greencharge2020.eu

GreenCharge Project Deliverable: D8.5

Viable Business and Replication Plans

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About GreenCharge

GreenCharge takes us a few important steps closer to achieving one of the dreams of modern cities: a zero-emission transport system based on electric vehicles running on green energy, with traffic jams and parking problems becoming things of the past. The project promotes:

Power to the people!
The GreenCharge dream can only be achieved if people feel confident that they can access charging infrastructure as and when they need it. So GreenCharge is developing a smart charging system that lets people book charging in advance, so that they can easily access the power they need.

The delicate balance of power
If lots of people try to charge their vehicles around the same time (e.g. on returning home from work), public electricity suppliers may struggle to cope with the peaks in demand. So we are developing software for automatic energy management in local areas to balance demand with available supplies. This balancing act combines public supplies and locally produced reusable energy, using local storage as a buffer and staggering the times at which vehicles get charged.

Getting the financial incentives right
Electric motors may make the wheels go round, but money makes the world go round. So we are devising and testing business models that encourage use of electric vehicles and sharing of energy resources, allowing all those involved to cooperate in an economically viable way.

Showing how it works in practice
GreenCharge is testing all of these innovations in practical trials in Barcelona, Bremen and Oslo. Together, these trials cover a wide variety of factors: *vehicle type* (scooters, cars, buses), *ownership model* (private, shared individual use, public transport), *charging locations* (private residences, workplaces, public spaces, transport hubs), energy *management* (using solar power, load balancing at one charging station or within a neighbourhood, battery swapping), and *charging support* (booking, priority charging).

To help cities and municipalities make the transition to zero emission/sustainable mobility, the project is producing three main sets of results: (1) *innovative business models*; (2) *technological support;* and (3) *guidelines* for cost efficient and successful deployment and operation of charging infrastructure for Electric Vehicles (EVs).

The *innovative business models* are inspired by ideas from the sharing economy, meaning they will show how to use and share the excess capacity of private renewable energy sources (RES), private charging facilities and the batteries of parked EVs in ways that benefit all involved, financially and otherwise.

The *technological support* will coordinate the power demand of charging with other local demand and local RES, leveraging load flexibility and storage capacity of local stationary batteries and parked EVs. It will also provide user friendly charge planning, booking and billing services for EV users. This will reduce the need for grid investments, address range/charge anxiety and enable sharing of already existing charging facilities for EV fleets.

The guidelines will integrate the experience from the trials and simulations and provide advice on localisation of charging points, grid investment reductions, and policy and public communication measures for accelerating uptake of electromobility.

For more information

Executive Summary

This deliverable will provide a summary of the most viable business models related to Charge Points for Electric Vehicles in Europe, that will be supported towards investor readiness and plans for replication in uptake cities. It consists of 3 parts: 1. Viable business models, 2. Strategic Urban Mobility Plans of Uptake Cities, and 3. Conclusion with learnings.

The description of Viable Business Models is limited to the European Charge Point market, because most relevant providers of energy and electric mobility are part of this eco-system. The European Charge Point (CP) market for Electric Vehicles (EVs) can be divided into the following 6 market segments: 1. Independent CP & Shared EV Providers, 2. CP & Shared EV Providers owned by large corporate or government, 3. Independent Charge Point Operators (CPOs), 4. CPOs owned by large corporates or government, 5. Independent CP hardware & software companies, and 6. CP Hardware, software, or navigation companies owned by large corporates or government.

The GreenCharge demonstrators are active in four of the six Charge Point market segments. ZET (BRE2) and MOTIT (BCN1) demonstrators are independent CP & Shared EV Providers, the St. Quirze (BCN3) demonstrator is a CP & Shared EV Provider owned by government, the GreenCharge Oslo (OSL1,2,3) and Bremen GC@Work (BRE1) demonstrators are independent CPOs, and the Eurecat (BCN2) demonstrator is a CP software company owned by a large corporate. The GreenCharge Demonstrators are used as guidance to extract this CP market segmentation.

Every market segment has a dominant business model, which has grown over time. The 6 market segments mentioned above are dominated by the following business models:

1. Independent Charge Point and Shared EV Providers are dominated by Shared EV Service,
2. Charge Point and Shared EV Providers owned by large corporate or government are dominated by Shared EV Service,
3. Independent Charge Point Operators are dominated by EV Charging Service,
4. Charge Point Operators owned by large corporate or government are dominated by EV Energy/Mobility Service,
5. Independent Charge Point hardware & software companies are dominated by CP Hardware/Software Products, and
6. Charge Point Hardware, software, or navigation companies owned by large corporates or government are dominated by CP Hardware/Software Products and EV Navigation Service.

Viable business models are exponential, green and circular business models. The evaluation criteria of viable business models are based on the 5 design principles of exponential business models as mentioned in Deliverable 3.4 plus 2 extra design principles for green and circular business models. The business models for EV Navigation and Shared EV Services have the highest total score and are the most viable, green and circular business models.

There are currently not many CPOs on the market, that predominantly sell green and locally produced electricity to customers with EVs. The Uptake Cities involved in GreenCharge want to change this by introducing Strategic Urban Mobility Plans (SUMPs), which stimulate viable business models and lower CO_2 emissions from mobility.

The central strategic question for Uptake Cities is: "How can City governments simultaneously stimulate the uptake of EVs, the roll-out of Electric Charging Stations, and the use of green electricity from local renewable sources leading to lower CO_2 emissions from mobility in their Cities?"

Uptake Cities should simultaneously stimulate the uptake of EVs, the roll-out of Electric Charging Stations, and the use of green electricity from local renewable sources. In this way the Uptake Cities have the chance to catch up and overtake other European Cities, that have stimulated EVs earlier. In this way Uptake Cities will

become front runners. As a result, they will stimulate viable EV business models and lower CO2 emissions from mobility in their Cities leading to better health for their City inhabitants. On top of that Uptake Cities need to discourage the uptake of fossil fuelled vehicles, the expansion of petrol stations, and the usage of fossil fuels by vehicles in Cities to lower CO2 emissions even more.

Uptake City governments should coordinate with players throughout the EV ecosystem to create a master plan for the uptake of EVs, for the roll-out of Electric Charging Stations, and for their usage of green electricity from local renewable energy.

The development and writing of Deliverable 8.5 has given us the following 5 new main insights and learnings:

1. Viable Business Models and effective SUMPs is a better title of Deliverable 8.5,
2. Viable Business Models and effective SUMPs stimulate the use of green electricity from local renewable sources,
3. The business models of GreenCharge demonstrators are viable as long as they resemble the dominant business models in the different CP market segments,
4. The business models of Greencharge ZET (BRE2), MOTIT (BCN1) and St. Quirze (BCN3) demonstrators are most viable, and
5. Effective SUMPs should not only stimulate EV charging green electricity from local renewable resources, but also discourage FV tanking petrol in order to lower CO2 emissions from mobility in Uptake Cities.

Table of Contents

Table of Figures

List of Tables

List of Abbreviations

Table 1: List of abbreviations

Abbreviation	Explanation
EV	Electric Vehicle
SUMP	Strategic Urban Mobility Plans
CP	Charge Point
CPO	Charge Point Operator
FV	Fossil Fuelled Vehicle
TS	Tank Station

List of Definitions

Table 2: List of definitions

Definition	Explanation
Viable Business Models	Exponential, green and circular business models
EV Navigation	The EV Navigation Service is a new business model offering green navigation and charging services for EV owners
TSO	Transmission System Operator
DSO	Distribution System Operator
ICE	Internal Combustion Engine
Uptake Cities	Group of Cities in Europe, that want to collaborate, learn and stimulate Green Charging of EVs in their Cities

1 About this Deliverable

1.1 Why would I want to read this deliverable?

The deliverable provides a summary of the most viable business models that will be supported towards investor readiness and plans for replication in uptake cities. This summary of the most viable business models related to electric mobility guides replication of GreenCharge solutions. Focus is on business models which lowers the barriers toward wide-scale adaption of green-charged EVs. Required technical infrastructure or solutions to support the business models are also identified. To help solution and service providers the document outlines required steps to enhance investor readiness for the most promising business models. The focus is on business models that are viable for roll out within the next 5 years.

The viable business models presented in this document is based on inputs from the following deliverables:

- D3.4: this document provides Final Business Model Designs. Viable business models are analysed based amongst other on the exponential business model design principles, evaluation criteria and business KPIs as mentioned in this deliverable. One of the proposed viable business models is the future one of GreenCharge as also described in D3.4.
- D5.5: this document provides Merged Final Evaluation Results. The results from the evaluation of Viable business models are analysed based amongst other on the exponential business model design principles and business KPIs as defined in this deliverable.

The Replication Plans for Uptake Cities presented in this document (Section 3) have been informed by inputs from the following deliverable:

- D7.3: this document presents Lessons learned from Roadmap Development in Uptake Cities. These roadmaps (Appendix A) are analysed and used as a basis for Strategic Urban Mobility Plans of Uptake Cities.

1.2 Intended readership/users

The intended readership and target groups in Europe for this deliverable are:

- EV charging providers,
- Oil & gas upstream, transport, and downstream companies,
- TSO, DSO and electricity retailers,
- EV manufacturers, importers and distributors,
- Public transport companies,
- Shared EV providers,
- EV navigation service providers,
- Knowledge institutes and universities,
- Branche organisations and lobby consultants,
- City governments, regulators, and policy advisors,
- National governments, regulators, and policy advisors, and
- EU governments, regulators, and policy advisors.

The deliverable can help them to identify the most viable business models for their context and provide a basis for developing their own business plan, potentially bringing them one step closer to investor readiness.

1.3 Structure

This Deliverable consists of 3 parts: Viable business models, Strategic Urban Mobility Plans of Uptake Cities, and Conclusion with learnings.

First an overview and analysis are described of the most viable, green and circular business models for green charged EVs. Then, new Strategic Urban Mobility Plans (SUMPs) of Uptake Cities are developed and

documented, which stimulate these most viable business models. Finally, the learnings from SUMP development activities in relation to viable business models are noted.

2 Viable business models

2.1 Background

The GreenCharge project aims to demonstrate how technological solutions and associated business models can be integrated and deployed to overcome barriers in wide-scale adoption of EVs. For large scale deployment and uptake of EVs, access to convenient, reliable and economical attractive charging opportunities is a prerequisite. To achieve this EV-charging must go from today's typically subsidised charging infrastructure towards self-sustaining charging infrastructure. To reach this viable, green and circular business models need to be identified and upscaled.

The GreenCharge project includes dedicated activities for pilots in living labs (WP2) and business model design and prototyping (WP3).

2.2 Objectives

The main objective is to identify the most viable business models related to electric mobility as identified by GreenCharge and provide initial strategies and plans for replication. Focus is on business models which lower the barriers toward wide-scale adaption of EVs. This requires both: (1) Deployment of user friendly and attractive charging services, and (2) Viable business models that leverage investments in such charging services. This document shall help solution and service providers in this regard and provide recommendations and outline next steps to enhance investor readiness for the most promising business models. The focus is on business models that are viable for roll out within the next 5 years.

2.3 Overview of viable business models

The description of Viable Business Models is limited to the European Charge Point market, because all relevant providers of energy and electric mobility are part of this eco-system. The European Charge Point market for EVs can be divided into the following 6 market segments (see table 3 below):

1. Independent Charge Point and Shared EV Providers,

2. Charge Point and Shared EV Providers owned by large corporate or government,

3. Independent Charge Point Operators,

4. Charge Point Operators owned by large corporate or government,

5. Independent Charge Point hardware & software companies, and

6. Charge Point Hardware, software, or navigation companies owned by large corporates or government.

The GreenCharge demonstrators are active in four of the six market segments. The ZET (BRE2) and MOTIT (BCN1) demonstrators are independent Charge Point and Shared EV Providers, the St. Quirze (BCN3) demonstrator is a Charge Point and Shared EV Provider owned by government, the GreenCharge Oslo (OSLO1,2,3) and Bremen GC@Work (BRE1) demonstrators are independent Charge Point Operators, and the Eurecat (BCN2) demonstrator is a Charge Point (CP) software company owned by a large corporate. The GreenCharge demonstrators are depicted in green in the table 3 below.

Many independent Charge Point Operators and Shared EV Providers have been bought by large corporate companies to scale their business models and make them more profitable. Fierce competition between different Charge Point Operators owned by large corporates has emerged in recent years. Charge Point Operators owned by large corporates also compete meanwhile fiercely with Independent Charge Point Operators. Private Charge Point Hardware and Software companies are mostly suppliers of Public Charge Point Operators. Charge Point and Shared EV Providers, which are independent or owned by government, tend to cooperate more and more to deliver door-to-door mobility services for customers.

