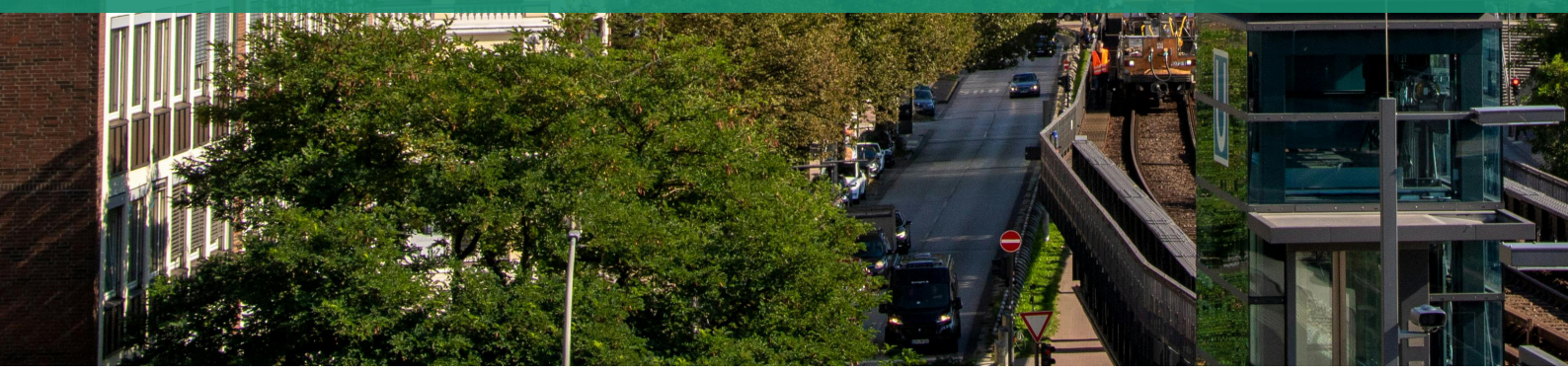
CITY ROADMAP FOR E-MOBILITY: HAMBURG

DEMONSTRATION PROJECT: INTER-MODAL TRAVEL CHAINS WITH E-MICRO VEHICLES



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PROJECT PARTNERS

ABOUT

To assess the geophysical, demographic, socio-economic, and legal, administrative political environment of the demonstration activity and of the scale-up concept in Hamburg. This can facilitate replication and inform potential follower cities about the transferability of the SOULTIONSplus approach to other cities and regions.

TITLE

City Roadmap for E-mobility: Hamburg
Demonstration project: Intermodal travel chains with e-micro vehicles

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DISCLAIMER

The views expressed in this publication are the sole responsibility of the authors named and do not necessarily reflect the views of the European Commission.

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City Roadmap for E-mobility: Hamburg

Demonstration project: Intermodal travel chains with e-micro vehicles

Hamburg – Intermodal travel chains with e-micro vehicles

February 2024

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Acknowledgments

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Executive Summary

The Hamburg demonstration activity introduced shared e-scooters to two suburbs where this service was previously unavailable. The micro-vehicles were intended to enhance first- and last-mile connectivity to public transport services. The ultimate objective of the demonstration action was to replace private car trips with intermodal travel options that combine shared micro-vehicles and public transport. Dedicated parking areas were created at major public transport stations to encourage intermodal use. Furthermore, shared vehicle services were integrated into the public transport app, and incentive schemes were tested to promote usage.

Demonstration activities are not implemented in a vacuum, but are influenced by a variety of factors, including geophysical, demographic, socio-economic, legal, administrative and political aspects of the environment. The configuration of these factors determines the persistence of the activity beyond the project period, its economic viability, sustainability impacts and user acceptance. Understanding the implementation environment facilitates replication and can inform potential follower cities about transferability to other cities and regions.

While the geophysical conditions in Hamburg are generally conducive to the use of micro-vehicles, the vehicle data collected during the demonstration activity showed a significant decrease in the number of users in winter and on rainy days, with peaks in the summer. As e-kick scooters are not suitable for all users and purposes, shared micro-vehicles should be considered as an additional option rather than a universal mobility solution, especially in an ageing population. In the future, such services should be complemented by on-demand mobility services to fill gaps in the public transport network.

Mobility is a multi-level policy area with responsibilities spread across all political and administrative levels, from the city district to the European Union. On the one hand, the assessment found that basic regulations are in place, including regulations on street legality and modalities of use for e-scooters. At the local level, the city of Hamburg is open to integrating shared micro-vehicles into public transport - as mentioned in the mobility strategy - through the establishment of a network of mobility hubs and the integration of micro-vehicles into the public transport app. However, cities are not free to implement any measure that could promote intermodal travel. For example, the scope to implement speed limits for cars or access restrictions is limited by national road laws. In addition, the city of Hamburg still relies on voluntary agreements with scooter operators. Stricter regulation of the provision and use of e-scooters, which would reduce the pressure on active modes and increase the general acceptance of shared micro-mobility, is still lacking.

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1. Background – Where are we now?

The SOLUTIONSplus demonstration activity introduced shared e-scooters to two suburbs of Hamburg where this service was previously unavailable. The micro-vehicles were intended to enhance first- and last-mile connectivity to public transport services. The ultimate objective of the demonstration action was to replace private car trips with intermodal travel options that combine shared micro-vehicles and public transport. Dedicated parking areas were created at major public transport stations to encourage intermodal use. Furthermore, shared vehicle services were integrated into the public transport app, and incentive schemes were tested to promote usage.

This roadmap outlines factors that influence the implementation, the feasibility, and the user acceptance of intermodal travel chains using shared e-micro-vehicles.

The availability of infrastructure, including parking facilities, and cycling tracks are relevant physical components influencing the viability and acceptance of shared e-micro-vehicle schemes, as German law requires e-micro-vehicles to use cycle paths or driving lanes where no cycling infrastructure exists. Other important factors include the availability of digital infrastructure, such as mobility apps, and the legal framework. The latter includes for example traffic laws, mobility plans, climate laws and climate action plans, and public subsidy programmes that affect the feasibility of operations. This roadmap provides an overview of the European, national, and local legal framework for e-mobility in general and for intermodal mobility solutions using zero-emission vehicles in particular.

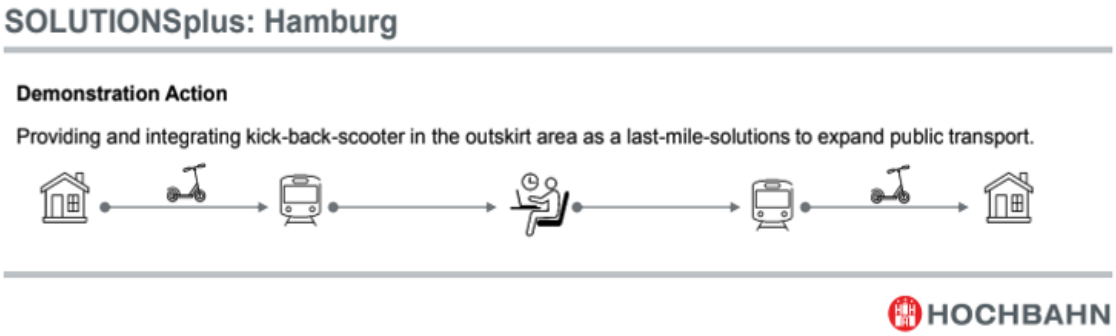


Figure 1: SOLUTIONSplus demonstration action in Hamburg

Moreover, the adoption of mobility services can be affected by geophysical and weather conditions, as well as socio-economic factors. Finally, the ecological impacts of the shift towards e-mobility solutions are contingent on the specific types of public transportation vehicles employed, such as the proportion of electric buses and the carbon intensity of the electricity supply.

