Stadt Leipzig

2050 CliMobCity
Interreg Europe

2050 Climate-friendly mobility in cities

Appendix-Leipzig-Report

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This report is an appendix to the Project Summary

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Content

1. Introduction

The project 2050 CliMobCity (= 2050 Climate-friendly Mobility in Cities) is about climate mitigation in the field of urban mobility, hence about reducing CO_2e (Carbon Dioxide Equivalents)[1] emitted by cars, trucks, public transport and other motorised vehicles in the city. Many cities have ambitious climate goals aiming for substantial reductions of CO_2e emissions like achieving climate neutrality in 2050 or earlier.[2] Many of the same cities, however, are uncertain about **how the mobility should change in order to reduce CO_2e emissions to the levels of their aims**, also against the background of exogenous technical and socio-economic developments. As the spatial setting of a city affects the sustainability of mobility the question includes: **how must the urban structure change to achieve climate-friendly mobility?** These questions were found relevant also by the municipality of Leipzig (MoL) which became a partner in the project together with three other cities and the knowledge organisations **Potsdam Institute for Climate Impact Research (PIK)** and the **Delft University of Technology (TUD)**, the latter being the initiator of the project and the project leader. The project started in 1 August 2019 and ends 31 July 2023.

The centre of Interreg Europe projects is **interregional learning**. The interregionally learning actors in this project are the four municipalities. The subject of interregional learning is to how to make mobility in cities sufficiently climate-friendly. More precisely, the interregional learning refers to **three learning issues**. The project focusses on strategic planning and the question what the content of municipal long-term transport and spatial measure packages could be to achieve the municipal climate aims. The identification of such measure packages is the first and central learning issue of the project.
The themes electric mobility and large scale charging, and information and communication systems supporting climate-friendly mobility represent the two other specific learning issues. The corresponding measures are also part of the mentioned measure package(s).
All learning issues refer to the long term and big picture.

Leipzig has, prior to the project, manifested itself in all three learning fields. The Department of Economic Development which became the representative of the city in the project, had a special interest in the electrification learning issue.

2. Policy instrument and 2050 CliMobCity

The Municipality of Leipzig (MoL) joined the project with the aim to support the work to update the policy and report called *Leipzig – City of smart mobility* [3] (= *L-SfiM*). The *L-SfiM* describes the policy framework for the development of smart, shared and electric mobility and is in charge of improving this, removing obstacles and creating synergies. The policy framework consists of plans and programmes regarding general mobility, regional transport, bicycling development, car free city centre, mobility hub development, public space, air quality, city development, energy and climate, financing, incentives and measures towards residents and businesses, and contracting service providers (electricity, shared [electric] cars, shared bicycles, information).

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1 Green House Gases (GHG).

2 At the same times, cities are aware of the fact that other challenges are at stake as well: accessibility and attractiveness of the cities must be safeguarded, as well as liveability – and consequently – also space utilisation.

3 „Leipzig – Stadt für intelligente Mobilität“ = L-SfiM.

The former version of the *L-SfiM* was developed in 2016 and adopted in 2017. The idea now was that the MoL could for its *L-SfiM* update benefits from 2050 CliMobCity by learning more about the contribution of additional electromobility and of mobility change in Leipzig for CO_2e reduction and city development. This fits well to the Interreg Europe perception that an Interreg Europe project is to support a so-called policy instrument, and perhaps even contribute to innovating such instrument. The new *L-SfiM* is this policy instrument.

Parallel to the *L-SfiM* the update of a related policy document, the *Charging Infrastructure Concept Leipzig 2020*, started. This focusses on the implementation of infrastructure to charge electric road vehicles, clarifying and deciding how many of which types of charging points and supporting infrastructure is needed, in which configurations (like mobility hub) and at which locations. This would be described in the *Charging Infrastructure Concept Leipzig 2030*.