Table 3: Segmentation of the European Charge Point market

European Charge Point market for EVs	Public Charge Point and Shared EV Provider	Public Charge Point Operator Service	Private Charge Point Hardware/Software/Navigation
Independent	ZET (BRMEN2) and MOTIT (BCN1), Jump, Lime, Dott, Bolt, Bird, Velov, NextBike, Smoove, Tier, Voi, Helbiz, LINK, Spin	GreenCharge Oslo demo (OSLO1,2,3), GC@Work Bremen (BREMEN1) demo, Allego, Fastned, InstaVolt, Recharge	Alpitronic, Chargecloud, ChargeNode, Garo, Gnrgy, GreenFlux, Has-to-be, Ingeteam, IES Synergy, Keba, Kostad, Last Mile Solutions, Circontrol, Compleo Charging Solutions, CTEK, DBT Group, Driivz, Easee, Efacec, Ekoenergetyka, eNovates, Ensto, Etrel, Evtec, Rolec Services, Smartlab, Tritium, Wallbe, Wallbox, Wirelane, Zaptec, ChargeTrip
Owned by large corporate or by government	St. Quirze (BCN3), Train, E-Bus, Tram, Metro	Fortum, BP Pulse, Bouygues, CEZ, EnBW, Eneco, Enel, ESB, Freshmile (Rexel), Iberdrola, Innogy (E.on), Izivia (EDF), Mer (Statkraft), NewMotion (Shell Group), TotalEnergies (Total), Vattenfall Group, Ionity (BMW, Daimler, VW, Ford), Tesla	Eurecat (BCN2), ABB, ABL, Alfen, EVBox (ENGIE), Green Motion (Eaton), Mennekes Group, Point (EDF), Schneider Electric, Siemens, Virta, Webasto, TomTom, Intellias, Telenav

Every market segment has one or two dominant business models, which have grown over time. The 6 market segments mentioned above are dominated by the following business models (see table 4 below):

1. Independent Charge Point and Shared EV Providers - Shared EV Service

2. Charge Point and Shared EV Providers owned by large corporate or government - Shared EV Service,

3. Independent Charge Point Operators - EV Charging Service

4. Charge Point Operators owned by large corporate or government - EV Energy/Mobility Service

5. Independent Charge Point hardware & software companies - CP Hardware/Software Products

6. Charge Point Hardware, software, or navigation companies owned by large corporates or government - CP Hardware/Software Products and EV Navigation Service

The GreenCharge demonstrators represent three of the six dominant business models. ZET (BRE2), MOTIT (BCN1), and St. Quirze (BCN3) demonstrators offer Shared EV Services. The GreenCharge demonstrator in Oslo (OSLO1, 2,3) and the GC@Work (BRE1) demonstrator in Bremen offer EV Charging Services. And the Eurecat (BCN2) demonstrator offers a Charge Point software service. The GreenCharge business models are depicted in green in the figure below.

Currently there are six dominant Charge Point Operator (CPO) business models for EVs in the market. These are: 1. EV Charging Service, 2. EV Energy Service, 3. EV Mobility Service, 4. Shared EV Service, 5. EV Navigation Service, and 6. CP Hardware/Software Products. The first and fifth business models are pure market place models, the second, third and sixth are pure pipeline business models. And the fourth contains a mix of pipeline and market place business model elements.

Traditional business models are pipelines. Every link in the value chain adds value in a linear way. Pipeline models do not scale very fast, because they are often asset heavy and must make a lot of marketing costs to attract new customers. New collaborative business models are multi-sided market places, which create an ecosystem of stakeholders connected via an orchestrator. The ecosystem can grow in an exponential way because all stakeholders can make use of same-side and cross-side network effects and the orchestrator is asset light. Customers and producers attract other customers and producers by word of mouth and positive reviews or recommendations at no cost for the orchestrator.

Table 4: Dominant business model per market segment

Business Models for Charge Points in Europe	Public Charge Point and Mobility Service Provider	Public Charge Point Operator Service	Private Charge Point Hardware/Software/Navigation
Independent	Shared EV Service	EV Charging Service	CP Hardware/Software Products
Owned by large corporate or by government	Shared EV Service	EV Energy Service EV Mobility Service	CP Hardware/Software Products EV Navigation Service

In the following paragraphs we will describe and evaluate these six dominant business models in more detail.

2.3.1 EV Charging Service

The business model for EV Charging Service is based on the Future Business Model of GreenCharge as mentioned in Deliverable 3.4. The orchestrator offers an Independent Public Charge Point Operator Service to customers with the aid of an EV charger at home/work, or away from home/work making use of locally produced renewable energy. In this business model the orchestrator creates value for the following four different types of stakeholders:

a. Prosumers, which are residents or businesses, with their own EVs,

b. Prosumers, which are residents or businesses premises, with their own solar panels,

c. Visitors of these home or business premises arriving with their own EVs, and

d. Traditional electricity retailer in combination with a DSO/TSO.

The orchestrator provides different electricity value propositions to four different stakeholders enabling the EV to be charged with as much renewable energy as possible. An extra fee is paid by the prosumers and visitors with an EV for priority charging services. The market place business model canvas is depicted below in figure 1.

Figure 1: Business Model of EV Charging Service
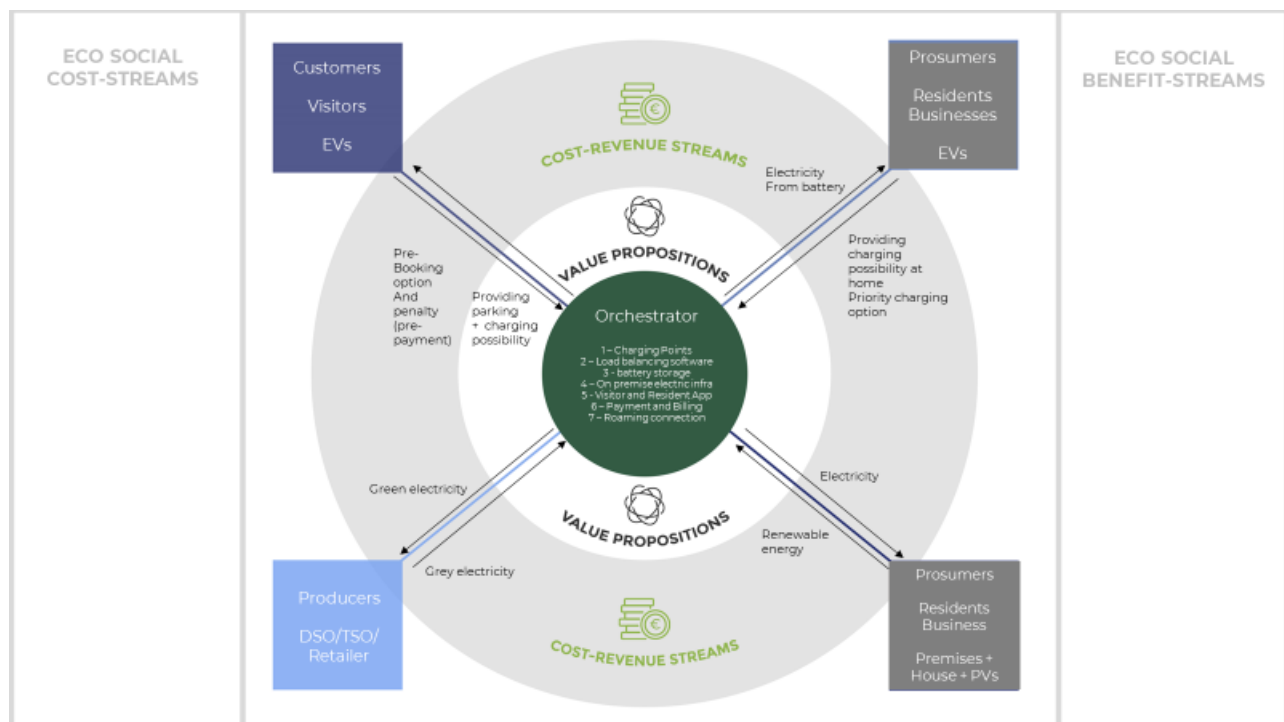
2.3.2 EV Energy Service

The business model of EV energy services is based on the Public Charge Point Operator Service of companies, like New Motion, Chargemaster, and Charging Solutions. These Start-Ups have been bought and scaled by traditional big oil & gas companies, like Shell, BP, and Total respectively. These traditional energy companies have extended their pipeline business model with a Charge Point Operator. They offer charging point services to consumers and business users with EVs at home, at work, and on the go. They charge a monthly subscription fee and a pay per use fee.

The main difference between the business models of EV Charging Service offered by start-ups and the EV Energy Service operated by Big Energy companies concerns the business model market place archetype and pipeline respectively and the priority charging option. The pipeline business model of EV Energy Service for production, transport and retail activities can be enhanced with a platform model for EV Charging Services to make use of local renewable energy. However, these Big Energy companies have conflicting interests and business incentives to do so.

The business model canvas for EV Energy Service is depicted below in figure 2. This canvas has a different format than the previous one, because the business model is a traditional pipeline instead of a market place.

Figure 2: Business model of EV Energy Service
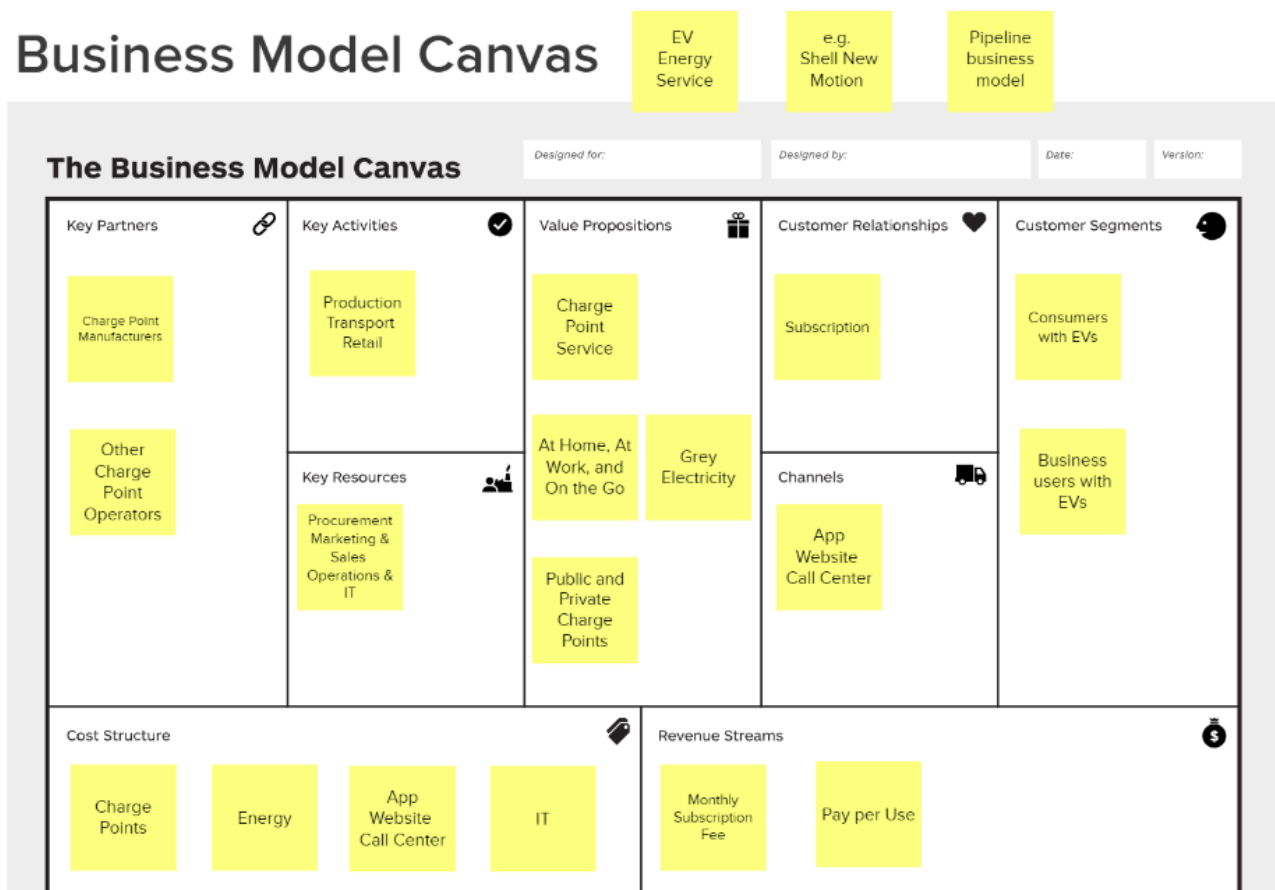
2.3.3 EV Mobility Service

The business model of EV Mobility Service is pioneered by Tesla. Tesla offers its own customers a Private Fast Charge Point Operator Service. Tesla is planning to open these Points up to EVs of other brands and make them Public Charge Points. Other traditional OEMs are starting to copy and mimic this business model. These traditional OEMs have extended their pipeline business model with a Charge Point Service. They want to offer an integrated Value proposition to their consumer and business customers existing of a vehicle lease plus (fast) charging services at public and private charge points. They charge a monthly subscription fee and a pay per use fee, which are higher than traditional electricity prices. The pipeline business model of OEMs for manufacturing, import, and retail activities can be enhanced with a platform model for EV Charging Services to make use of local renewable energy. But these Big Car and Truck companies have conflicting interests and business incentives to do so. The business model canvas is shown below in figure 3.