The paper starts with baseline information of the city of Hamburg. Chapter 1 outlines the external conditions – i.e., conditions that are beyond the immediate influence of mobility agents in Hamburg – that may influence the feasibility and uptake of intermodal, e-vehicle based mobility solutions. This

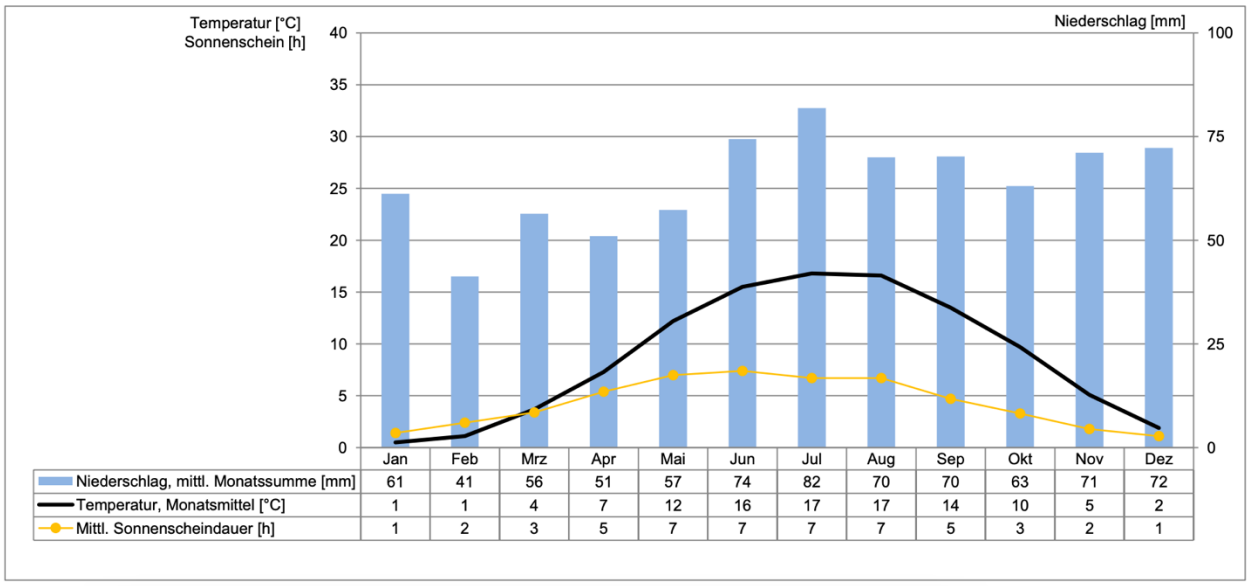
comprises the geophysical and socio-economic environment (Chapter 1.1), and the distribution of competencies between the European, the national, the federal state and the local level. Chapter 1.3 explores environmental impacts of road transport in Hamburg, including the carbon intensity of the electricity mix. Chapter 2 provides a closer look at the current mobility system in Hamburg, outlining key indicators and introducing public and private mobility service providers. Chapter 3 dives deeper into the current political framework that shapes the environment for electric mobility in Hamburg. It considers the European, the national, and the federal state and local level. Chapter 4 outlines the SOLUTIONS+ demonstration activity, chapter 5 provides more information on data collection. Chapter 6 detail visions and objectives and provides a tentative timeline; and chapter 7 derives an implementation plan.

1.1 Geophysical and socio-economic environment

Hamburg is a major German harbour city connected to the North Sea by the River Elbe. The city has a flat topography, with the urban area lying just above or below sea level. Its topography and proximity to the sea make Hamburg particularly vulnerable to the impacts of climate change and sea level rise.

Topography and Climate

Hamburg, located in northern Germany, has a maritime temperate climate that is significantly influenced by its proximity to the North and Baltic Seas. The climate pattern closely follows an oceanic classification (Köppen-Geiger), with mild winters and relatively cool summers. During summer (June to August), the average temperature in Hamburg ranges between 20 and 25 degrees Celsius. Winter, which lasts from December to February, is colder, with temperatures ranging from 0 to 5 degrees Celsius. Snowfall is infrequent and generally light. precipitation is relatively evenly distributed throughout the year, with the wettest months in summer.



	Jan	Feb	Mrz	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
Niederschlag, mittl. Monatssumme [mm]	61	41	56	51	57	74	82	70	70	63	71	72
Temperatur, Monatsmittel [°C]	1	1	4	7	12	16	17	17	14	10	5	2
Mittl. Sonnenscheindauer [h]	1	2	3	5	7	7	7	7	5	3	2	1

Figure 2: Climate Diagramme Hamburg-Fuhlsbüttel
Source: (Deutscher Wetterdienst n.d.)

Demography

With a population of over 1.8 million, Hamburg is the second largest city in Germany and the eighth largest in the European Union. The city's metropolitan region is home to more than five million people. With an average age of 42, Hamburg has the youngest population in the country. However, as in most industrialised countries, the proportion of the elderly population is expected to increase in the coming decades.

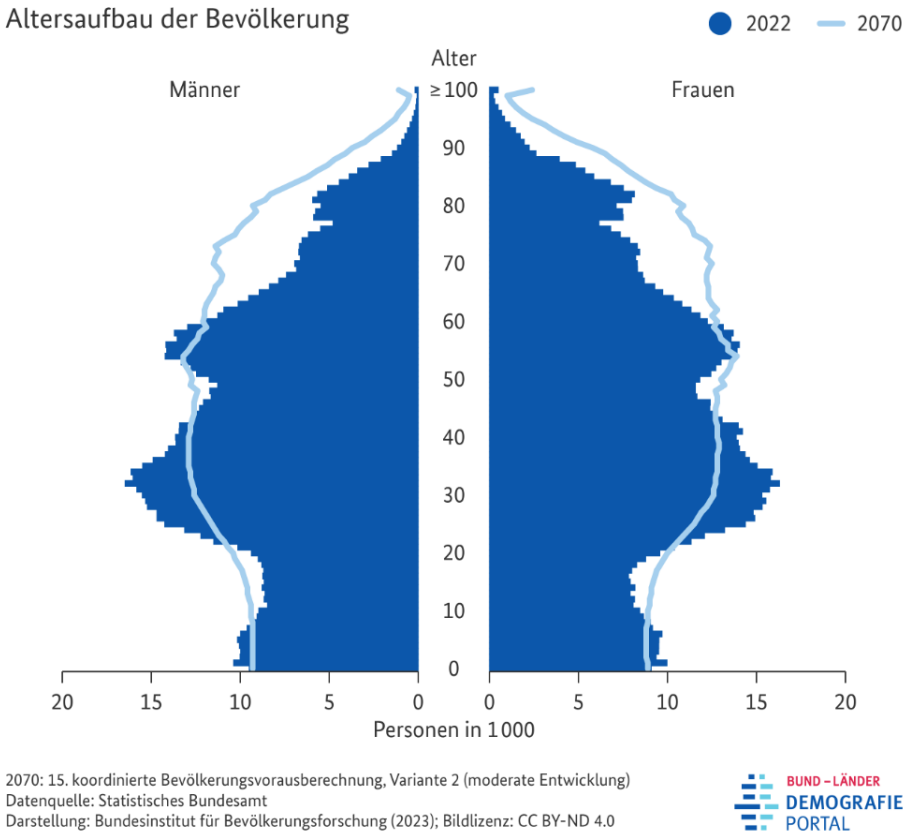


Figure 3: Age Structure of Hamburg's Population in Hamburg 2022 and scenario for 2070 - moderate development. Source: Bund-Länder Demographie Portal 2023

Implications for the demonstration activity

The mild and temperate climate in Hamburg is generally conducive to the use of micro-vehicles where users are unprotected from weather. Nevertheless, vehicle data collected from the demonstration activity showed a significant drop in user numbers in winter and on rainy days, and peaks during summer.