In the meantime the drafts of both reports have been circulated and discussed with all involved departments and external stakeholders. The result is:

- that the draft *L-SfiM*-work has done and is doing its work (see Chapter 5), but there will be no final *L-SfiM* decided by the council or mayor;
- that the draft *Charging Infrastructure Concept Leipzig 2030* will be sent to the city council and mayor (see Chapter 6) in order to have the council formally decide the concept.

In this Appendix-Leipzig-Report some mainlines of *L-SfiM* and the *Charging Infrastructure Concept Leipzig 2030* will be described in respectively the Chapters 5 and 6. Before, Chapter 3 presents a short description of the city, and Chapter 4 summarises the main findings of the project's demonstration for and with Leipzig.

3. About Leipzig in a nutshell

The City of Leipzig is the second biggest city in the eastern part of Germany after Berlin. In Leipzig live about 620,000 people. Since 1998 Leipzig has grown about 180,000 inhabitants, which makes Leipzig the fastest growing big city in Germany (Figure 1).

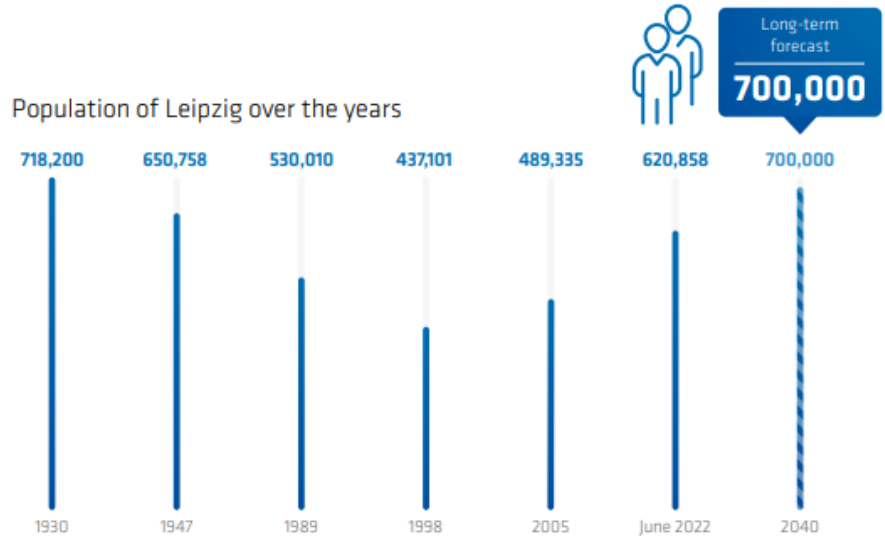

Figure 1: Development of population City of Leipzig (Source: Leipzig Means Business 2022)

It was an important trade, production and cultural town already centuries ago. The Leipzig fair dates back to medieval times and today is accommodated in a large complex of exhibition and conference halls. Leipzig until 1945 had a large publishing and editing sector, some of which is still flourishing. Due to the large-scale industrialisation in the 19th century Leipzig has a substantive dense residential belt around the city centre (both, the centre and the belt have about 3500 inhabitants per km2), outside of which the densities gradually decrease, ending in single house areas in the city's fringes. The fringe, however, also includes a number of suburbs hosting large housing complexes, stomped out of the ground during the GDR-period (1945-1989). These areas have a density comparable with the belt (Figure 2).