Figure 3: Business model of EV Mobility Service
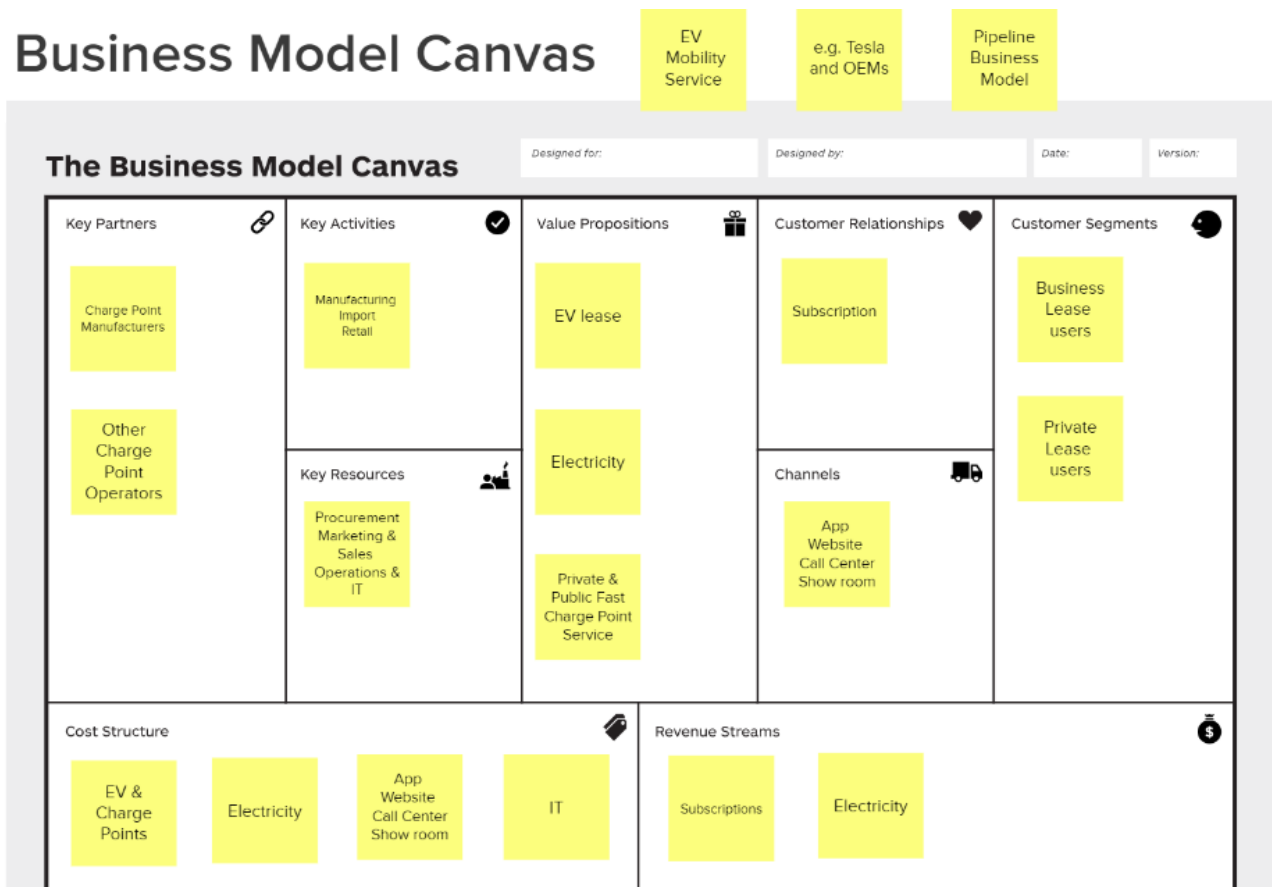
2.3.4 Shared EV Service

The business model of a Shared EV Service is based on the extended business model of public transport companies and organizations. They offer door-to-door mobility and transportation services to consumer and business customers with the aid of train, tram, e-bus, in combination with shared e-cars, e-bikes, and e-scooters. They charge subscription, and/or pay use fees for their services. Public Transport Companies often make use of green electricity to charge their electric vehicles, and have a large positive impact in reducing CO2. The pipeline business model of Public Transport Companies for Operations & IT, Retail, and Service activities can be enhanced with a platform model for Shared EV Services to make use of local renewable energy. But these Big Public Transport Companies have conflicting interests and business incentives to do so. The business model canvas is shown below in figure 4.

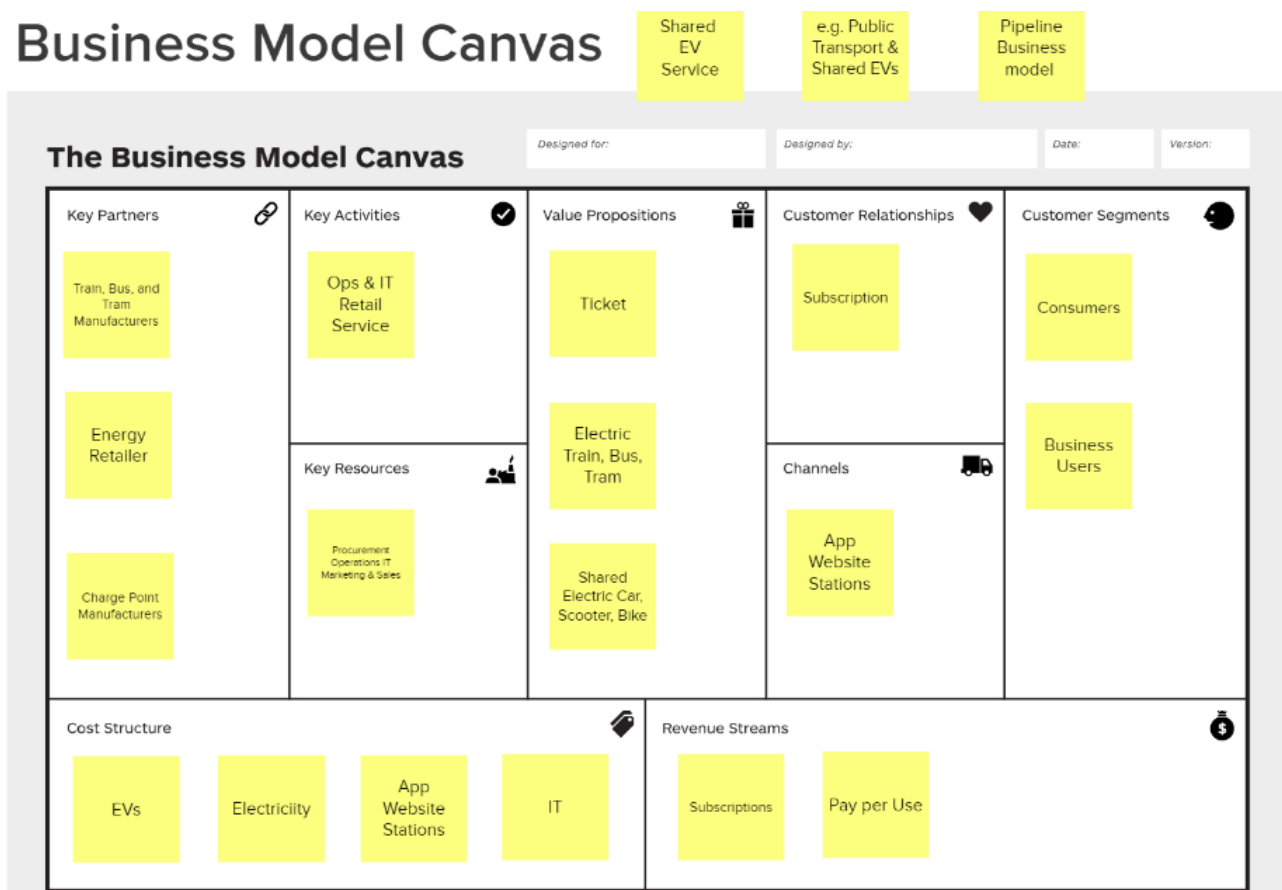**Figure 4: Business model of Shared EV service**

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020) under grant agreement n° 769016.

15 of 39

2.3.5 EV Navigation Service

The EV Navigation Service is a new business model offering green navigation and charging services for EV owners based on a combination of business models of ChargeTrip, and a traditional TSO/DSO. The Route Navigation Software not only shows the fastest route to get from A to B, but also the route with available public EV Charging Points. This business model offers EV navigation and priority charging services to consumer and business users making use of local renewable energy at home, work, and on the go as much as possible. They can charge more and more lower tariffs, because Charging Points offer more and more local renewable energy. Besides it offers a load balancing service and temporary storage of green energy for different Charge Point operators, which have a shortage or an overload of locally produced renewable energy. The market place business model of EV Navigation Service is shown below in figure 5.

Figure 5: Business model of EV Navigation Service
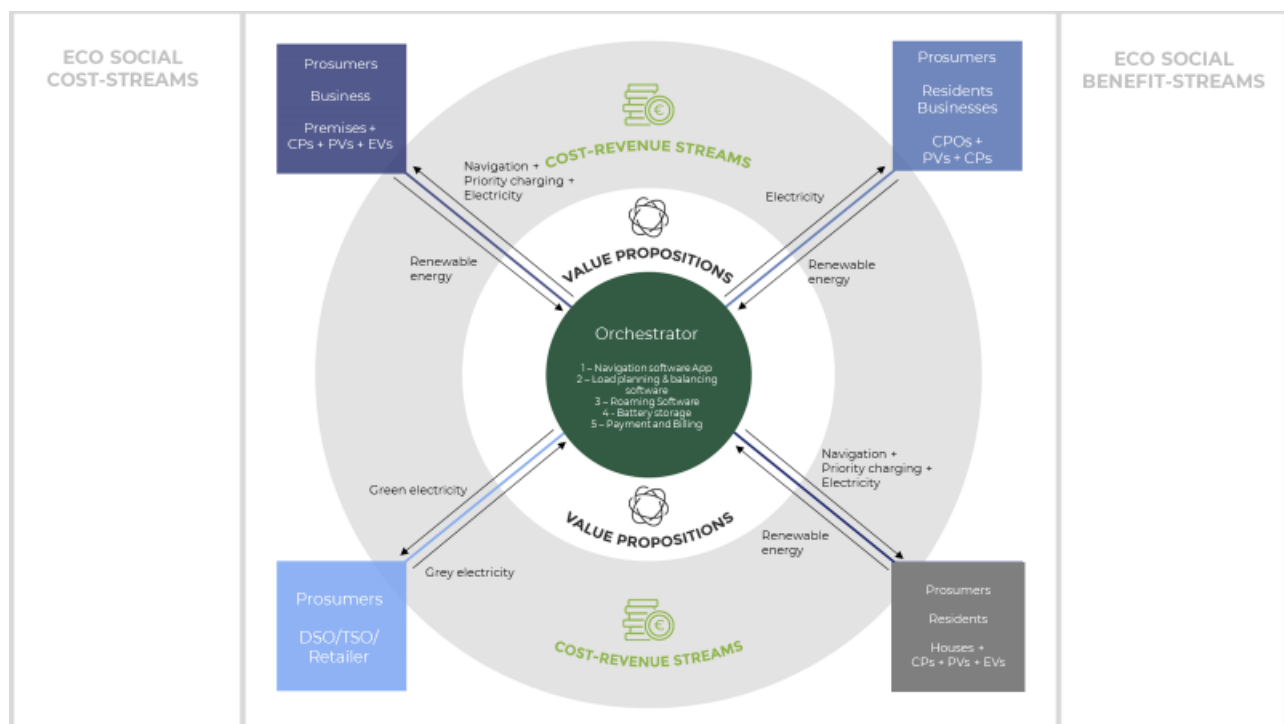
2.3.6 CP Hardware and Software Products

The Business Model of CP Hardware and Software Products is used by both independent and large corporate manufacturers of Charge Point poles and software to operate them creating value for their Charge Point Operator customers and earn money. The pipeline place business model of CP Hardware and Software Products is shown below in figure 6.