The typical user of shared e-micro vehicles is between 18 and 65 years old. This age group is relatively well represented in Hamburg. E-kick scooters, however, are not suitable for all purposes, such as shopping or care activities, and for all population groups, as they exclude children, elderly and disabled people.

Shared microvehicles, therefore, should be viewed as an additional, flexible mobility option for population groups that tend to use cars more commonly than average, and therefore have a certain potential to shift trips away from private motorised transport. It is important to note that they should not be considered a universal mobility solution, specifically in ageing populations. In the future, such services should be complemented by on-demand mobility services to fill gaps in the public transport network.

Economy

Hamburg has a very strong economy. Its GDP per capita was EUR 67,300 in 2019, well above the German average of EUR 41,500 and more than double the EU average of EUR 31,200. Hamburg ranks 6th out of all 240 EU regions at NUTS2 level (destatis 2023). The unemployment rate is 7.6%.

1.2 Administration and Governance

The 'Free and Hanseatic City of Hamburg' is both a city and a German federal state. Internally, it consists of seven boroughs which are subdivided into 104 districts.

The seven boroughs are Hamburg-Mitte, Altona, Eimsbüttel, Hamburg-Nord, Wandsbek, Bergedorf and Harburg. Hamburg-Mitte covers most of the city's urban centre. The SOLUTIONSplus demonstration areas were located in the borrows Hamburg-Nord (district Langenhorn) and Eimsbüttel (district Lokstedt).

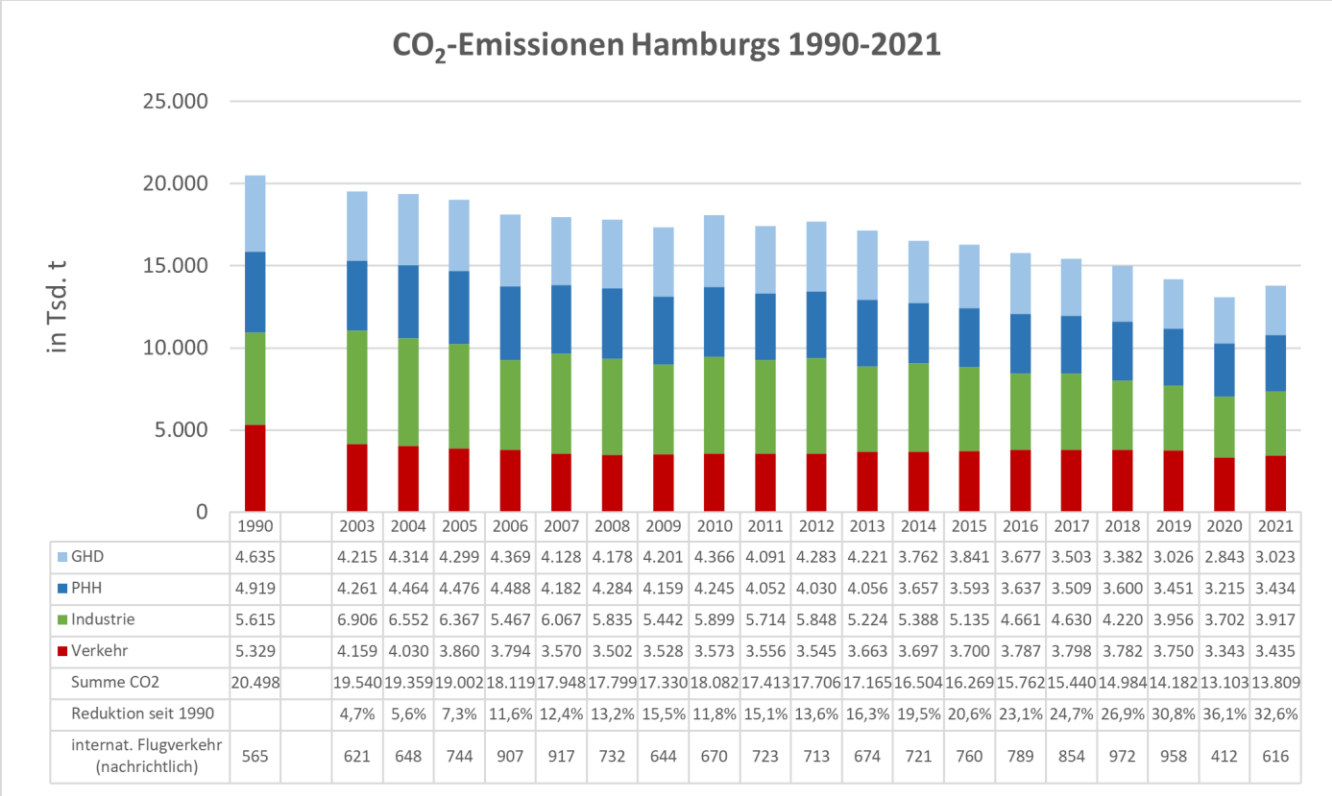
Figure 4 Map of administrative districts of Hamburg
Source: TUBS, CC BY-SA 3.0, via Wikimedia Commons

Due to the multi-level administrative structure, responsibilities are divided between different authorities. As a federal state, Hamburg is responsible for the organisation of local and regional public transport, for general mobility planning and for the major road network, with the exception of motorways. The state of Hamburg has also adopted a climate law and a climate action plan (as mentioned in chapter 3.3). The planning and allocation of urban space and most secondary roads, including cycling infrastructure and low-speed zones, are the responsibility of the districts and boroughs. Road laws, vehicle and fuel taxations and subsidy programmes for e-mobility are determined on the national level. This also means that cities are not free to implement any instruments, but that potential actions, such as the introduction of a zero-emission zone or a 30 km/h speed limit in the urban area, are prohibited by legislation at national level.

1.3 Environmental impacts of road transport in Hamburg

Emissions of air pollutants and greenhouse gases

Hamburg's total CO_2 emissions (excluding international aviation) fell from around 20.5 t CO_2 in 1990 to 13.8 Mt in 2021, representing a 32.6% decrease during this period. Per capita CO_2 emissions amounted to ca. 7.8t CO_2, in 2021, which was below the German average of 9.1t (Umweltbundesamt 2023).