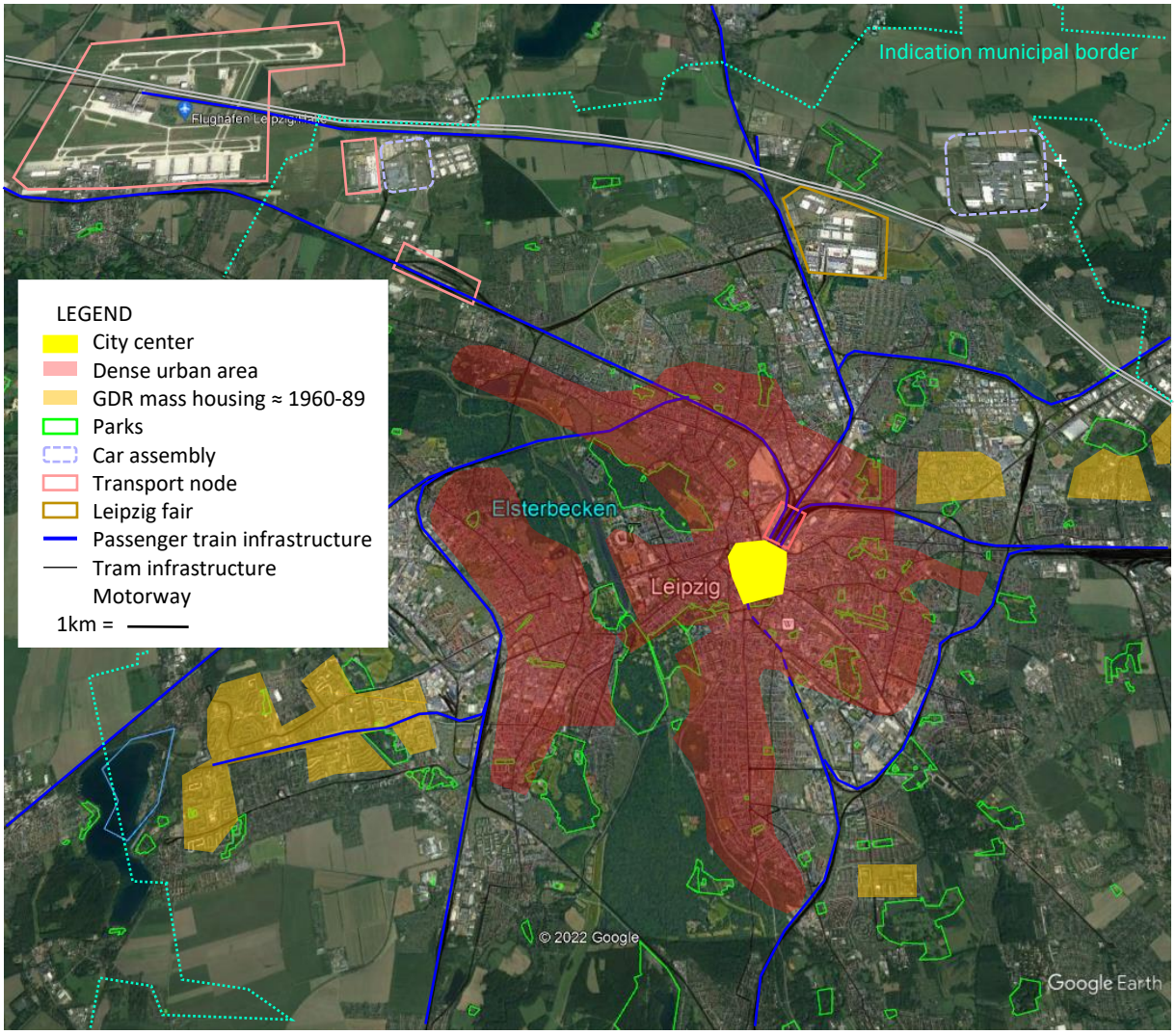

Figure 2: Structure of the City of Leipzig (Source: *Project Summary*)

The city is divided by a green corridor, today hosting recreational functions in a forest and along a small river.

The industrial activities of some large parts of the 19th century industrial areas have moved to other places in the world, but their many buildings have been or are being repurposed giving home to young enterprises, housing and culture. After the unification of West and East Germany there have been substantial investments by large employers in transport and logistics (airport, DHL freight hub) and car assembly factories (BMW, Porsche) along the northern edge of the city. In this area about 25,000 jobs at mainly three places: around the BMW factory, around the new trade fair, around the

Porsche factory. Figure 3 gives an impression of the employment development in Leipzig during the last 15 years.