Figure 6: Business model of CP Hardware and Software Products
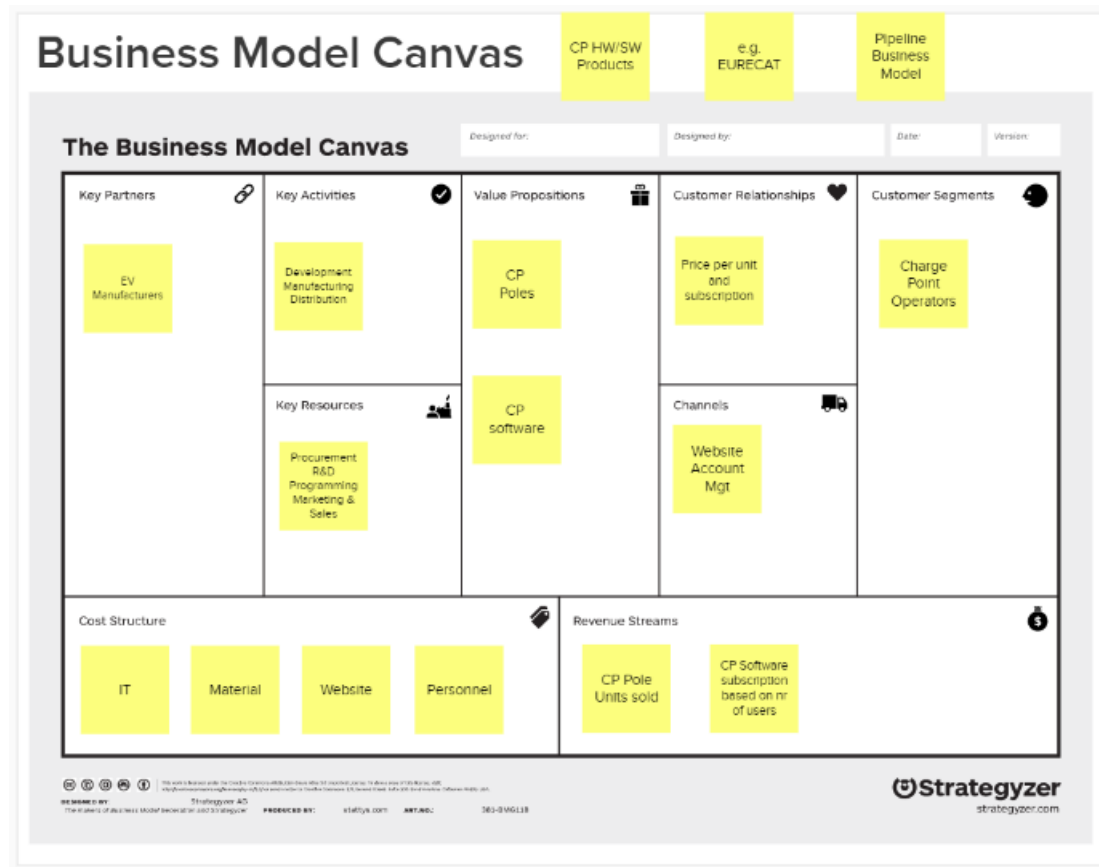
2.4 Evaluation criteria of viable business models

Viable business models are exponential, green and circular business models. The evaluation criteria of viable business models are based on the 5 design principles of exponential business models as mentioned in Deliverable 3.4 plus 2 extra design principles for green and circular business models.

An exponential business model looks at the same key areas as a traditional business model—but it has radically different goals. Most business models are linear, designed to increase profits or decrease costs by 10 percent. With an exponential business model, we think in terms of changes that are 10 times greater or lesser than today's value—the common shorthand for this goal is simply "10X". Taking your business model from 10 percent to 10X is not simply about scaling.

Often it requires a completely new way of looking at your business and the market it serves. Exponential business models require exponential imagination. Further, to 10X your business model, you must create value by leveraging technology in at least one key building block, such as the value proposition, channels, or key resources. Amazon, Facebook, Airbnb, Snap, Alibaba and Slack are just a handful of the companies that have successfully done so. Airbnb, for example, built a software platform to connect those in need of lodging to those who had it. By combining existing tech with an alternative value proposition, they liberated a huge, underused resource and created 10X value without owning a single room.

There are 7 design principles that refer to the most important elements of a business model concerning: what? (value proposition); for who? (customer segments); how? (key activities and network effects), and; at what costs and revenues?

A. <u>Customer Segments: Solve a problem for the masses</u>

Technology is enabling organisations to reach entirely new markets in massive and viral ways. As the world's population approaches 7.5 billion, companies and organizations with exponential business models can help close the gap between our growing population and the resources they need. Many companies start with one core offering to customers to serve one need—like Uber and personal transportation—then expand their services to meet other needs, like UberEATS or UberHEALTH.

B. <u>Value Proposition: Information-based digital services</u>

As companies digitise their products and services, they are not just creating new versions of their traditional offerings, they are creating entirely new market places. Airbnb's platform re-imagines short-term accommodations; Slack digitises collaboration and knowledge sharing; the consumer genetics firm 23andMe offers affordable DNA sequencing to anyone. Every business, regardless of industry, should be exploring how and what to digitise in their existing value proposition to not only serve existing customers better, but to potentially open up foundationally new exchanges of value.

C. <u>Key Activities: Ultra scalable processes, asset-light technologies and algorithms</u>

Google is one of the best examples of a company built on an algorithm (to rank websites), that is then augmented by machine learning. StichFix, one of the fastest-growing on-demand retail companies, has a team of over 65 data scientists and uses algorithms to drive nearly every part of its business. It even has a well-respected public blog on data science. Amazon Web Services (AWS)—rented access to computing infrastructure—was launched in 2006. Ten years on, it contributed 56 percent of Amazon's growth and is on target to be a $100 billion business in less than five years.

D. <u>Revenues and costs: capture of value in money terms</u>

A business model describes how a company delivers and captures value from customers. Without revenues no income for the company. Value can on the other hand also be created in non-monetary terms. In that case we speak of an organisation or non-profit model, instead of a business model.

E. <u>Market place: network effects</u>

Traditional business models are pipelines, as shown in the stakeholder overview in Deliverable 3.1. Every link in the value chain adds value in a linear way. They do not scale very fast, because they are often asset heavy

and must make a lot of marketing costs. They do not stimulate collaboration between all stakeholders, because the increased margin for one link in the chain goes at the cost of another. A pipeline business model does not maximise value for all stakeholders.

New collaborative business models of GreenCharge are multi-sided market places, which create an ecosystem of stakeholders connected by an orchestrator. The ecosystem can grow in an exponential way, because all stakeholders collaborate, make use of network effects, and maximize value. More customers will attract more producers of energy and the other way around. As a result, market place businesses can grow exponentially.

F. Green: Using green electricity from production to usage

Green Business models use green electricity from production to usage. Green Charge Point Operators sell green electricity to customers with an EV. This CO2 impact should be measured from raw materials, electricity production, electricity transport, charge point, to driving an EV.

G. Circular: Charging and usage of locally produced renewable energy

Circular business models charge and use locally produced renewable energy from windmills, solar energy, and/or water turbines using recycled EV batteries for energy storage. These business models make use of short loops, do not generate waste and are circular. As a result electricity of Charge Point Operators is not transported over long distances, but stays local.

These evaluation criteria will be used in order to evaluate the viability of most dominant business models in the Charge Point market. A viable business model solves a problem for the masses, which can be measured by the number of EVs and the number of CPs, that are used by a demonstrator. A viable business model delivers information-based digital services, which can be measured by the Ratio of Capital investment costs and Average operating revenue. For traditional pipeline business models this ratio is high (around 30%), because they often own the assets of (energy) production. For viable business models this ratio is low (around 10%), because they do not own the (energy) assets. They only connect (energy) customers with (energy) producers with information-based services. A viable business model has ultra-scalable processes and algorithms, which is measured by the Ratio of Average operating revenues and costs. The more a business model produces, the higher its gross margin, because the use of algorithms mainly leads to fixed costs and not to variable costs.

A viable business model captures its value creation for customers by revenues and costs, which is measured by earnings. Earnings is the resulting cash flow from the business model. For the calculation of earnings we refer to the business case format mentioned in section **Error! Reference source not found.**. A viable business m odel generates network effects, which can be measured by savings per customer (and per producer) as a result of joining a market place instead of a pipeline business model. These network effects create lower costs for customers (using energy) from an exponential business model in comparison to a pipeline business model, because they do not pay for the marketing. In a viable business model marketing is done by customers themselves, because they recommend the use of the business model to other customers. The viable business model gives an incentive to customers to attract other customers, which in turn attract more producers. The more producers and customers, the lower the costs of the service per customer and the higher the revenue of the service per producer (of energy).

A viable business model is green, because it uses green electricity from production to usage and as a result reduces its CO2 footprint. To minimize the CO2 footprint of a business model it should also be circular making use of locally produced renewable energy. The combination of an exponential, green, and circular business model is viable. These 7 design principles and evaluation criteria of viable business models were translated into KPIs during the GreenCharge project. They are mentioned in the table below (see table 5 below):

Table 5: Design principles and KPIs of viable business models

Design principles of viable business models	KPI	KPI number
1. Customer segment: **Solve a problem for the masses**	Number of EVs	GC 5.1
	Number of CPs	GC 5.2
2. Value proposition: **information-based digital services**	Ratio Capital investment cost and Average Operating revenue (%)	GC 5.7 and 5.8
3. Key activities: **ultra-scalable processes and algorithms**	Ratio of Average Operating Revenue and Costs (%)	GC 5.6 and 5.8
4. Revenues and costs: **capture of value with money**	Earnings and Net Present Value	GC 5.15
5. Market place: **network effects**	Cost savings per Customer and per Producer	GC 5.6 and 5.8
6. Green: **From Production to Usage**	% Green Electricity from production to usage	GC 5.16
7. Circular: **Charging and usage of locally produced renewable energy**	% Locally produced renewable energy used for EV charging	GC 5.17

2.5 Evaluation of viable Business Models

The viable business models mentioned above will be evaluated with the aid of the viable business model criteria. The shared EV service scores highest on the first criteria of customer segment solving a problem for the masses, because it targets all consumers and business customers with or without an EV. The EV Navigation Service business model scores highest on the second criteria of value proposition, because the orchestrator mainly develops and owns software, and is asset light. The EV Navigation Service scores highest on criteria 3 for ultra-scalable processes, because it optimizes renewable energy use and production with the aid of algorithms for both EVs and PVs at different locations. The EV Mobility Service Business Model scores highest on criteria 4 on revenues and costs, because it monetizes a premium segment of business and lease EV customers. The EV Navigation Service scores highest on criteria 5 with respect to network effects, because onboarding of EV owners is easiest. The Shared EV Service scores highest on CO_2 impact (criteria 6), because EV vehicles, like in trains, trams, e-buses, e-cars, etc. are shared with many passengers and charged with green electricity since most are publicly owned companies. The EV Navigation Service scores highest on charging EVs with locally produced renewable energy, because the business model maximizes the charging and usage of locally produced renewable energy from solar panels on nearby houses and business premises.

The scores of the different dominant Charge Point business are mentioned in the table below (see table 6 below).