	1990	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GHD	4.635	4.215	4.314	4.299	4.369	4.128	4.178	4.201	4.366	4.091	4.283	4.221	3.762	3.841	3.677	3.503	3.382	3.026	2.843	3.023
PHH	4.919	4.261	4.464	4.476	4.488	4.182	4.284	4.159	4.245	4.052	4.030	4.056	3.657	3.593	3.637	3.509	3.600	3.451	3.215	3.434
Industrie	5.615	6.906	6.552	6.367	5.467	6.067	5.835	5.442	5.899	5.714	5.848	5.224	5.388	5.135	4.661	4.630	4.220	3.956	3.702	3.917
Verkehr	5.329	4.159	4.030	3.860	3.794	3.570	3.502	3.528	3.573	3.556	3.545	3.663	3.697	3.700	3.787	3.798	3.782	3.750	3.343	3.435
Summe CO2	20.498	19.540	19.359	19.002	18.119	17.948	17.799	17.330	18.082	17.413	17.706	17.165	16.504	16.269	15.762	15.440	14.984	14.182	13.103	13.809
Reduktion seit 1990		4,7%	5,6%	7,3%	11,6%	12,4%	13,2%	15,5%	11,8%	15,1%	13,6%	16,3%	19,5%	20,6%	23,1%	24,7%	26,9%	30,8%	36,1%	32,6%
internat. Flugverkehr (nachrichtlich)	565	621	648	744	907	917	732	644	670	723	713	674	721	760	789	854	972	958	412	616

Figure 5: Hamburg's CO2 emissions 1990-2021 by sector
Source: Behörde für Umwelt, Klima, Energie und Agrarwirtschaft 2023

Transport activities are responsible for approx. 25% of the city's CO2 emissions (excluding international aviation). Road transport accounts for about three quarters of the city's transport-related CO2 emissions. Transport-related emissions have decreased by 35% compared to 1990 levels, however, they were at their lowest in 2008 (approx. 3.5 million tonnes of CO2) and have since increased in the years leading up to the Covid pandemic (approx. 3.8 million tonnes of CO2 in 2018). According to the city's climate plan, CO2 emissions from transport should fall by 30% between 2017 and 2030, i.e. from approx. 3.8 to 2.66 million tonnes of CO2.

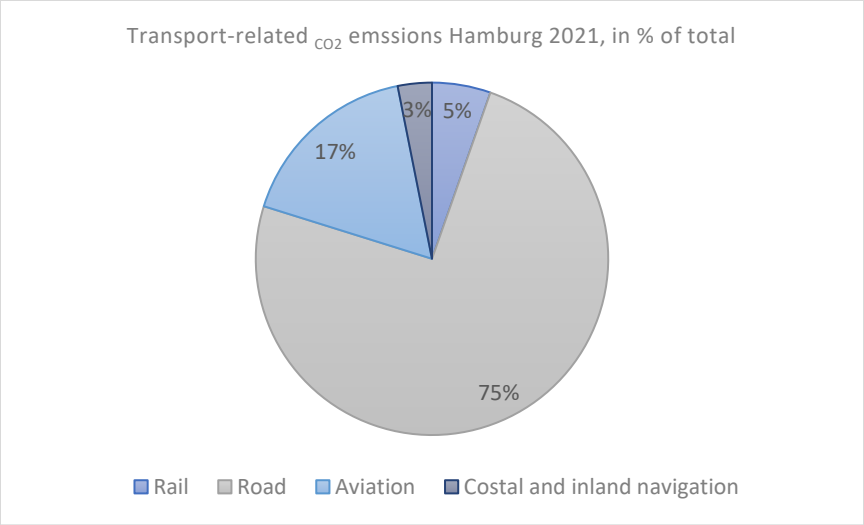


Figure 6: Transport-related CO2 emissions in Hamburg by mode in 2021
Source: Behörde für Umwelt, Klima, Energie und Agrarwirtschaft 2023 (Source: Statistik Nord 2023)

Air quality

All four air quality monitoring stations in Hamburg that focus on traffic have reported exceeding the limit values for nitrogen dioxide (NO2) annual average between 2002 and 2021. In 2022, the annual average NO2 values at the traffic-focused monitoring stations ranged from 28 µg/m3 to 38 µg/m3, which is in line with the European Framework (allowing 40 µg/m3 annual average, as stated in the EU Air Quality

Directive, see ch.3.1), but significantly higher than the World Health Organization's (WHO) recommended limit of 10 µg/m3.

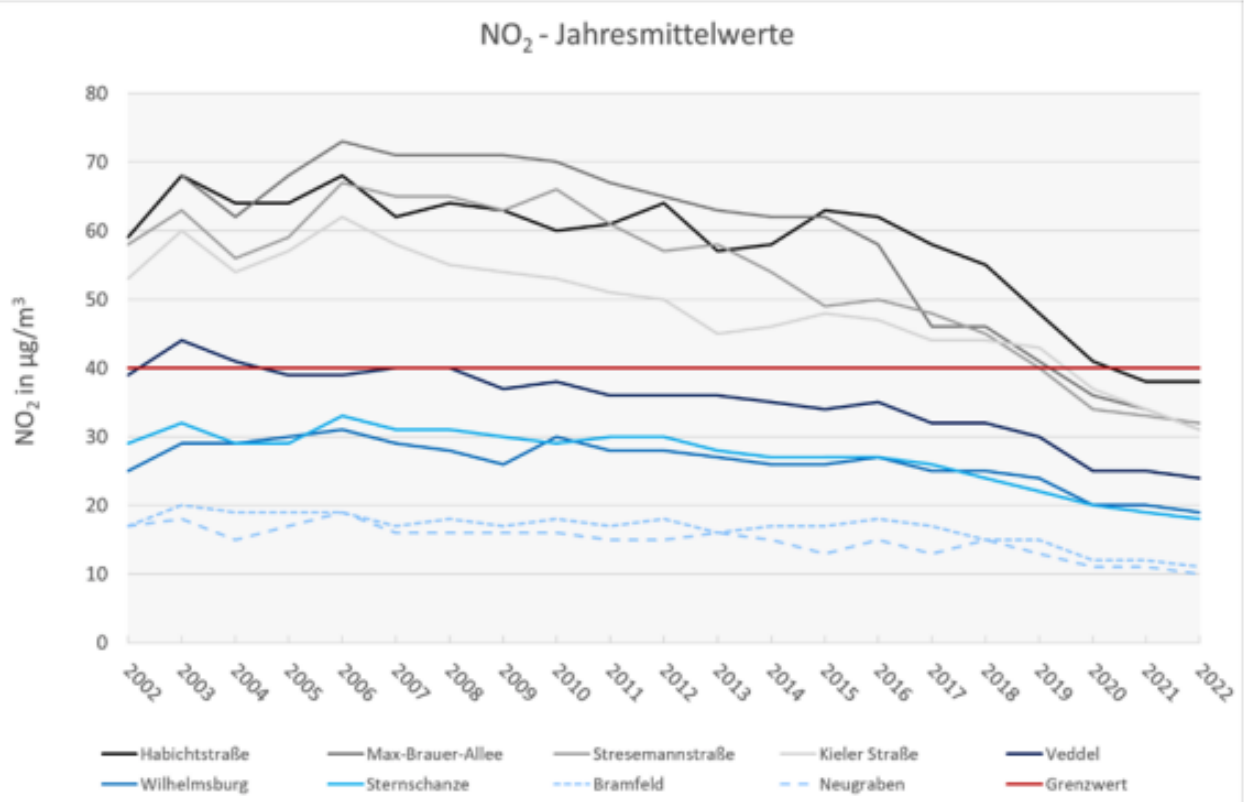


Figure 7: NO_2 average annual values in Hamburg
Note: The grey graphs refer to transport-focused monitoring stations. Red: EU wide limit value
Source: Behörde für Umwelt, Klima, Energie und Agrarwirtschaft, Hamburg 2023

For particulate matter (PM10), the measured annual averages have been continuously below the European limit value of 40 µg/m3 since 1998. Annual average PM10 levels in 2022 were between 18 and 21 µg/m3 at the traffic-focussed monitoring stations. As for NO2, these values are in line with European limits, but exceed the latest WHO recommendations of 15 µg/m3. In addition to annual average concentrations, the Air Quality Directive also limits the number of days on which daily average concentrations of PM10 (50 µg/m3 in 24 hours) may be exceeded. The permitted number of 35 days was exceeded in 2005, 2006 and 2011.