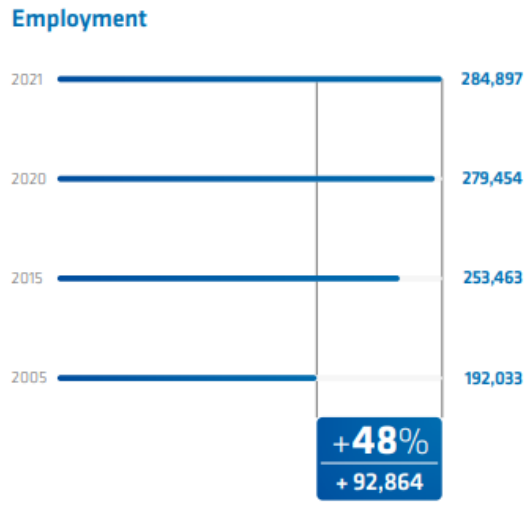

Figure 3: Development of employment City of Leipzig (Source: Leipzig Means Business 2022)

Leipzig has the largest train station building in Germany, part of which still accommodates national and regional trains. The local public transport network includes a dense network of rather fast tramlines which access the dense residential areas and also go beyond these. Quite some Leipzig residential areas including the mass housing on the westside of the city are accessed by regional train.

In 2015 of all trips in, from and to Leipzig 18% went by public transport, 42% by car, the rest being active travel. Within public transport 58% of public transport trips in, from and to Leipzig took place by tram, 25% by bus, and 17% by regional train.

The most important part of the public transport system is the tram. Every day are over 270 trams on the street in Leipzig. The tram network is over 210 km long and one of the largest network in Germany. The public transport operator Leipziger Verkehrsbetriebe runs over 150 busses. 31 of them are already full electric. In the year 2021 over 100 million passengers used the services of Leipziger Verkehrsbetriebe.

4. Towards climate-friendly mobility in Leipzig

The learning in the project has taken place by means of **demonstrations**: Each partner city demonstrated the carbon reduction effects of explorative policies in the own city and could learn from its own demonstration and from the demonstrations of the other partner cities. The demonstration steps were as follows. Each city defines one or more CliMobCity mobility measure packages and then predicts the change of mobility due to the new measures. The change of mobility together with the change of powertrains and change of energy mix are the central input for the analysis of the reduction of CO_2e emissions.
The analysed carbon reduction is shown by comparing three scenarios, the current situation, the business-as-usual (BAU) future and the CliMobCity future. Each scenario consists of social-economic backgrounds, a mobility package including spatial measures, the mix of powertrains (e.g. gasoline, diesel or electric vehicles) and the energy mix for producing electricity.

Given Leipzig's focus in the project on electrification, the city chose the BAU mobility package to be valid also for the CliMobCity scenario. The reduction of emissions in CliMobCity would then mainly depend on the change of powertrains and of the energy mix. The BAU package was represented by the Mobility Strategy 2030 and the Planfall 2035 mobility modelling, the latter taking account of less population growth in comparison to the former Planfall 2030 mobility modelling.

The demonstration result for Leipzig was:

- a description of the main mobility changes due to the policy of the Mobility Strategy 2030, such as modal shift from the private car to public transport and active travel, or change of average travel distance per mode, all cumulating in a decrease of (private) car-kms. These are between 2015 and 2035 expected to decline by 8%, implying, as most of the current car-kms are fossil fuel ones, a relevant reduction of CO_2e emissions (BAU and CliMobCity). At the same time, however, the volume of truck-kms is expected to increase by 12%.
- that the mobility changes together with the electrification of all public transport busses until 2035 (CliMobCity) and the electrification amongst the remaining car-kms provide a reduction of CO_2e emissions of roughly 25 to 40%, dependent on the degree of electrification of cars and on the magnitude of the greening of electricity production; 40% emerges if the electricity production is 100% green. More CO_2e reduction can be achieved, if transport and infrastructure measures go beyond the Mobility Strategy 2030 and electrification measures go beyond the Infrastructure Charging Concept 2030. Such perspectives have been outlined in the demonstration.[4] Leipzig is already preparing for further development towards sustainable mobility.[5]