Table 6: Score of viable business models

Score of viable business models	KPIs (score out of 10)	EV Charging Service	EV Energy Service	EV Mobility Service	Shared EV Service	EV Navigation Service	CP HW/SW Products
1. Customer segment: Solve a problem for the masses	Number of EVs Number of CPs	4	6	8	10	2	0
2. Value proposition: Information-based digital services	Ratio Capital investment cost and Average Operating revenue (%)	8	6	4	2	10	0
3. Key activities: ultra-scalable processes and algorithms	Ratio of Average Operating Revenue and Costs (%)	2	8	6	4	10	0
4. Revenues and costs: capture of value with money	Earnings and Net Present Value for all stakeholders	0	8	10	4	2	6
5. Network effects: market place	Cost savings per Customer and per Producer	0	6	4	8	10	2
6. Green: Green Electricity From Production to Usage	Contribution per EV CO2 emission reduction (kgs/day)	6	2	4	10	8	0
7. Circular: Charging and usage of locally produced renewable energy	% Locally produced renewable energy used for EV charging	8	4	2	6	10	0
Total score of exponential business models	Sum of scores on Criteria 1-5	**14**	**34**	**32**	**26**	**34**	**8**
Total score of green and circular business models	Sum of scores on Criteria 6-7	**14**	**6**	**6**	**16**	**18**	**0**
Total score of viable business models	Sum of scores on all Criteria	**28**	**40**	**38**	**42**	**52**	**8**

The business models for EV Navigation and Shared EV Services have the highest total score and are the most viable, green and circular business models. The EV Energy and EV Mobility Services have high Exponential scores, but low Green and Circular Scores. These business models currently have the highest Charge Point Market Share, because big oil & gas companies and large car manufacturers have bought the most successful independent Charge Point Operators to complement their offerings and scale their services in the past few years. These big oil big oil & gas companies and large car manufacturers have no business incentive to sell green electricity from local renewable sources to their large customer base. As a result there are currently not many Charge Point Operators on the market, that predominantly sell green and locally produced electricity to customers with EVs. How can Strategic Urban Mobility Plans of Uptake Cities change this?

The business models of GreenCharge demonstrators are viable as long as they resemble the dominant business models in the different CP market segments, because the business models in the CP market have developed faster than the business models of the GreenCharge demonstrators. The business models of GreenCharge ZET (BRE2), MOTIT (BCN1) and St. Quirze (BCN3) demonstrators are most viable, because they have a Shared EV Service business model. The EV Shared Service and EV Navigation Service models of Charge Point Wholesale Operators are the most viable business models in the market, that Uptake Cities should stimulate.

3 Uptake Cities

3.1 Background

There are currently not many Charge Point Operators on the market, that predominantly sell green and locally produced electricity to customers with EVs. Uptake Cities of GreenCharge want to change this by introducing Strategic Urban Mobility Plans (SUMPs), which stimulate viable business models and lower CO2 emissions from mobility. They want to stimulate the adoption of both EVs in comparison to Fossil Fuelled Vehicles, and EVs charging green electricity from local renewable sources. Uptake Cities should incentivize EV Energy and EV Mobility Service Providers to transform their business models into green and circular ones and to stimulate green and circular Shared EV and EV Navigation Business Models.

GreenCharge works with up to 12 Uptake Cities, who have learned from the three pilot cities through site visits and an advanced webinar programme. This has culminated in an electric mobility road map for each city that covers issues relating to the construction, configuration and location of charging infrastructure for electric/hybrid vehicles, and their integration into mobility planning. Uptake Cities are: 1. San Sebastian, 2. Budapest, 3. Krakow, 4. Ploiesti, 5. Porto, 6. Stockholm, 7. Thessaloniki, 8. Edinburgh, and 9. Zagreb. (See Appendix A). Work with the Uptake Cities is outlined here for context, and reported fully in Deliverable 7.3.

These Uptake City Roadmaps as mentioned in Deliverable D7.3 stimulate EV sales, EV usage, EV parking, CP sales, CP placements, CP usage, etc., but do not stimulate the use of green electricity from local renewable sources. The current roadmap measures of Uptake Cities tend to stimulate Public Transport and Public EVs, such as e-buses and trams, but do not stimulate the charging and use of green electricity from local energy sources over grey electricity. And these roadmaps do not discourage the uptake of fossil fuelled cars, the roll-out of petrol stations, and the usage of fossil fuels. We advise the Uptake Cities to include these green elements in their roadmaps.

On 11 December 2019, the European Commission unveiled the EU strategy on climate neutral Europe, or the European Green Deal. The strategy promises to ensure that there are no net greenhouse gas (GHG) emissions by 2050, including increasing the EU's 2030 GHG reduction target to 55% in a responsible way. This clear shift towards sustainable and zero emissions technologies and economy-wide change is urgently needed if the EU is to meet the ambition of the Paris Agreement. All Cities in the EU in general and the Uptake Cities in particular need to incentivize the buildout of EV charging stations, sales and usage of EVs and the roll-out of green and circular EV business models. At the same time, they need to discourage the expansion of petrol stations, the sale and use of fossil fuelled vehicles, and the growth of business models for fossil fuelled vehicles with high CO2 emissions.

The most viable business models of Shared EV service and EV Navigation Service are not adopted at a fast pace in European Cities, because they are start-ups which face high barriers of entry and this young CP market is not regulated enough. The incumbent business models of EV Energy Service and EV Mobility Services have the lowest impact on CO2 emission reduction, but tend to dominate the market, because of their large customer base, and strong financial positions. The traditional oil and gas companies and OEMs prefer to sell grey, instead of green, electricity to EV users, because they do not want to cannibalize their traditional and profitable fossil business. As a result there are currently not many Charge Point Operators on the market, that mainly sell green and locally produced electricity to customers with EVs.

The central strategic question for Uptake Cities is: "How can City governments simultaneously stimulate the uptake of EVs, the roll-out of Electric Charging Stations, and the use of green electricity from local renewable sources leading to lower CO2 emissions from mobility in their Cities?"

EVs require charging—but charging stations in most countries are still relatively few and far between. When consumers consider buying their first EV, therefore, many have "range anxiety"—wondering if they will be

stranded on the highway as gas powered vehicles sail by. In fact, a June 2021 survey led by Nissan[1] revealed that "56% of European internal combustion engine (ICE) drivers who are not considering buying an EV believe there are not enough charging points." Simultaneously, potential investors in EV charging points (CPs) or other EV infrastructure are hesitating until more electric vehicles are sold, creating a financing gap.

While many EV drivers use privately funded chargers at home or work, we still expect 20% to 50% of charging to take place on the road and at destination chargers, depending on the region. And according to a recent survey of European EV drivers by NewMotion[2] 33% of respondents cannot install a CP at home.

Without public charging infrastructure, therefore, EV adoption will remain slow. And with the private sector left to its own devices, this dilemma could bring EV markets to a standstill. As a result, many Cities have already stepped into the gap to kick-start the market. Yet they tend to do so without a clear plan or goals, resulting in early stage open-market chaos. Besides most EVs are still charged with grey electricity, because traditional energy companies and OEMs keep start-ups that introduce green EV business models from entering the EV market. City orchestration to resolve these issues is thus essential, especially in immature markets.

3.2   Objectives of Uptake Cities

Uptake Cities should simultaneously stimulate the uptake of EVs, the roll-out of Electric Charging Stations, and the use of green electricity from local renewable sources. In this way the Uptake Cities have the chance to catch up and overtake other European Cities, that have stimulated EVs earlier. In this way Uptake Cities will become front runners. As a result they will stimulate viable EV business models and lower CO_2 emissions from mobility in their Cities leading to better health for their City inhabitants. On top of that, Uptake Cities need to discourage the uptake of fossil fuelled vehicles, the expansion of petrol stations, and the usage of fossil fuels by vehicles in Cities to lower CO_2 emissions even more.

Uptake City governments should coordinate with players throughout the EV ecosystem, including national and EU governments, to create a master plan for the uptake of EVs, for the roll-out of Electric Charging Stations, and for their usage of green electricity from local renewable energy. The Uptake Cities should communicate the plan's goals to all stakeholders as clearly as possible. And they should both regulate and incentivize the buildout of CPs with Local Renewable Energy until the private sector is ready to step in. Only then can the dilemma be resolved, setting the stage for private investment and creating a self-sustaining market structure—one that will be economically viable without grants and other government support.

3.3   Strategic Urban Mobility Plans (SUMPs) of Uptake Cities

Uptake City governments should adopt SUMPs, including EV Uptake, EV charging infrastructure and EV electricity usage from local renewable sources as suggested by BCG in a recent article "How Governments Can Solve the EV Charging Dilemma?"[3]. A plan that will ensure that the preferred EV viable business models with the highest impact on CO_2 emission reduction are supported, that public-private partnerships have the right frameworks, and that the private sector is confident this is an attractive sector worth participating in. Besides Uptake Cities should take into account how fast they want to accelerate EVs and how fast they want to bring down the use of fossil fuelled vehicles. This plan should include the following five key components (see Figure 7 below):

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[1] https://europe.nissannews.com/en-GB/releases/release-7aa4d3e4b25782dcbedfa7df601b078a-nissan-reveals-european-ev-drivers-are-travelling-further-than-petrol-and-diesel-motorists

[2] https://newmotion.com/en/knowledge-center/reports-and-case-studies/ev-driver-survey-report

[3] https://www.bcg.com/publications/2021/electric-vehicle-charging-station-infrastructure-plan-for-governments

Figure 7: Five elements of a structured SUMP

1. Urban Mobility Strategy Goals of Uptake Cities

As a first step in laying out their master plan, City governments should agree on the following three types of SUMP goals:

a. High-level EV uptake targets, such as number of registered EVs in a particular Uptake City per year, number of road lanes for EVs, number of private parking spaces for EVs, etc. What kind of EVs does an Uptake City want to stimulate – Trains, Metro, Trams, Electric cars, e-Busses, e-Scooters, e-Bikes, e-Steps? What mobility hubs with Shared Electric Vehicles do Uptake Cities want to build at train, metro, and tram stations, at parking garages, and/or at logistics centers?

b. CP Infrastructure goals with respect to network size, optimal locations, affordability, accessibility, and even construction timing. Weighing existing experiences from CP buildouts globally and comparing them to previously established goals can guide decisions and help avoid mistakes from the past. For example, what should the split of private and public charging be? What is the minimum road coverage to avoid range anxiety? What is the optimal ratio of EVs to public chargers? Where in the City is the penetration of houses and business premises with Solar Panels the highest? Where and when is the building of new housing or business premises planned? A strong City wide master plan for EV charging and Petrol Tank infrastructure and accessibility is necessary to ensure that the private sector sees it as an attractive sector worth participating in.

c. Usage goals of green electricity from local renewable sources for the % green electricity, and % of local renewable sources per EV type, per CP type (public or private), and per year. What is local electricity and how far is green electricity allowed to be transported? What are the goals for Solar Panels, Wind Mills, and Water Power Plants to generate green electricity? How fast will the grid need to grow to offer load balance services between CPOs?

We recommend plotting out all CP locations in advance, bearing in mind the mix, spread, and use of different types of locations, in which people might charge and tank their vehicles. For example, the City government may decide to place a fast charger every so many miles on a ring road of a City, and a charger in every zone of a certain size, etc. It is also critical, that governments ensure inclusive and convenient charging access for low- and mid-income users, who cannot easily upgrade their homes for EV charging.

Analysing the current CP coverage and coverage gaps can help determine the most appropriate infrastructure for the geography, traffic, user needs, locations, and conditions of each region in question. The German government has done good work in this area, creating a centralized toolkit for identifying and coordinating charging requirements down to the individual street level. The toolkit also shares information about newly built CPs with the public and helps market participants become more informed as they bid for CP contracts. Note that slower public and workplace chargers will cover most of the need for CPs, at a much lower Capital Expenditure (CAPEX) level, than fast chargers. Thanks to high traffic, and thus value creation for the businesses involved, private-sector investments would have a good economic return in these locations.

Fast and ultra-fast chargers, in contrast, require more careful planning and monitoring, since they are needed in pivotal locations to secure universal coverage, reduce range anxiety, and increase confidence in EV adoption. Gas stations and highway rest areas ideally should offer these faster chargers. As a part of this entire process, governments should also determine the investments required for electricity grid upgrades and create a comprehensive transition schedule, coordinating it with existing mobility targets such as Internal Combustion Engine (ICE) bans and specific EV-ICE sales-share targets.

Evaluation Criteria of Viable Business Models form an important aspect of SUMP goals, because SUMP should stimulate exponential, green and circular business models. In this way Business Models, which contribute to the 3 overall EV SUMP targets, will be stimulated by the SUMP measures of Uptake Cities.

2. Urban Mobility Strategy of Uptake Cities

The Uptake Cities should stimulate viable business models depending on their positive CO2 impact of Green Electricity from production to usage activities, and charging and usage of locally produced renewable energy. In this way Uptake Cities can prevent the usage of Grey Electricity, that is produced from far way and transported to an Uptake City to charge an EV. All Uptake City measures should be made dependent on these 2 criteria for viable business models to prevent market externalities.

