involves technical considerations for strategic charger placement, traffic management, and real-time optimization algorithms. **3. Urban Integration Challenges for Charger Sizes:** *Overcoming Challenges in Urban Integration of Charger Sizes*: A commercial obstacle arises from the specific sizes of chargers on the lines, making urban integration difficult. Technical solutions involve innovative design approaches and urban planning considerations to seamlessly integrate chargers into urban environments. **4. Inadequate Offerings and Standards for Inductive Static Charging:** *Addressing Insufficiencies in Offerings and Standards for Inductive Static Charging*: A commercial challenge is recognized in the lack of offerings and standards for inductive static charging. This involves technical considerations for developing comprehensive offerings and standardization protocols to promote the widespread adoption of inductive static charging solutions.
Political	• Lack of regulations for underground parking • uncertain which is the correct mix of different charging technologies (in terms of charging speed) • Possible ban of diesel might cause an impact on the acquisition planning of electric buses. • There's no standard for dynamic inductive charging, so, if different technologies coexist on the road from one line to another, there's a loss of flexibility. • If dynamic inductive charging, vehicles wouldn't be able to park.

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SPAIN	
	1. Regulatory Gaps in Underground Parking: *Addressing Regulatory Gaps in Underground Parking for Charging Infrastructure*: A political challenge is identified in the lack of regulations for underground parking, specifically related to charging infrastructure. This necessitates technical considerations for developing comprehensive regulations to guide the deployment and usage of charging infrastructure in underground parking facilities. **2. Uncertainty in Optimal Mix of Charging Technologies:** *Navigating Uncertainty in Determining the Optimal Mix of Charging Technologies (Charging Speeds)*: A political barrier exists in the uncertainty surrounding the most effective mix of various charging technologies, particularly in terms of charging speeds. Technical solutions involve research, testing, and data-driven assessments to establish standards that optimize the integration of diverse charging technologies. **3. Impact of Diesel Ban on Electric Bus Acquisition Planning:** *Mitigating Impact of Diesel Ban on Electric Bus Acquisition Planning*: A political challenge arises from the potential ban on diesel, impacting the planning and acquisition strategies for electric buses. Technical considerations involve developing flexible and adaptive acquisition plans to accommodate changes in regulatory frameworks and promote the adoption of electric buses. **4. Lack of Standardization for Dynamic Inductive Charging:** *Addressing Standardization Gaps in Dynamic Inductive Charging*: A political barrier is identified in the absence of standards for dynamic inductive charging, leading to a loss of flexibility when multiple technologies coexist. Technical solutions involve developing standardized protocols to ensure compatibility and seamless operation of dynamic inductive charging systems across different lines and technologies. **5. Parking Challenges for Vehicles with Dynamic Inductive Charging:** *Resolving Parking Challenges for Vehicles with Dynamic Inductive Charging*: A political concern is raised regarding the inability of vehicles equipped with dynamic inductive charging to park. Addressing this involves technical considerations for designing parking infrastructure that accommodates and supports dynamic inductive charging capabilities, fostering the coexistence of this technology with parking requirements.

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ITALY	
PUBLIC EVS OPERATORS (BUSES, OTHER ELECTRICS)	
Technical	**1.High electrical supply costs**: Users perceive electrical supply costs as high, hindering the penetration of the electric vehicle market. **2.Insufficient charging infrastructure**: Although there are 937 public charging points available in the metropolitan area, it is acknowledged that they are still not enough, and there is uncertainty about the appropriate number of charging points and the most suitable type of infrastructure due to a lack of data on electric vehicle users' behavior. **3.Uncertainty regarding the optimal mix of charging technologies**: There is uncertainty about the right combination of different charging technologies (in terms of charging speed) to develop, as well as the behavior of EV users.
Commercial	1.**Charging solution mix:** Charging operators are uncertain about the mix of charging solutions (in terms of supplied power) to implement and prefer to install mainly fast charge stations. **2.Limited regional payment system**: The current payment system used by GTT (the BIP) is restricted to Piedmont. However, there is a need to develop a national or international payment platform to cater to the needs of users from other regions or countries. **3.Urban EV Charging Challenges**: The uncertainty about regulations and the lack of clarity about integrating charging infrastructure in underground parking represent a commercial barrier to expanding electric vehicle charging infrastructure in urban and peri-urban areas.
Political	**1.Uncertainty about charging policies:** The implementation of charging infrastructure in public spaces is subject to national regulations requiring 5% of parking spaces to have charging points. Although Turin has increased this percentage to 25%, there is still uncertainty about whether this is the correct percentage to address future mobility needs. 2.Integration of tariffs and payment methods: There are barriers to integrating tariffs and payment methods for electric mobility services at the national level.