As a consequence, Hamburg has adopted an Air Quality Plan which contains measures to reduce transport-related air pollution. In addition to access restrictions for older diesel cars and trucks, the package of measures includes the provision and support of intermodal mobility options, including the integration of shared mobility and the provision of mobility hubs at public transport stations (Measure Package 3: Intermodal Offers & Mobility Management).

Energy sources for road transport

Road transport in Hamburg currently relies almost exclusively on fossil fuels, i.e. diesel and petrol. Electricity played a negligible role in the road transport sector in 2021.

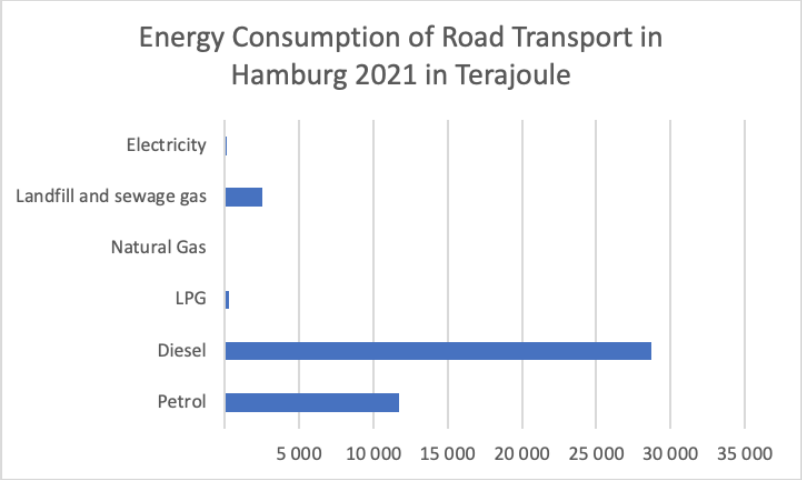


Figure 8: Energy Consumption of Road Transport in Hamburg 2021 in Terajoule
Source: Statistik Nord 2023

CO_2 intensity of the German electricity mix

The environmental and climate impact of a shift to electric mobility is heavily influenced by the carbon intensity of the electricity mix. The energy mix is usually determined at national level, with very limited influence by local authorities. In 2022, the carbon intensity of the German electricity mix was ca. 366g CO_2e per kWh. This compares to an EU average of 251 g (European Environment Agency 2023) and a global average of 438 g (OurWorldInData.org 2023). Renewable energy sources accounted for 46.2% of Germany's electricity mix in 2022, and this figure is expected to exceed 50% in the first half of 2023. In the mid-term, the German government has committed to achieving 80% of electricity generation from renewable sources by 2030.

Energy and Electricity Supply

Hamburg has a high level of electricity reliability, with almost 100% access to electricity and an average of 12.7 minutes of power outages per user in 2021 (Clean Energy Wire 2022). Hamburg is integrated into the German power grid. Electric power generation in the UK is sourced from a combination of conventional and renewable sources. Coal and gas make up 46.6% and 13.9% respectively, while wind, photovoltaics, and biogas contribute 28.6%, 11.9%, and 6.1%. Hydropower and other renewables contribute 4.1% and 2.7% respectively. In the first semester of 2023, nuclear power contributed 2.9% to the country's electricity production, before the shut-down of the last remaining nuclear power plants in April 2023. In the first semester of 2023, renewable energy accounted for 54.3% of domestic electricity production.

Implications for the demonstration activity: split responsibilities

Administratively, Hamburg is both a federal state and a city. Internally, it is divided into boroughs and districts, which have to be involved in activities related to the allocation of urban space, for example for parking zones and mobility hubs or the expansion of the bicycle network. Other factors, such as the taxation of vehicles, fuels and mobility services, or emission standards for motorised vehicles, are determined at national or European level. The strong influence of other policy levels means that cities are not free to adopt any measures they consider beneficial. Possible measures, such as the introduction of a zero emission zone or a 30 km/h speed limit in the urban area, are prohibited by legislation at national level. Most of the relevant regulations at the respective policy levels are outlined in Chapter 3.

Road transport is still heavily dependent on petrol and diesel, and vehicle efficiency gains have been marginal, if at all. However, the persistence of negative externalities from transport has increased the impact of local environmental policies on the mobility system. Climate and air quality policies have been catalysts for Hamburg's efforts to promote e-mobility and mobility services using electric vehicles. Other levers for local action include public procurement of vehicles (e-buses, administrative fleets) or concessions for mobility service providers.

Finally, universal and reliable access to electricity is provided as a prerequisite for the mainstreaming of electric mobility. The carbon intensity of electricity is a determinant of the greenhouse gas and air pollution reduction potential of e-mobility, but as Hamburg's electricity grid is integrated into the German grid, the carbon intensity of electricity is mostly determined at the national level.

2. Mobility System

1.1. Basic Indicators

Transport Volumes and Modal Split: Cycling and public transport on the rise

As a result of the COVID pandemic, the total volume of passenger transport decreased by 16% in 2022 compared to 2017, mainly due to a reduction in private motorised transport. At the same time, the volume of environmentally friendly modes of transport remained broadly constant at 30 million passenger-kilometres per year. In addition, the number of kilometres travelled by bicycle doubles from about three to about six million person-kilometres.

Motorised Individual Transport

The volume of motor vehicle traffic, including heavy goods vehicles, on the urban road network shows a declining trend over the last decade. The decrease was more pronounced in the city centre, while on motorways and at traffic counting points in the periphery a slight increase in car traffic was observed until 2019. During the COVID-19 pandemic (2020 and 2021), car traffic decreased significantly. Traffic decreased by eleven percent in 2020 and by a further three percent in 2021. Even in 2022, pre-pandemic levels were not reached. The traffic volume in 2022 was still about 10 percent below the level of 2019, indicating that the general trend towards less car traffic is continuing.

Active Mobility

Bicycle traffic has seen a significant increase, especially since the COVID-19 pandemic. The measured volume of cycling traffic at counting points in 2022 was 33 per cent higher than in 2019, and between

200 and 2022, the volume has more than doubled (Bürgerschaft der Freien und Hansestadt Hamburg 2023b). The share of walking, on the other hand, has significantly decreased since 2008.

Collective Public Transport

In 2022, around a quarter of all passenger trips were made by public transport. Overall, passenger numbers in the HVV service area have increased by more than 60 per cent between 2000 and 2019. This strong growth was partly due to the continuous expansion of the service area. In 2020 and 2021, passenger numbers collapsed due to the COVID-19 pandemic. Initially, passenger numbers recovered only slowly. The national government-subsidised '€9 ticket', which allowed the use of public transport for €9 per month and was issued between June and August 2022, led to an increase in passenger numbers. In 2022, however, passenger numbers were still 17% below pre-pandemic levels.

Modal Split

As a result of the developments described above, the modal share for public transport increased from 19% to 24% between 2008 and 2022, while for cycling it even increased from 13% to 22%. The percentage of trips made by walking decreased from 29% to 22% during the same period. In 2022, 32% of all trips in Hamburg were made using private motorised vehicles, with a decreasing share over the last years (from 36% in 2017 and 39% in 2008). Still, the rate of car ownership remained mostly unchanged at ca. 330-340 private cars per 1.000 inhabitant over the last years, and continuous population growth has led to an increase of the total number of registered vehicles by 10% between 2010 and 2017 (infas et al. 2020). The total number of vehicle kilometres travelled remained mostly stable at ca. 10200 km per vehicle and year between 2008 and 2019 (Statistische Ämter des Bundes und der Länder 2022), but declined since then. As a result of the COVID pandemic, the volume of passenger transport decreased by 16% in 2022 compared to 2017 levels, mainly due to a reduction in private motorised transport. At the same time, the volume of environmentally friendly modes of transport remained broadly constant at 30 million passenger-kilometres per year. In addition, the number of kilometres travelled by bicycle doubles from about three to about six million person-kilometres (Bürgerschaft der Freien und Hansestadt Hamburg 2023a).