The larger the reduction of CO2 emissions from an EV by using green and locally produced renewable energy the larger the City grants for EV user, the Charge Point Operator, and the Shared EV Service Provider. The larger the increase of CO2 emissions from an EV by using internationally produced grey electricity from fossil fuels like oil & Gas, the larger the City taxes for the EV user, the Charge Point Operator, and the Shared EV Service Provider.

Uptake Cities should make the height of grants and taxes for Vehicles users, Charge Point Operators/Tank stations, and Shared EV Service Providers/Fossil Fuelled Vehicle Service Providers dependent on both CO2 emissions and location of the energy source. Uptake City grants should be high and taxes should be low at the start of the EV adoption curve. And conversely grants should be low and taxes high at the end of the adoption curve of EVs in Uptake Cities.

3. Urban Mobility Measures of Uptake Cities

The following urban mobility measures will make Uptake Cities attractive for EV Charging with local renewable energy and positive impact on CO2 emissions as much as possible. And at the same time, these measures will make these Cities more and more unattractive for tanking petrol of vehicles with an internal combustion engine:

a. Uptake City Grants and taxes
- Subsidize EV users, Charge Point Operators, and Shared EV Mobility Service Providers depending on their CO2 reduction from using green electricity from local renewable sources
- Tax Vehicles users, Tank Stations, and Fossil Fuelled Vehicle Service Providers depending on CO2 emissions
- Lower parking fees for EVs depending on CO2 emission reduction from using green electricity from local renewable sources

b. Uptake City Spatial planning
- Make more dedicated parking spaces available for EVs with public CPs, which use green electricity from local renewable sources
- Build EV hubs at Train, Metro, and Tram stations with parking space for Shared Electric Cars, Scooters, Bikes, and Steps
- Build more and better dedicated e-bike/bike/e-step lanes

c. Uptake City Regulation and permits
- Eliminate barriers for permit requirements, or accessing land from municipalities for private and public EV charging stations as long as they use local renewable energy sources

- Increase barriers for permit requirement of petrol tank stations and reduce the maximum number of petrol stations permits
- Introduce regulation that new houses and business premises receiving sunlight are forced to be equipped with solar panels, EV chargers, battery storage, etc. and existing houses and business premises, which are renovated and which receive sunlight, are forced to be equipped with solar panels and use them
- Allowing low emission zones in cities for vehicles depending on usage of green electricity from locally produced renewable energy with the aid of newly developed Internet of Things and Track & Trace technology
- Create shared ownership model of Charge Point Provider for producers of green electricity, who supply to local CP

d. Uptake City Investment Fund
   Public investment in equity of CP Operators and Shared EV Service Providers, which use green electricity from local renewable resources, obtaining a minority or majority share concerns a measure to bridge a possible funding gap and stimulate the reduction of CO_2 emissions from mobility in the City.
- Invest in Charge Point Operator Start-Ups using green electricity from locally renewable sources
- Invest in Shared EV Service Provider Start-Ups using green electricity from locally renewable sources
- Stop investing in fossil fuelled business models

e. Uptake City Fleet and Transport procurement
- All leased vehicles of Uptake City governments should be EVs and charged with as much as possible locally produced renewable energy
- All transport of Uptake City personnel should use (shared) EVs and charged with as much as possible locally produced renewable energy
- Police, Ambulance, and Fire Brigade of Uptake Cities should use (shared) EVs and charged with as much as possible locally produced renewable energy
- All procured transport services by Uptake Cities should make use of (shared) EVs and charged with as much as possible locally produced renewable energy

4. Agile implementation roadmap of Uptake Cities

Uptake City governments should communicate everything they hope to achieve—from the goals, the governance to the SUMP measures — to gain buy-in from members of the charging ecosystem and create a roadmap to attaining these achievements. This implementation roadmap should include clear milestones and the roles and responsibilities of key public and private stakeholders. A good place to start is by creating public-private partnerships, such as offering public land concessions to private players to install public CPs or establishing multistakeholder platforms to facilitate dialogue and collaboration. Governments should also work with the private sector to determine the best incentives and grants—for example, tax reductions and exemptions, grants, or low-interest loans—and to define allocation methods and timeframes. Any incentive must include some measure of accountability individually and collectively to ensure these public funds' efficient use and their contribution to the sustainability of the EV charging sector. For instance, grants can be linked to periodic progress reports to ensure that the original tender requirements are being met.

Underlying the entire plan, Uptake City governments need the flexibility to adjust and adapt to learnings from the evolving EV market, if they are to avoid the pitfalls met by earlier efforts. They should therefore develop the plan both dynamically and transparently, including the continuous publication and update of the EV charging network, progress, spending, and incentives. An Uptake City government will also need a transparent mechanism for intervention in case of market failure—including when, how, and for what duration—to give a clear signal to the market of how serious it is about ensuring success.

5.   Project governance for SUMP of Uptake Cities

The project governance for SUMP of Uptake Cities consists of the following 3 levels in alignment with the content of the SUMP mentioned above:

• Overall: City Council sets and controls SUMP targets in the coming 5 years,
• Strategy: Strategy and Planning team develops a SUMP strategy and controls the planning, and
• Measures: Project teams develop, operate and control the SUMP measures.

Figure 8: Project governance for SUMP of Uptake Cities
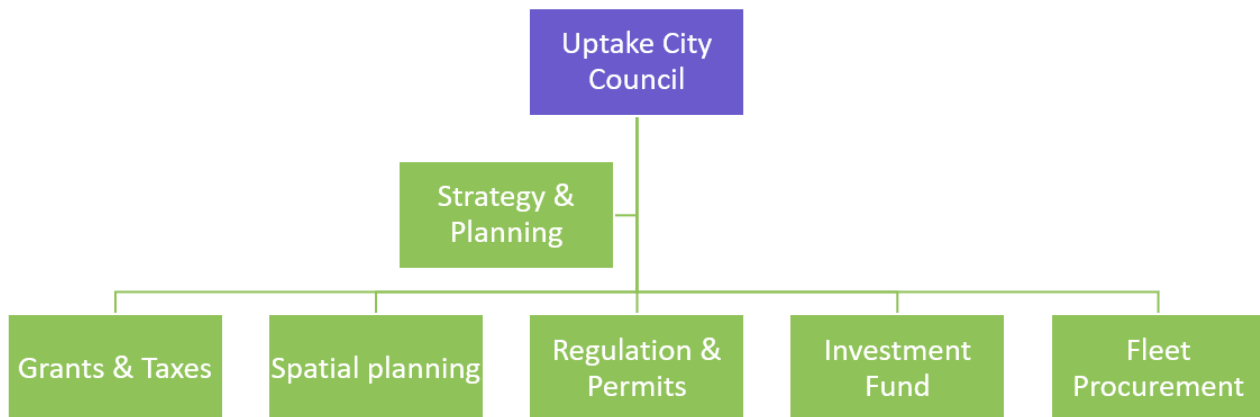
The strategy and planning manager also represents the Uptake City in the Uptake Cities Group. ICLEI convenes an Uptake Cities Group that acts as a sounding board for the project, and coaches local governments in the process of planning the integration of e-charging infrastructure solutions developed in the pilot cities in their Sustainable Urban Mobility Plans (SUMPs). ICLEI further supports dissemination of the project results, amongst others by dedicating one edition of the established conference series 'Informed Cities Forum' to GreenCharge. ICLEI is the Uptake City facility manager.

Founded in 1990, ICLEI's network has grown to 1,500 local governments dedicated to sustainable development. ICLEI encompasses 200 European members from 35 countries and include municipalities from small towns to large cities. ICLEI Europe provides technical consulting, training, events, (online) information and communication services to build capacity, share knowledge, and support local governments in the implementation of initiatives furthering sustainable development. ICLEI is uniquely positioned to facilitate the discussion amongst local governments and various stakeholders about innovative solutions for the challenges related to urban mobility. The organisation has established communication channels towards cities, national and EU institutions, research, NGOs and businesses.

3.4   Planning

A master plan will help Uptake City governments shepherd their market quickly and effectively through the three main stages of development, that we foresee, which we have labelled the inception, ramp-up, and maturity phases. Our analysis finds that the EV charging market is still in the initial stages in most Uptake Cities and have not yet reached the Ramp up stage. Uptake Cities should also facilitate the decrease of Fossil Fuelled Vehicles (FVs) and decrease the number of Tank Stations (TS) at the same time. This will be a careful balancing act. The planning format of a SUMP for Uptake Cities is shown in the following figure (see Figure 7 below):

29 of 39

Table 7: Format of SUMP planning for Uptake Cities

	1. Inception	2. Ramp-up	3. Maturity
Key dimensions	**Regulator driven market**	**Mix of regulation and self regulation**	**Self-regulated market**
Decrease FVs	• > 50% FVs inhabitants	• 50% - 25% inhabitants	• < 25% inhabitants
Uptake EVs	• < 25 EV per 10k inhabitants • < 5 EV per CP	• 25 - 250 EVs per 10k inhabitants • 5 – 50 EVs per CP	• > 250 EVs per 10k inhabitants • > 50 EVs per CP
Decrease Tank stations	• > 1 TS per 1.000 FVs	• 1 TS per 10.000 FVs	• < 1 TS per 100.000 FVs
Uptake CPs	• < 5 CP • < 1 fast CPs	• 5 – 50 CPs • 1-150 fast CPs	• > 50 CPs • > 150 fast CPs
Usage of green electricity from local renewable sources by CPs	• < 10% green electricity • < 10% local renewable sources	• 10%-50% green electricity • 10%-50% local renewable sources	• > 50% green electricity • > 50% local renewable sources

3.5 Progress report on SUMPs

We offer five key dimensions for measuring progress through the three stages: Inception, Ramp-up and Maturity. As the EV charging market matures, the growing value chain and larger number of electric vehicles on the road will make it more attractive to the private sector. Governments should therefore create a plan to evolve their role from acting as the protagonist in the inception stage to serving as an enabler in the ramp-up and, finally, to a supervisory role in the maturity state. This evolution will mean defining and redefining their actions, priorities, and use of resources at each of the four stages, as well as market-control mechanisms such as pricing,

We offer five dimensions for measuring progress through the three stages:

a. Number of EVs registered in a City
b. Number of FVs registered in a City
c. Size of the CP network in a City
d. Size of the TS network in a City
e. The use of green electricity from local renewable sources by CPs

The landscape of players in the ecosystem, beginning with two or three end-to-end businesses and regional monopolies in the inception phase, shifting to a fragmented and competitive market in the ramp-up stage and then to a consolidating market in the target state with the government winding down to a purely regulatory role.

Uptake City Governments should plan to evolve their role from acting as the protagonist in the inception stage to a supervisory role in the mature market. interoperability, and regulations, while accounting for country specifics and priorities.

Most viable business models will flourish and fossil fuelled business models will cease to exist by SUMP measures of Uptake Cities. The EV Navigation and Shared EV Services will grow, and EV Energy and Mobility Services will adapt their model to use more green electricity from local renewable sources. In this way private investments of big oil & gas companies and OEMs are secured to accelerate the adoption of EVs and lower CO_2 emission from mobility in Uptake Cities. SUMP will stimulate local renewable energy producers to supply local CPs, and maximize not only value creation for all stakeholders, but also CO_2 emission reduction from mobility in Cities and their own energy smart neighbourhoods.

4 Conclusions/further work/learnings

The development and writing of Deliverable 8.5 have given us the following 5 new main insights and learnings:

1. <u>Viable Business Models and effective SUMPs is a better title of Deliverable 8.5</u>

"Viable Business Models and effective Strategic Urban Mobility Plans would be a better title of Deliverable 8.5 than "Viable Business and Replication Plans", because the growth of (and not the replication of) viable business models can be stimulated (and not replicated) by effective SUMPs of Uptake Cities. Uptake Cities do not replicate viable business models with the aid of SUMPs, but stimulate the growth of viable business models by creating favourable market conditions for them.

2. <u>Viable Business Models and effective SUMPs stimulate the use of green electricity from local renewable sources</u>

Effective SUMPs of Uptake Cities stimulate the use of green electricity from local renewable sources by Charge Point Operators and Shared EV Service Providers with the following 5 types of measures: a. Grants & taxes, b. Spatial planning, c. Regulation and Permits, d. Investment Fund, and e. Fleet Procurement. These local measures stimulate Charge Point Operators and Shared EV Service Providers to design their business models in a more green and circular way to maximize their contribution to CO_2 emission reduction. And CO_2 emission reduction is the most important goal of EU Policy and the Green Deal to prevent climate change and the heating of the earth with no more than 1,5 degrees Celsius. So viable Business Models and SUMPs of Uptake Cities are linked to each other via Charge Point Operators, and/or Shared EV Service Providers.