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ESTONIA	
DS OS AND ENERGY DISTRIBUTRORS OR PROVIDERS	
Technical	1 **Electricity Grid Expansion:** Estonia's low population density means that each consumer must support a larger portion of the electricity grid, increasing network-related costs and making it challenging to expand infrastructure to meet demand.
Commercial	**1. Funding Uncertainty and Government Support:** Uncertainty about the availability of funding and government support for grid expansion projects can hinder the organization's efforts to improve the electrical infrastructure and meet growing demand, especially regarding the adoption of electric vehicles.
Political	**1. Funding Shortage**: The lack of funds or special grants from the EU or Estonian government for the construction of additional electricity networks along roads hinders overall grid reconstruction to increase capacity.
EQUIPMENT SUPPLIERS (BATTERIES OR ELECTRIC CHARGERS)	
Technical	**1.Time and cost of installation:** Installing new charging points can be costly and time-consuming, posing a hurdle for rapid expansion of charging infrastructure. **2.Availability of fast chargers:** Delivery of fast chargers may be delayed, with waiting times of up to 6 months. This can negatively impact both the company and its customers, leading to dissatisfaction and delaying the adoption of electric vehicles.
Commercial	**1.Competition and market participation**: In an emerging market like electric vehicle charging, competition can be intense. The company may face challenges in maintaining its position against emerging competitors or established firms in the sector. **2.Business models and profitability**: The profitability of charging infrastructure projects may be affected by a lack of clarity on business models, revenue streams, and operational costs. This can deter investors and hinder the company's expansion efforts.
Political	1.**Regulations on charging infrastructure:** Despite efforts by the European Union to address the lack of charging infrastructure as a barrier to electric vehicle adoption, there may still be insufficient or inconsistent regulations in Estonia hindering the expansion of the charging network. **2.Purchase incentives and support policies:** The absence of government incentives for electric vehicle purchases and the implementation of supportive policies for charging infrastructure can slow down the transition to green energy transportation.

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14 ANNEX 6 – NATIONAL AD-HOC MEETINGS

Slovenia	
What	Round table
When	December the 1st 2023
Where	Center Noordung in Vitanje, Slovenia
Moderator	Janez Humar (ELES)
Participants	The decision makers from the following institutions: • president if E-Mobility Society of Slovenia • members of different municipalities • representative of Siol.net – the leading Slovenian digital media • representatives of the Ministry of the Environment, Climate and Energy • representative of the Consumers' Union of Slovenia • representative of Petrol company (largest Slovenian energy company, the owner of public e-charging station on more than 100 locations across Slovenia) • representatives from EMC Austria (Austrian E-mobility Club) • members of the general public
Discussion	Discussion about the data collect by interviews (ICRI and E-mobility association) regarding: quality of the charging stations, quality perception of charging stations and barriers to EVs diffusions. From the results of interviews the bigger issue among Slovenian users seams the vehicle range and the time charging, higher than ICE vehicles. Of the 48 columns analyzed only 24 were rated as good, 18 as average, 4 as deficient, and 2 as unsatisfactory. The researchers pointed out that, unlike some users, they idn't find problems in charging using the designated cards but at the same time they reported than no charging station offered an easy way to pay with a card.
Main findings	Needs from the user point of view: • make sure the charging stations are covered with a canopy or a roof • make sure that payment is possible with a commonly used credit card • make sure the power of charging stations with DC is greater than 150kW, and those with AC should be as many as possible In June 2023 Slovenia passed a new law, the so-called Act on Infrastructure for Alternative Fuels and Promotion of the Transition to Alternative Fuels in Transport. As part of this Act ELES was granted an obligation in the form of public service for the purpose of providing supporting infrastructure and connection capacity. This includes: • Identification of suitable locations for EV charging stations and the necessary connection power • Acquisition of land belonging to the area of the charging stations, including access to a public road • Assurance that charging stations are all equipped with supporting infrastructures