Figure 9 below also shows target values for 2030, as agreed in the climate plan and the mobility transition strategy.

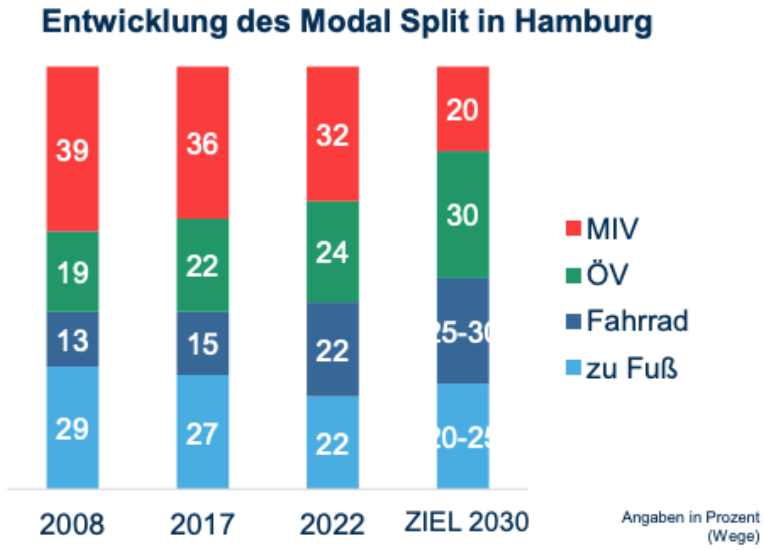


Figure 9: Development of Hamburg's Modal Split 2008-2022 and target for 2030, in %, by trip.
Source: Bürgerschaft der Freien und Hansestadt Hamburg 2023b

Electrification rates

Battery-electric vehicle (BEV) registrations have seen a strong growth over the last years, although starting from a very low basis. In December 2023, ca. 19% of all newly registered passenger cars in Hamburg were BEV; which is below the German average of 23%. 2.7% of the existing car fleet were BEV (Data source: Kraftfahrtbundesamt 2023).

As of February 2023, Hochbahn AG had more than 200 zero-emission buses and VHH (Verkehrsbetriebe Hamburg-Holstein GmbH) more than 80. In total, 13 per cent of the fleet was electrified by then. Additionally, all on-demand vehicles included in the Hamburg-Takt public mobility offer, (MOIA and hvv hop), are 100 per cent electric. Car sharing providers have electrified 39% of their fleet as of June 2023, while taxis have electrified 17% of their fleet as of July 2023. Four car-sharing providers have committed to achieving an 80% electrification rate by the beginning of 2024.

1.2. Organisation of the Mobility System

Publicly owned transport providers

The public transport system consists of buses and the subway and is almost exclusively operated through the publicly owned HOCHBAHN AG. Light rail (S-Bahn) and most regional trains are operated by Deutsche Bahn. The Hamburger Verkehrsverbund (hvv) is the transport association that covers the city of Hamburg and its surrounding area. Hvv coordinates the transport operators in the municipal area, provides a unified transport and fare system, and operates the integrated mobility app for the region. StadtRAD is a station-based provider of ca. 3,700 shared bikes and ca. 50 e-cargo bikes. Highest density

of the ca. 280 stations is in the city centre, but stations are also located in suburbs. The system is operated by Deutsche Bahn on behalf of the city of Hamburg.

Private Ride Sharing and Shared Vehicles Operators

Besides the publicly owned transport operators, private mobility companies are active in Hamburg. Two on-demand ride pooling operators (hvv hop and MOIA) are integrated into the public transport system and operating in several parts of the city. To use the service, passengers need a public transport ticket and have to pay a surcharge. While hvv hop is operated by a public transport authority, MOIA is owned by Volkswagen AG. It deploys more than 300 fully electric mini vans and has a concession to operate up to 450 vehicles until 2025. The on-demand service uses ca. 15,000 virtual stations. Following an amendment of the national passenger transport act in 2021, on-demand services that do not follow pre-defined routes between two stations can be recognised as part of the public transport system. The services are integrated into the hvv fare system.

Moreover, several profit-oriented car and micro-mobility sharing operators are active in Hamburg. Some private providers are integrated into the hvv switch app, including TIER, LIME, VOI, Bird, Bolt, SIXT share, MILES, and MOIA, and can be paid via the app. While the service areas of most shared micro-vehicle services were limited to inner-city areas in 2020, providers subsequently extended their operation area to suburbs. Ca. 20,000 shared e-kick-scooters, 1,400 shared e-bikes, and 4,100 shared cars are available in Hamburg (Bürgerschaft der Freien und Hansestadt Hamburg 2023a).

The micro-vehicle shared transport sector has entered stage of consolidation, with providers disappearing and merging, following a period of venture capital and rapid expansion of operators and vehicles.

Implications for the demonstration project:
Over the years, Hamburg has seen a decline in the use of private cars, specifically in the city centre, with more people opting for biking and public transport instead. The city has relatively high rates of electrification in its public transport and mobility services. Hamburg is recognized for its advanced integrated transport system, with emerging privately operated on-demand services seamlessly integrated into public transport options. Additionally, private shared vehicle providers are incorporated into the city's mobility app, enhancing convenience for users.

3. Current Policy Framework and Market Readiness for deployment of e- mobility

Mobility is a multi-level policy field, and the transition to e-mobility in Hamburg is influenced through decisions and policy actions on the European, the national, the federal state, and the city level (including boroughs and districts). Moreover, the framework for the deployment of e-mobility is not only determined through transport policies, but increasingly through environmental, fiscal, or industry

policies. The following chapter outlines the policy framework for e-mobility in general and intermodal mobility, using e-vehicles, in specific.

If focuses on the following elements:

- Strategies, targets and objectives that align with low-carbon and intermodal transport offers, including public funding and financing;
- Electrification of public transport vehicles, including buses, taxis, and vehicles for ride hailing;
- Availability of road-, charging-, and digital infrastructure;
- Availability of public transport and new mobility services, such as shared micro-vehicles or on-demand services

3.1 European Level

Transport, Mobility and Vehicles

Sustainable and Smart Mobility Strategy

The European Sustainable and Smart Mobility Strategy (SSMS, COM(2020) 789 final) maintains that mobility in Europe should be based on an efficient and interconnected multimodal transport system with cleaner and more active mobility in greener cities that contribute to the good health and wellbeing of their citizens. The Strategy aims at achieving at least 30 million zero-emission vehicles in operation on European roads by 2030 and that by 2050 nearly all road vehicles will be zero-emission. The Strategy defines 10 Flagship areas for transforming mobility system, out of which two make explicit reference to intermodal e-mobility.

Flagship 1 aims to increase the uptake of zero-emission vehicles and low-carbon fuels, and to build the infrastructure to enable this. This includes stricter emission standards for road vehicles and measures to increase demand for low-carbon vehicles, including carbon pricing, taxation or road pricing. The strategy also refers to measures to increase the uptake of zero-emission vehicles in business and urban fleets. 3 million public charging points are to be installed by 2030, of which 1 million by 2025.