3. <u>The business models of GreenCharge demonstrators are viable as long as they match the dominant business models in the different CP market segments</u>

The business models of GreenCharge demonstrators are viable as long as they resemble the dominant business models in the different CP market segments, because the business models in the CP market have developed faster than the business models of the GreenCharge demonstrators.

The European Charge Point (CP) market for Electric Vehicles (EVs) can be divided into the following 6 market segments: 1. Independent CP & Shared EV Providers, 2. CP & Shared EV Providers owned by large corporate or government, 3. Independent Charge Point Operators (CPOs), 4. CPOs owned by large corporates or government, 5. Independent CP hardware & software companies, and 6. CP Hardware, software, or navigation companies owned by large corporates or government.

GreenCharge demonstrators are active in four of the six Charge Point market segments. ZET (BRE2) and MOTIT (BCN1) demonstrators are independent CP & Shared EV Providers, the St. Quirze (BCN3) demonstrator is a CP & Shared EV Provider owned by government, the GreenCharge Oslo (OSLO 1,2,3) and Bremen GC@Work (BRE1) demonstrators are independent CPOs, and the Eurecat (BCN2) demonstrator is a CP software company owned by a large corporate.

4. <u>The business models of GreenCharge ZET (BRE2), MOTIT (BCN1) and St. Quirze (BCN3) demonstrators are most viable</u>

The business models of GreenCharge ZET (BRE2), MOTIT (BCN1) and St. Quirze (BCN3) demonstrators are most viable, because they have a Shared EV Service business model. The EV Shared Service and EV Navigation Service models of Charge Point Wholesale Operators are the most viable business models in the market, that Uptake Cities should stimulate.

The business model of a Shared EV Service is based on the extended business model of public transport companies and organizations. They offer door-to-door mobility and transportation services to consumer and business customers with the aid of train, tram, e-bus, in combination with shared e-cars, e-bikes, and e-scooters.

The EV Navigation Service is a combination of the business model of Start-Up ChargeTrip and a traditional TSO/DSO. The navigation service is complemented with load balancing and storage services for overflow of

green electricity from local renewable sources between CPs. If SUMPs are effective, then EV Navigation Services should sprout up and flourish in those Uptake Cities.

5. <u>Effective SUMPs should not only stimulate EV charging, but also discourage FV tanking petrol in order to lower CO2 emissions from mobility in Uptake Cities</u>

Effective SUMPs should not only stimulate EV charging, but also discourage FV tanking petrol in order to lower CO2 emissions from mobility in Uptake Cities. Uptake Cities should simultaneously stimulate the uptake of EVs, the roll-out of Electric Charging Stations, and the use of green electricity from local renewable sources. At the same time, Uptake Cities need to discourage the uptake of fossil fuelled vehicles, the expansion of petrol stations, and the usage of fossil fuels by vehicles in Cities to lower CO2 emissions even more.

Effective Strategic Urban Mobility Plans of Uptake Cities should consist of clear goals, strategy, and measures in a similar way as business strategy is formulated. They should not only stimulate EVs charging green electricity from local renewable sources, but also discourage FVs tanking petrol in order to reduce CO2 emissions in Uptake Cities. Effective SUMPs should strike a careful dynamic balance between these two objectives over time.

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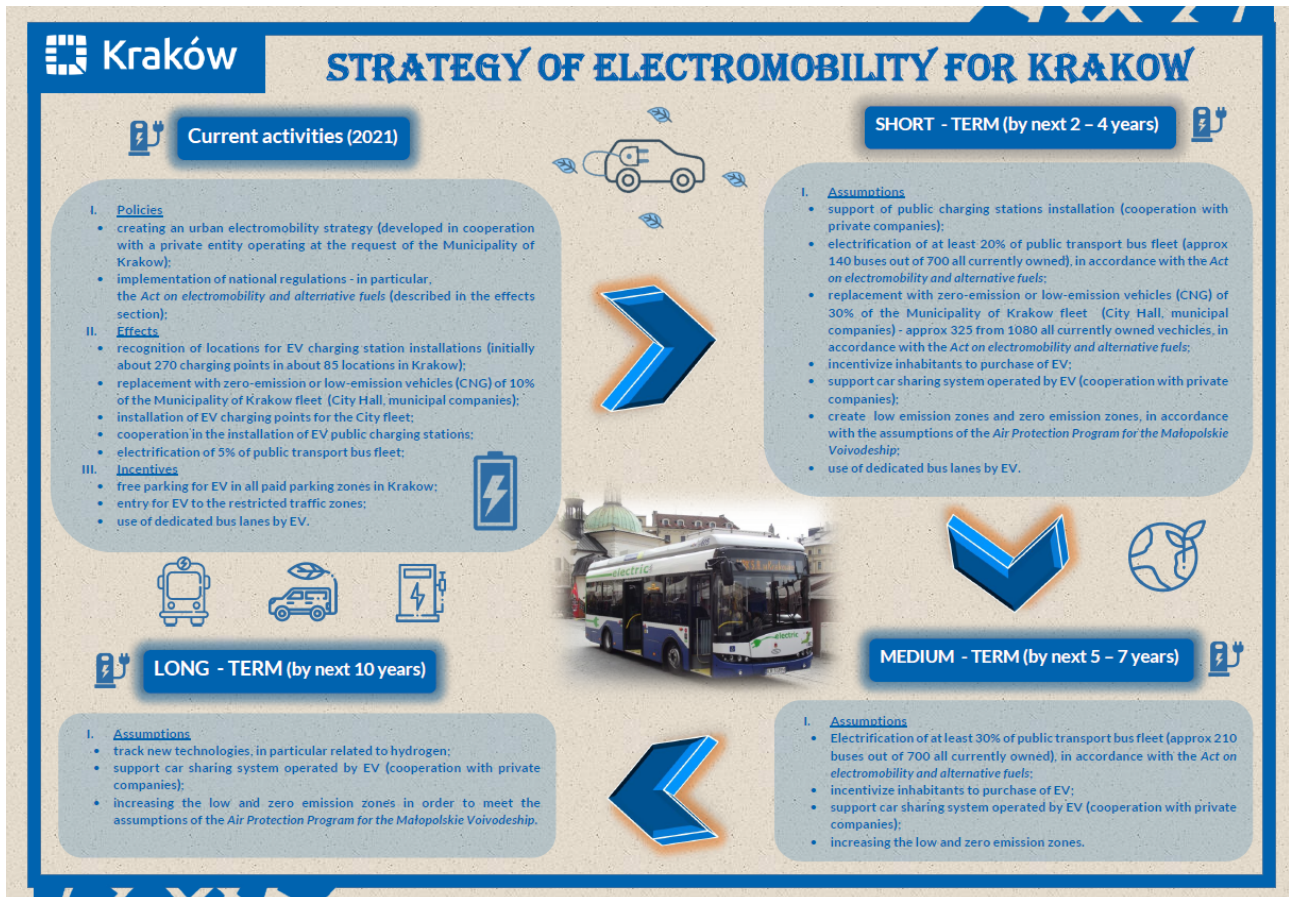
A   Appendix A: Roadmap of Uptake Cities

The following roadmaps, developed by each Uptake City through GreenCharge (as reported in Deliverable 7.3), are provided for context to the business plan concepts proposed for Uptake Cities.
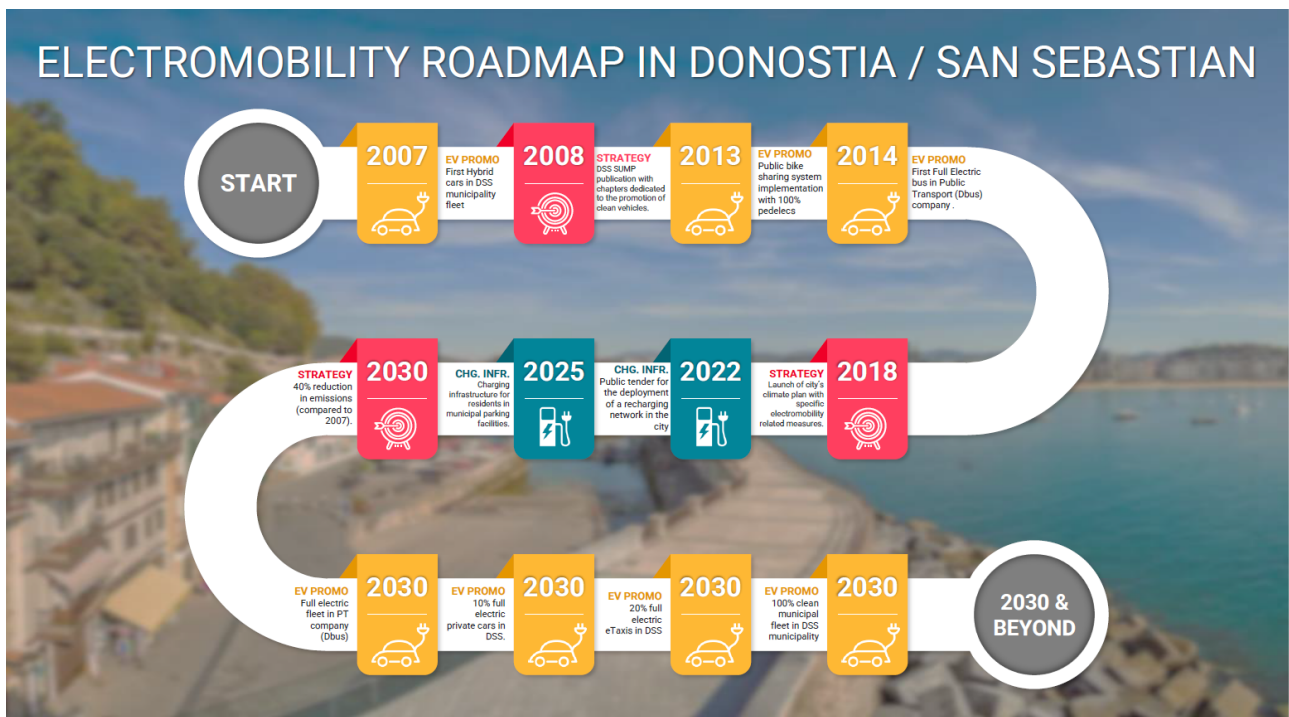