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	• Assurance of connectors which connects the charging stations with the electricity network. The Act also includes a plan for charging infrastructures for municipalities (at the local level). According to this plan a dedicated charging infrastructure will be set up for publicly accessible charging points for the following groups of end users: • Providers of public services and providers of public passenger transport • Residents of multi-apartment buildings without access to privately owned parking spaces or without the possibility of charging in the immediate surrounding of the multi-apartment buildings • Car sharing • Employees in public institutions • Users of public parking lots and parking lots for trucks in urban areas • Other users at the municipality's discretion. In addition, the preparation of a planning tool in the form of a digital twin of the electronic-traffic system is already underway. The tool will help the various stakeholders in the electromobility ecosystem to correctly and timely implement investments and understand how the transition to electromobility will affect their operation. The E-mobility Association has conducted an evaluation of random EV charging stations. In order to determine what changes and improvements have to be made to make the use of EVs and charging experience more popular and tailored to the user, field testing was conducted. Different towns and charging stations across Slovenia were selected with the aim to test the charging experience. Members of the E-mobility Association which conducted the test, concluded that there is still room for improvement. Even though free charging stations are available across Slovenia, there are still too many drivers that use the designated parking lots as a parking opportunity for their petrol or diesel cars. Also, different apps for charging activation designated for mobile phones are not working in majority of cases. Next steps for the country: • Ensure and implement the infrastructural arrangement of charging park • Ensuring that the charging park is equipped with all supporting infrastructure • Acquisition of land near the charging park, including access to a public road • Set up of dedicate charging infrastructures for different groups of end users like providers of public services or employees in public institution • Preparation of a tool in the form of a digital twin that can help the different stakeholders in the electromobility ecosystem to correctly and timely implement investments and understand how the transition to electromobility will affect their operation • Financial incentives (grants and loans) for both EVs and infrastructure by the ministry of Environment, Climate and Energy • upgrade of the existing highway resting stops in order to strengthen the fast charging infrastructure • Increase the number of charging stations (at least ten times) compared to nowadays • Increase the power of charging stations from 50kW to 150,250,350 kW.

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France	
What	Round table
When	December 2023
Where	Paris Avere-France
Moderator	Avere-France: Joseph Beretta, Quentin Fournier
Participants	"Electricity syndicates" that have the delegation of the municipalities for the installation and management of public charging infrastructures: SMED 13, TE 53, Hauts-de-France, SDEM 50, SDEI 36,TE 61, SYANE , SIGEIF, SYDELA, SIEDA, Toulouse Métropole, SDEHG, Morbihan Energies, SDESM.
Discussion	The meeting began with a legislative and regulatory update on electric mobility in France. Then the elements were presented on the questions posed by the INCIT-EV project: • What are the main obstacles to the development of e-mobility in France? • From your point of view, is the number and distribution of infrastructures are correct? • What are the priorities for charging? • In the future, how charging systems for e-mobility evolve? (Charging power, inductive charging, electric road…) A round table allowed us to have the point of view of the participants.
Main findings	The main obstacles to be overcome are the price of vehicles and charging stations, the development of public charging stations, especially in cities (less so in suburban areas) and finally education and information for future users. Presentation of the Avere Charging Barometer: As of February 29, 2024, France had 123,347 charging points open to the public. The 12-month change rate is +36%. The availability of charging points seems to have stabilised at the beginning of the year after 2023 was marked by regular declines. It will reach 81% in February 2024 with disparities depending on the power of the charging stations. Finally, we note that the price per Kwh of B2B charging has decreased in AC (€0.32) as well as in DC (€0.33). Faced with the equipment obligations imposed by the Government, deployments are accelerating at motorway service areas. In February 2024, 1 charging point averaged around 14.7 charging sessions over the month. In view of these data, the deployment of infrastructure is well underway in France, especially on the motorway network. The distribution of charging points is managed by the national deployment plan, it can be said that France is working to meet the expectations of users to regard the number and location of charging stations. <u>The priorities for charging:</u>

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	It is now necessary to deal with the ease of payment and connection because there is a plurality of operators and charging cards and not everything is compatible to date, which causes many problems for users. Deployment on motorways must continue. Another project is the harmonization of tariffs (per kWh, per duration or both) and clear information for consumers as is the case for fossil fuels. The future of charging: The development of new charging technologies must consider the expectations of users and not be in a race for technology. So before deploying the high-power load (300kW), which only addresses a small number of vehicle models, let's consolidate the implementation of 150kW charging stations. Static inductive charging, it is an ideal solution for vehicle fleets. The electric route (dynamic charging) must first be tested to have a precise vision of the costs, the durability and acceptance of consumers.