Flagship 3 ‘Making interurban and urban mobility more sustainable and healthy’ emphasises the need to transform transport systems into multimodal system of sustainable and smart mobility services. This includes activities to increase the modal share of collective transport, walking and cycling. The strategy expects that automated, connected and multimodal mobility can significantly lower negative impacts of transport and maintains that seamless multimodality enabled by digital solutions is vital in urban and sub-urban areas. A shift towards shared and collaborative mobility services (shared cars, bikes, ride-hailing, and other forms of micro-mobility) facilitated by the emergence of intermediary platforms, could reduce daily traffic.

TEN-T Regulation

Hamburg is one node of several trans-European Network (TEN-T) corridors. The EU’s TEN-T consists of railways, inland waterways, short sea shipping routes and roads and aims at providing a coherent, multimodal, and high-quality transport network across the EU member states.

Figure 10: TEN-T Network
Note: Emphasis on Hamburg added
Source: European Commission n.d.

The European Commission's recent proposal for the revision of the TEN-T Directive (COM(2021) 812 final) aims, inter alia, to facilitate seamless and efficient transport in urban nodes of the network, promoting multimodality and interoperability between transport modes. It urges urban centres to develop Sustainable Urban Mobility Plans (SUMP) containing objectives, targets and indicators to measure the performance of the urban transport system, at least in terms of greenhouse gas emissions, congestion, accidents and injuries, modal share and access to mobility services. In addition, the proposal (Art.40) calls for urban TEN-T hubs to provide sustainable, seamless and safe connections between rail, road, air and active mobility by 2030; multimodal digital mobility services for passengers to access information, book, pay and retrieve their tickets; and the development of multimodal passenger hubs. Article 41 urges the promotion of efficient, low-noise and emission-free transport and mobility, including the greening of urban fleets and increasing the modal share of public transport and active modes in urban centres.

Clean Vehicle Directive

The Clean Vehicle Directive regulates the public procurement of vehicles and public services, such as passenger transport, refuse collection, or mail and parcel transport and delivery. It provides nationally differentiated procurement targets, which are minimum percentages of clean vehicles in the aggregate public procurement across a member state, for different vehicle categories.

The Directive mandates that in Germany, 10% of all N1 and N2 trucks, 45% of all buses, and 38.5% of light-duty vehicles must meet the clean emissions criteria. From 2026 to 2030, these percentages increase to 15% for trucks and 65% for buses. A vehicle is considered clean if it emits no more than 50g

CO2/km and meets up to 80% of the applicable real driving emission limits for NOx and PM. Starting in 2026, only zero-emission vehicles will be counted as 'clean'.

Regulation on CO2 Emission Performance Standards for New Passenger Cars and New Light Commercial Vehicles

The regulation defines fleet-wide emission targets for new passenger cars and new light commercial vehicles registered in the EU. Fleet-wide emission targets are continuously being reduced until they reach zero (100% reduction) in 2035. Moreover, from 2025, 25% of new passenger cars and 17% of new light commercial vehicles will have to be zero- or low-emission (up to 50g CO2/km) vehicles.

Energy, Climate, and transport-related emissions

European Green Deal, Climate Law, and Fit-for-55 package

In December 2019, the European Commission presented the European Green Deal as a concept to achieve climate neutrality in Europe by reducing net greenhouse gas emissions to zero by 2050. The European Climate Change Act, adopted in the summer of 2021, sets mitigation targets to reduce net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. As 25% of European ghg emissions stem from transport activities, achieving this target requires ambitious changes in the transport sector. Moreover, countries that are particularly affected will receive a total of 100 billion euros to support their transition to a zero-emission economy. In July 2021, the European Commission introduced a package of reformed and new EU directives and regulations in the sectors energy, transport, industry, and agriculture. This 'Fit for 55' package aims to achieve the goals outlined in the European Green Deal and the Climate Law targets.

Renewable Energy Directive

The recast of the Renewable Energy Directive (RED II) aims to increase the share of renewable energy in consumption sectors, including transport. Member States must oblige fuel suppliers to provide at least 14% of the energy used in road and rail transport from renewable sources by 2030. The use of electricity in transport is one option to meet this requirement.

Directive on Alternative Fuels Infrastructure

The Directive on Alternative Fuels Infrastructure (2023/1804, AFID) contains targets on the roll-out of charging and refuelling infrastructure, and aims at ensuring the interoperability of infrastructure and services. The AFID states that fast charging (150kw) should be available at least every 60 km along the TEN-T road network (see below), and 350kw charging for heavy duty vehicles every 100 km. Member states should ensure that for each light-duty battery electric vehicle registered in their territory, a total power output of at least 1,3 kW is provided through publicly accessible recharging stations; and for each light-duty plug-in hybrid vehicle registered in their territory, a total power output of at least 0,80 kW is publicly accessible (Article 3).

The expected major uptake of battery-electric vehicles and other forms of e-mobility requires the smooth integration of e-vehicles into the electricity grid. The deployment of smart recharging infrastructure and bidirectional vehicle-to-grid systems will help to provide storage capacity and

flexibility to the electricity system. The AFID states that all recharging points built or renovated after 13 April 2024 should support smart recharging, and communication standards supporting smart and bidirectional recharging should be adopted to ensure interoperability.

European Emission Trading System 2

A new European emissions trading system (ETS 2) covering emissions from road transport, buildings and industrial and energy facilities not covered by the current ETS 1 from 2027. All allowances will be auctioned. Fuel distributors must purchase allowances for the emissions contained in the fuels they sell. The cost of this will be passed on to end users, providing an incentive to save fuel and switch to electric vehicles. Crucially, the EU ETS 2 has a binding cap and CO2 prices are set on the carbon market. The reduction in the EU ETS 2 should be 42% by 2030 compared to 2005. Revenues from the EU ETS 2 will be used for the Social Climate Fund and for climate protection and social compensation measures.

Effort Sharing Regulation

The Effort Sharing Regulation (ESR) sets mandatory national targets for each Member State to cut GHG emissions. It covers sectors that were not part of the original ETS1, including domestic transport. The national targets for 2030 vary from -10% for Bulgaria to -50% for Germany, Luxembourg, Finland, and Sweden. In 2023, the national targets have been revised to comply with the Climate Change Act targets. As per the updated targets, Member States would collectively reduce emissions in the ESR sectors by 40% compared to 2005 levels.

Air Quality Directive

As described above, the European Directive on ambient air quality and cleaner air for Europe (2008/50/EC) sets air quality standards and requires agglomerations in which limits are exceeded to take action. The Commission's proposal for a revised Directive names the introduction of low-emission zones, increased uptake of public transport and active mobility, the development of smart mobility solutions, and the shift from fossil fuels to e-mobility as measures to attain limit values in the transport sector. Due to its binding nature, the Ambient Air Quality Directive triggered action in European cities towards low-emission mobility, including the introduction of 30km/h zones, access restrictions, or low emission zones. The aim of introducing a 'Hamburg Takt' (see below) was a reaction to the exceedance of air quality limits in Hamburg.

Pressure on cities to reduce transport-related air pollution has decreased in recent years due to improved exhaust treatment technologies. A current revision of the Air Quality Directive is likely to refer to the much stricter WHO recommendations as limit values. Meeting these limits would put renewed pressure on cities and towns.