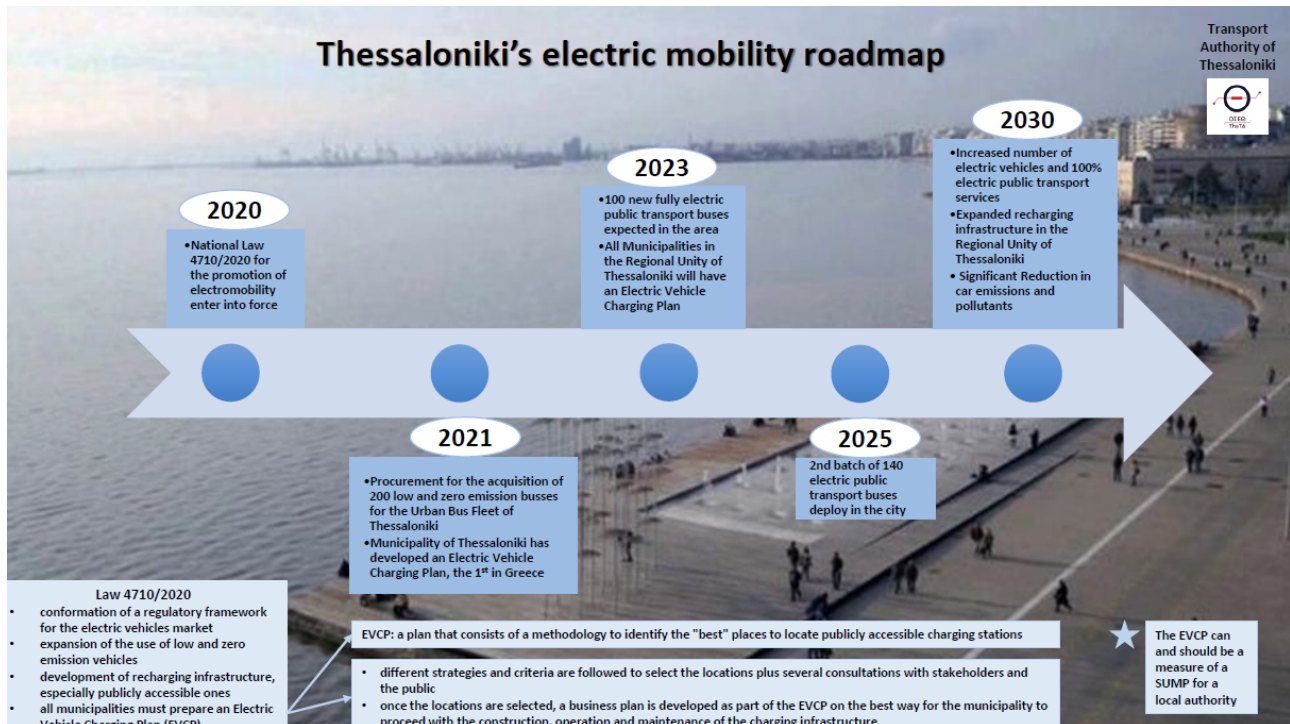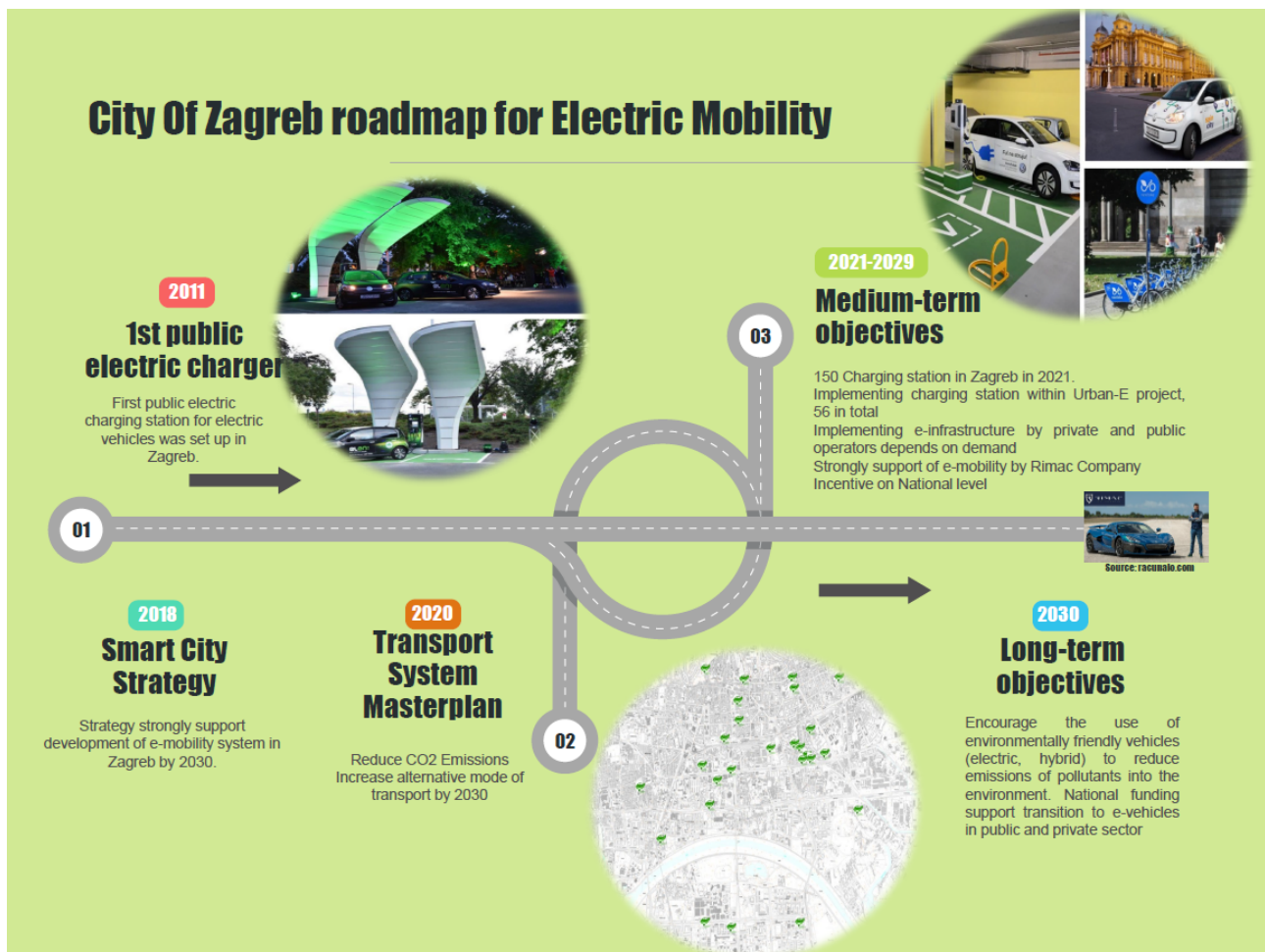**Stockholm e-mobility roadmap (City of Stockholm, 2021)**

Edinburgh e-mobility roadmap (City of Edinburgh, 2021)
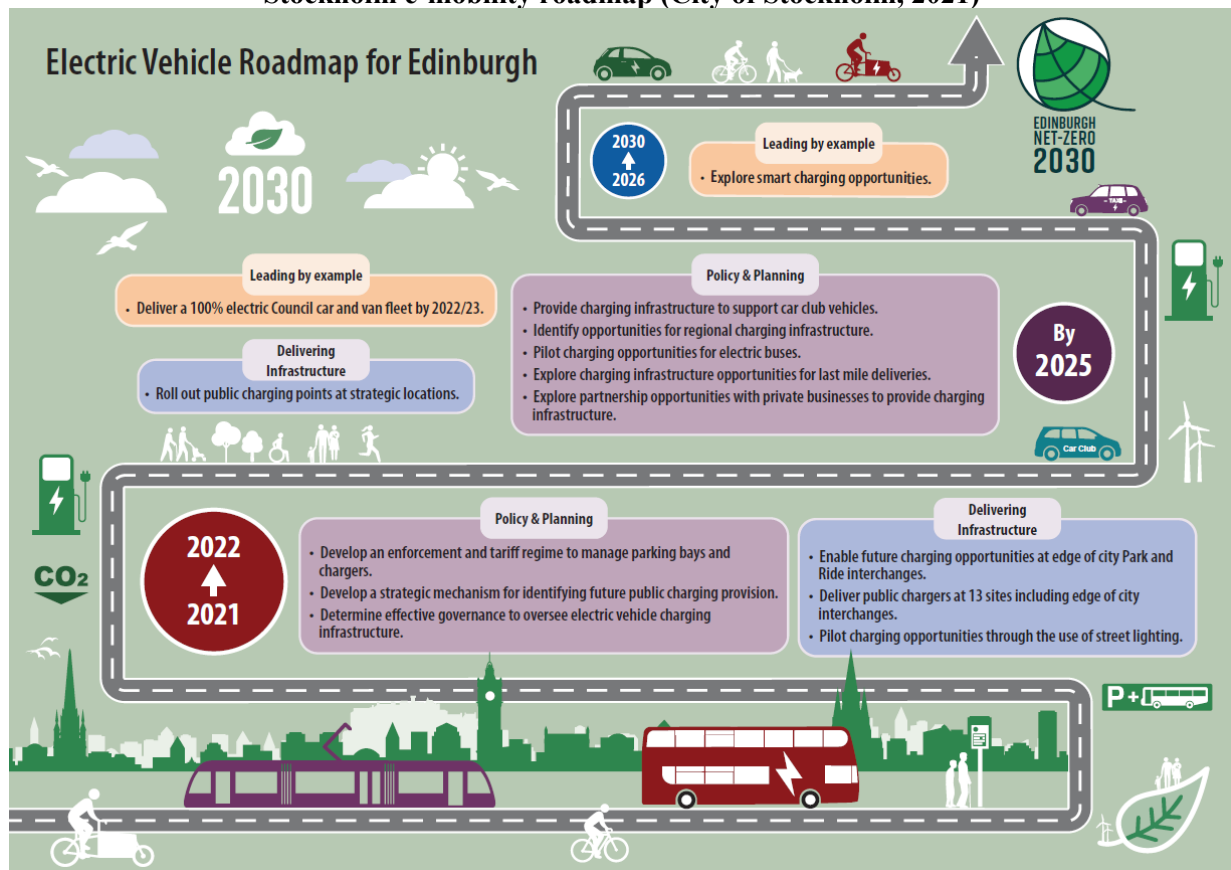
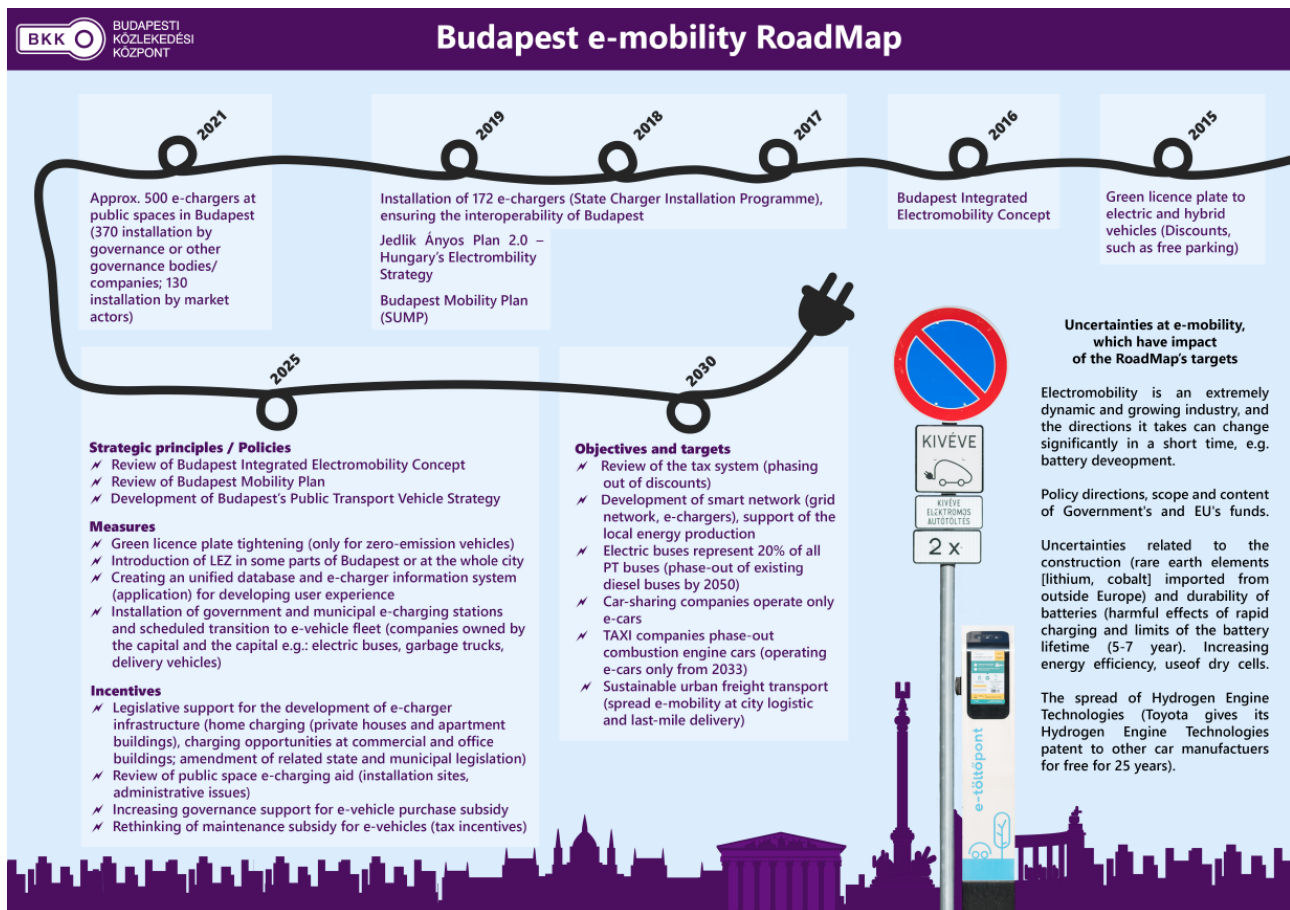**Krakow e-mobility roadmap (City of Krakow, 2021)**

San Sebastian e-mobility roadmap (City of Donostia/San Sebastian, 2021)

Thessaloniki e-mobility roadmap (Transport Authority of Thessaloniki, 2021)

Zagreb e-mobility roadmap (City of Zagreb, 2021)

Budapest e-mobility roadmap (BKK, 2021)

Members of the GreenCharge consortium

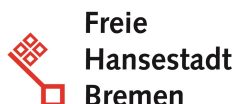|		
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