The reduction aim of Leipzig was climate neutrality in 2040. This corresponds with 80% reduction until 2035[6] (this was the aim for the project). Since the MoL has joined the EU mission of 100 climate neutral and smart cities in 2030, the climate aim has become more ambitious. For the project the climate aim has remained 80% in 2035. Still this means a large gap between targeted and achievable CO_2e reduction. **The quintessence of all is that the ambitious electrification aims of the draft**

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[4] The effects of additional measures was explored: a so-called forecasting lever exercise was conducted, by varying the position in input levers in the carbon model without preceding transport modelling. The additional mobility and/or powertrain changes (lever variations) were: a reduction of the car share in passenger mobility by another 10 %-points, 10% less time spent, an increase of the share of post-fossil cars by 20 %-points, and a combination of these. The latter implies a total reduction in comparison to the base year of 50%, hence does not sufficiently respond to the reduction aim.
In search for an indication of a measure package which provides sufficient reduction a backcasting analysis was carried out, again by means of a lever exercise in the carbon model without preceding transport modelling. The result was that 80% can be achieved by adding decreasing the car share by another 10 %-points, and increasing the share of electric cars and LDVs to the level of 86% and that of trucks to 22%.

[5] Example: Building Mayor Thomas Dienberg: "For the 2023/2024 implementation programme, the focus is on the traffic turnaround. Our nationwide initiative for 30 km/h speed limits on Leipzig's roads, as well as the expansion of public transport and the bicycle network, are important measures that we will tackle intensively over the next two years. The aim is to create area justice in transport and to make sustainable mobility possible for all Leipzigers."

[6] According to the Energy and Climate Protection Programme 2030 (EKSP), Leipzig strives for becoming a climate-neutral city by 2040. The MoL wants to reduce emissions from 5.18 tonnes of carbon dioxide emissions per capita in 2020 to 1.9 tonnes per capita in 2030. By 2040, the continuous reduction to 0.25 tonnes of carbon dioxide per capita per year is to be achieved through a variety of measures.
In addition, the Climate City Contract is in process of becoming signed within the framework of the EU model project "100 Climate Neutral Municipalities", among other things, in order to encourage society and business to make their contribution in a more binding manner.
"Climate change is one of the greatest challenges of our time," states Environment Mayor Heiko Rosenthal. "With the Energy and Climate Protection Programme 2030, we want to implement almost 60 ambitious measures in seven fields of action by 2030 via the municipal leverage sectors of transport, heat and power supply together with our municipal companies, in order to make a clear contribution to the Paris Climate Agreement."
public transport, district heating expansion and densification as well as energy-efficient refurbishment are further objectives of the energy and climate protection programme.

Charging Infrastructure Concept Leipzig 2030 still are modest in the light of the CO_2e reduction needed to reduce CO_2e emissions in line with Leipzig's reduction aims.

The project has conducted a limited literature review concerning shared mobility, micromobility and mobility hubs. This review supplements the cities' demonstration findings. The reason for reviewing was that the mentioned types of innovative mobility are hardly part of any city transport model, also not of the Leipzig. This means that the corresponding changes of mobility and derived CO_2e reduction were not in picture in the demonstrations.
A main conclusion from the supplementing review was that additional CO_2e reduction may be expected from shared cars, as their use reduces the volume of total car-kms and despite of modal shift from public transport and active travel to the shared car. If the shared cars are electric ones, they also accelerate the electrification of the car fleet in a city. But the magnitude of CO_2e reduction is very small as long as shared car use remains a niche market. Hubs near public transport stops allow shared car users to reach shared cars also by public transport. (Shared) bicycle facilities near public transport stops support public transport use. The sustainability of shared scooters depends on how nice the scooters are treated by the users and is not necessarily positive.[7]

In all municipal policy-making it is important to be aware of the fact that the needed changes do not completely depend on measures on the municipal level. The mobility is also influenced by measure choices in neighbouring municipalities and of the region. Powertrain shifts largely depend on (inter)national powertrain policies. Energy policies are largely a supra-municipal matter.
A city's contribution to the powertrain shift is limited to providing sufficient charging infrastructure, support by erecting mobility stations with a substantial shared electric car offer, and awareness raising campaigns. However, a city can by means in bottom-up actions draw attention to higher level governance levels to improve the frameworks for successful municipal actions.