Italy	
What	Round table
When	December the 19th 2023
Where	LINKS Foundation, Turin, Italy
Moderator	Cristiana Botta (LINKS Foundation), Angela Carboni (Polytechnic of Turin), Francesco Deflorio (Polytechnic of Turin)
Participants	• Piedmont Region • Metropolitan city of Turin • City of Turin • Polytechnic of Turin (Department of Energy and Department of Environment, Land and Infrastructure Engineering)
Discussion	To start the discussion, the following questions were put to the table: • what is the main factor holding back the development of e-mobility in Italy? the poor spread of infrastructure? • are the use case experiments of the INCIT-EV project, after 5 years, still interesting for the market? • are data on the use of electric vehicles and charging infrastructure available to understand whether the PA is progressing well? • will the near future of charging systems for electric mobility still be heterogeneous or will it converge towards fewer solutions?
Main findings	• **Needs.** Charging needs are very different and each need must be met with specific solutions (e.g. taxis need fast recharging also in urban contexts, privates usually recharge at home with slow and cheaper charging, couriers may need spot and fast charging in the city, but they recharge mainly in depots (private recharging) or at depots (need to be able to book public recharging)) • **Data**

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	- Turin receives data on recharging infrastructure use, but the shortage of technical staff limits the possibility of analysing it. Furthermore, stringent confidentiality constraints create barriers to data dissemination except in aggregate form, so it is difficult to provide the data externally. On the other hand, there is less information on electric vehicle usage data. - The PNIRE (National Plan for Electric Recharging Infrastructure) defines the National Platform and Regional Platform (PUN and PUR) for the management of information on charging infrastructures. The City of Turin and 5T are working on the inclusion on charging stations basic information in the 'Muoversi a Torino' portal. A national standardisation is needed to define data to be collected and managed (e.g. for the accessibility of commercial vehicles, the size of parking space is needed, or the radius of curvature allowed for manoeuvring • **Incentive/disincentive policies.** Park&ride solutions outside city centres with charging infrastructures (e.g. use case INCIT-EV Piazzale Caio Mario) can be a good alternative. However, they are often little used because alternative and more convenient parking facilities are available close to the final destination of the trip (e.g. in the city centre). Incentive policies are not enough for the spread of e-mobility; policies to disincentivise the use of unsustainable alternatives are needed. With a view to multimodality, one opportunity for mobility management with targeted incentives is represented by MaaS (Mobility as a Service), which can integrate EV charging at selected points (e.g. interchange nodes) • **Last-mile delivery.** Electric solutions are being chosen for last-mile delivery. Recharging takes place mainly in depots, however, for a share of vehicles (about 10%) the need for fast recharging also emerges in the city, during missions • **Installation constraints.** The installation of charging infrastructure on public land often encounters many constraints. In Turin, for instance: - space cannot be taken away from pedestrians, so they are built along the carriageway, enclosing them between 'noses' that delimit the spaces - they cannot be placed on water pipes - they must be away from waste bins so as not to restrict vehicle manoeuvring space - they may not be installed in front of commercial establishments because they reduce their commercial value (e.g. no outdoor area construction) they cannot be close to cycle paths to avoid risks from potential charging cables on the paths • **Power.** To power the charging stations, the use of electricity from tram network (INCITEV pilot in Turin) is a technically feasible solution. The main difficulties are regulatory (e.g. difficulty in accounting for DC energy quantities) • **Interoperability.** The market fragmentation of charging service providers creates the need for the user to take out different subscriptions, although some aggregation initiatives are developing

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	• **Parking.** Lack of education and parking problems often lead to abusive use of parking areas dedicated to EV charging • **Economic aspects.** They are perhaps the most important in the choice of purchasing an electric vehicle, but there are other important factors such as mobility habits and the availability of home charging • **Investments.** Today's operators of recharging services are financially loss-making. The big companies do not have any problems because they can balance their budgets and also use the service as a marketing solution; on the other hand, the small ones could be compromised • **V2G.** There are few vehicles suitable for V2G, the most promising solution at present is smart charging • **Wireless** charging. - It should be a fundamental requirement for certain categories of users (e.g. disabled). However, the costs of technologically adapting vehicles and infrastructure are high - today EU has ruled out dynamic wireless charging as a tool to incentive e-mobility. The only existing standard is for heavy goods vehicles • **Battery** - Today, battery swapping seems to be prevalent for scooters and bicycles in Asian countries, where it has become a standard for battery charging. Automatic systems for cars are still being deployed in Europe, with development plans by Chinese manufacturer Nio and recent alliances with Stellantis. - Today, the recycling of batteries to extract their useful materials, as opposed to reusing them for a second life, has taken hold. This trend is driven by the law that can oblige and regulate disposal and recovery • **Electric cabins.** A possible obstacle linked to the development of charging infrastructures is linked to the availability of electrical cabins. The Ireti company in Turin, for example, claims that there are areas where the maximum available power has already been reached.

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