5. Leipzig – City of smart mobility

5.1 Update of the report Leipzig – City of Intelligent Mobility (draft L-SfiM)

As a the first step to update the L-SfiM the Leipzig Institute for Energy (Leipziger Institut für Energie GmbH) evaluated the current situation and challenge, and, based on this, Aufbauwerk GmbH outlined the actions to be taken.[8] The updating of the measures and implementation concept is being carried out in the framework of the 2050 CliMobCity project.
Within this update of the concept the following measures were elaborated:

Block I - E-mobility (vehicles)

1) Test programme for the use of e-utility vehicles/e-taxis by tradespeople
2) Promotion of electric vehicles for driving schools

Block II - E-mobility (charging infrastructure)

3) Sharing of commercial fast charging infrastructure
4) Promotion of charging infrastructure on municipal properties
5) Dynamic planning basis for the expansion of public charging infrastructure

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7 This remark actually goes beyond the scope of the project, as it also relates to other lifecycle emissions (like of the production, maintenance and recycling of vehicles and infrastructure) and not only to the use of vehicles, which is the project's scope.

8 More precisely, the update intention was articulated in the report „Preparation of the updating of the concept „Leipzig – City of smart mobility" („Vorbereitung zur Fortschreibung des Konzepts „Leipzig – Stadt für intelligente Mobilität" = L-SfiM), conducted by the Leipziger Institut für Energie GmbH in the framework of the the Interreg Europe project E-Mob and commissioned by the Aufbauwerk Region Leipzig GmbH in cooperation with the Department of Economic Development of the Municipality of Leipzig (MoL).

(platform for charging infrastructure needs)
6) Provision of dedicated charging infrastructure for e-taxis
7) Further training and innovations for charging infrastructure
8) Adaptation of parking spaces to charging infrastructure for commercial vehicles

Block III - Logistics/charging zone management
9) Delivery stations in neighbourhoods
10) Inner-city city and micro-hubs
11) Establishment of charging zones
12) Local emission-free delivery traffic for local traders
13) Research project and establishment of alternative autonomous (delivery) solutions

Block IV - Smart City
14) Platform for operational mobility management for/in companies
15) Charging infrastructure for car sharing
16) Open Data Urban Development Mobility - Platform
17) Joint design of new building projects as experimental spaces for 2040
18) Test and experimental space for new ideas and start-ups

Block V - Incentive systems and concepts
19) Municipal mobility management - targets for 2025
20) Corporate mobility management for/in companies and competence centre
21) Concept for business transport with targets
22) Areas for strengthening corporate mobility management
23) Sharing test programme - offers for companies

These measures were the subject of numerous discussions with different departments of the MoL and with stakeholders in Leipzig in the autumn 2022 and first semester of 2023. The result is that:
- it finally has been decided that the updated draft L-SfiM will not be formally decided by the council or mayor;
- the updated draft L-SfiM serves as internal working programme for which a council decision is not required, and as a pool of ideas anticipating on development directions. It gives orientation for the work of the city administration, especially of the department of Economic Development. and whenever a company approaches the MoL with a concrete wish. One of the main tasks of the Economic department is to find partners in companies to implement measures. This is especially the case in the field of Block III - Logistics/charging zone management. Companies in this field are not used to working closely together with the city administration;
- about 1/3 of the proposed measures in the updated draft L-SfiM has been implemented;
- regarding about 2/3 of the proposed measures in the updated draft L-SfiM, no company has yet shown interest to act as a partner for implementation.

5.2 Leipzig actions in the city's Action plan for 2050 CliMobCity

Each partner city in the third project year wrote an Action plan containing one or more actions. The actions related the policy instrument, in Leipzig the update of the *L-SfiM*. Each partner city implemented its actions in the fourth project year and monitored the implementation. Each city reported its Action plans and implementation experiences via the project leader to Interreg Europe.

Leipzig's Action plan contained two actions:
- Action 1: **Sharing of fast charging infrastructure on commercial properties**
  In addition to the car models of the American company Tesla, which have been provided with high charging power of more than 100 kW at the specially installed Superchargers for years, other car manufacturers also offer vehicles for sale that can handle high charging power. High Power

Chargers (HPC), for example, enable an energy supply of 150 up to 350 kW thanks to cooled charging cables. These fast-charging stations offer numerous advantages to commercial users of e-vehicles. One of the biggest advantages of a fast-charging station is that it makes it possible to supply an electric car with enough power to cover a distance of around 200 kilometres in less than an hour. With such a charging process using a fast-charging point, batteries can be full again within around 45 minutes. This means that deliveries over long distances can be made more quickly with e-vehicles without major breaks, and it also makes long-distance journeys with e-cars possible, which previously required considerable effort.
However, fast charging stations are associated with high costs, so that individual companies and private individuals are reluctant to install this infrastructure. The solution to this problem can be a joint use of the stations by several companies and private individuals.

- Action 2: **Charging infrastructure for carsharing**
  Especially in urban areas, where residents drive on average 2,000 kilometers less than the rural population, car sharing is an interesting alternative. Carsharing vehicles are always available when there is a need and are used by other drivers the rest of the time. Carsharing users are almost as mobile as car owners, although fewer vehicles are in use. This saves money and resources and protects the environment and climate. In Leipzig, the advantage of carsharing was discovered early on. For example, two offices of the city administration decommissioned four vehicles. In exchange, a car sharing station with five vehicles was installed directly on site. The pilot was so successful that more vehicles were taken out of service and carsharing stations were set up. Car sharing also reduces process costs and relieves the fleet manager. The employees borrow the vehicles themselves and the car sharing provider takes care of the vehicle supply. The carsharing development less often requires a tendering process for the procurement of new vehicles. The next step to make car sharing even better for the climate and the environment is to gradually switch from vehicles with fossil fuel to post-fossil fuel vehicles. Car-sharing in urban areas is ideal for this, as the distances are usually short. However, in order to implement this change, investments in charging infrastructure are required.

The charging stations of both actions have been installed.

6. Charging Infrastructure Concept Leipzig

The Charging Infrastructure Concept Leipzig gives orientation regarding the development of e-mobility and the demand for infrastructure to charge electric vehicles:

- How many vehicles?
- How often each charges?
- Where will the charging take place and how much at public or private locations?
- How much electricity is needed?

The Concept then gives an outline of the charging infrastructure to be implemented in the planning period. The planning horizon of the Concept being updated is 2030.

The planning in the Concept is not directly linked to climate aims, but takes trends and ambitions into account on the national, regional and municipal level, and these all partly relate to the climate challenge. As already indicated above, for the Leipzig climate aim the electrification aim envisaged in the Concept are ambitious, however not sufficient for the envisaged reduction of CO_2e emissions.

The updated concept will lead to two decision proposals:

- proposal 1 for the city council. The council will take note of the proposal and decide to create a new position;

- proposal 2 for the mayor: the head of administration decides to revise the process of permits, to digitize the process of permits and elaborate binding criteria.

7. Conclusion

2050 CliMobCity has supported the process of the MoL of updating the policy instrument and framework for further development of smart and electric mobility in Leipzig. The cities' demonstrations in the project have thrown light on the mutual influence of mobility change, vehicle electrification and the greening of electricity production on CO_2e reduction, and underlined that further development of all three is important, in order to achieve sufficient reduction on time, and in order to develop the city and its mobility in a space-efficient way. The supplementary literature review of the project has contributed to a better understanding of the performance impact of innovative types of mobility, such has shared car use and (shared) micromobility. Highlights of the project's findings for Leipzig's future smart and electric mobility were that the ambition of the Charging Infrastructure Concept Leipzig is surely not exaggerated, that making freight transport climate-friendly needs to be accelerated, and that shared car use needs to be pulled out of its niche market position.