Green Investments

Recovery and Resilience Facility

To address the economic impact of the COVID-19 pandemic, the European Commission established the 'Recovery and Resilience Facility' (RRF) in 2021. The RRF offers €338 billion in non-repayable grants and €385 billion in loans, financed through debt to be repaid jointly by 2058. Member States had to submit

investment plans, to be approved by the Commission, in order to gain access to RRF capital. 16% of RRF investments were allocated to the transport sector. The majority of funding in this sector was directed towards e-mobility, public transport, and urban mobility systems. However, the RRF also financed investments in combustion vehicle infrastructure and aviation (Werland and Fahrenkrog 2021)

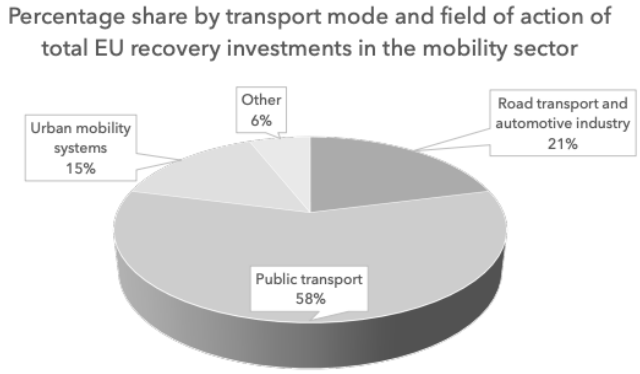


Figure 11: Distribution of mobility-related recovery spending in the EU by mode
Source: Werland and Fahrenkrog 2021

European Taxonomy Regulation

The European Taxonomy is a comprehensive framework developed to promote sustainable economic activities. Introduced as part of the EU's broader Sustainable Finance Action Plan, the taxonomy provides a standardised classification system for environmentally sustainable economic activities. Its primary goal is to channel investments towards activities that contribute to climate change mitigation, adaptation, and other environmental objectives. The European Taxonomy aims to guide investors, businesses, and policymakers toward a greener and more resilient economy. It enhances transparency, allowing stakeholders to make informed decisions and align their investments with the EU's sustainability goals.

The taxonomy covers a wide range of sectors, including energy, transport, agriculture, and more. To be considered environmentally sustainable, economic activities must meet specific criteria outlined in the taxonomy regulations. The Delegated Regulation (EU) 2021/2139 inter alia classifies investments into urban transport with zero tailpipe emission vehicles, into infrastructure for personal mobility (walking, cycling) and cycle logistics', or into the 'operation of personal mobility devices where the propulsion comes from the physical activity of the user or from a zero-emissions motor, as having the potential to substantially contribute to climate change mitigation, as long as specific conditions are met (use of recycled content in infrastructures, end-of life management of vehicles and batteries).

3.2 National Level

Ordinance on Electric Micro-Vehicles (Elektrokleinstfahrzeuge-Verordnung)

The regulation sets out the framework for the legal use of micro electric vehicles (micro-EVs) on the road. It states that the maximum speed of micro-EVs is 20 km/h, that they must be insured, that they can only be used by one person at a time, and that they are permitted on cycle paths and roads, but not

on sidewalks or in pedestrian areas. Defining how micro-EV may be used is a prerequisite for efficient urban planning, e.g. for locating parking facilities or connecting them to the road or cycling infrastructure. Unclear legal requirements have led to inconsistencies in route planning or delays in the allocation of urban space for parking shared micro-vehicles in cities.

Subsidy schemes for e-vehicles and infrastructure

The German federal government introduced an eco-bonus scheme in 2016 to promote the sale of fully electric and hydrogen cars and to promote the transition towards low-emission vehicles. The eco bonus consists of two parts: a manufacturer's share and a federal share. The manufacturer's share (currently between EUR 750 and EUR 2,250) is directly deducted from the purchase price. With the market diffusion of e-vehicles, the scheme has gradually been phased out: Since 2023, plug-in hybrids were excluded from the eco-bonus. Until the end of 2023, the bonus was available both for new and used vehicles that do not exceed a price of EUR 65,000, with higher subsidies for less costly vehicles. Cars with a net price of less than EUR 40,000 received a bonus of up to EUR 6,750; vehicles between EUR 40,000 and EUR 65,000 a maximum of EUR 4,500. The subsidy scheme was finalised in December 2023.

Climate Change Act (Klimaschutzgesetz)

The German Climate Change Act of 2021 outlines targets to reduce CO2eq emissions by 65% by 2030 (compared to 1990 levels) and achieve greenhouse gas neutrality by 2045. The Act also establishes sector-specific targets and mitigation pathways. The transport sector is supposed to reduce its annual CO2eq emissions from 150 million tonnes in 2020 to 85 million tonnes in 2030, a reduction of 43%. However, due to continuous underachievement in the transport sector, the sector targets are likely to be abolished in 2024 and replaced with a cross-sector target.

Germany's greenhouse gas emissions have been reduced by around 39% by 2021 compared to 1990. The one-off effect of the COVID pandemic led to a greenhouse gas reduction of around 9% in 2020 compared to 2019. Greenhouse gas emissions in 2021 show a significant increase of 4.5 per cent compared to the previous year, but are still 4.8 per cent lower than in the pre-coronavirus year 2019.

Renewable Energy Act

According to the amended Renewable Energy Act of 2023, at least 80% of the electricity consumed in Germany should come from renewable sources by 2030. Once the coal phase-out is complete, Germany's electricity supply is expected to be greenhouse gas neutral. A low-carbon electricity mix is crucial to avoid emissions from e-vehicles.

3.3 Federal State, City and District Level

Mobility Transition Strategy (Strategie Mobilitätswende)

The Mobility Transition Strategy aims at limiting the modal share of private cars to 20% in 2030, from 30% in 2020. It explicitly states that e-scooters can increase accessibility of buses and local trains and complement public transport; but also mentions conflicts about the use of public space. The Hamburg-Takt was initiated as a reaction to exceeded air pollution limits, as stated in the European Air Quality Directive (see above), and is mentioned in the city's integrated public transport strategy. The Hamburg-

Takt, aims to ensure that every resident has access to high-quality public transport within five minutes from morning to evening. Achieving this objective requires higher frequencies and denser networks, but also the integration of on-demand services to fill service gaps. The integration of services into a single digital platform, the hvv switch app, facilitates access to new forms of mobility and intermodal travel.

Since 2020, all public transport vehicles procured by the public transport authorities Hamburger Hochbahn AG and Verkehrsbetriebe Hamburg-Holstein GmbH (VHH) are locally emission free.

Climate Protection Law and Climate Plan

Hamburg's Climate Protection Law targets a 70% reduction in GHG emissions by 2030 compared to 1990 levels. It also aims to achieve net climate neutrality (-98%) by 2045. The Climate Plan outlines sectoral emission reduction targets, with a pathway for the mobility sector from 5.3 million tonnes of CO2 in 1990 to 2.5 million tonnes in 2030 and 6,000 tonnes in 2045. This represents a 25% reduction between 2020 and 2030.

The 2024 revision of the Climate Law (§29, sustainable Mobility) explicitly mentions the expansion, improvement and optimisation of cycling and walking infrastructure and public transport services with the aim of increasing the share of eco-mobility. This explicitly comprises the integration of bike and car sharing and on-demand services into public transport.

The updated Climate Law also aims to gradually increase the proportion of locally emission-free motor vehicles and to reduce negative effects of transport on the climate, the environment and health, and appropriate traffic-calming and traffic-reducing measures (§29). §29a requires that concessions for taxis or on-demand transport vehicles may only be issued for locally emission-free vehicles. Moreover, the law stipulates that generally, new parking areas with more than 35 spaces, which are suitable for the use of solar energy, must be equipped with a photovoltaic system covering at least 40 per cent of the parking spaces.

ITS strategy

The Hamburg ITS strategy, for instance, mentions the linking of public mobility, sharing and on-demand services, […] and the further expansion of mobility hubs as one means to reduce transport-related CO2 emissions (Free and Hanseatic City of Hamburg 2021).

Regulation of shared vehicle use

As the shared vehicle sector is undergoing a process of market consolidation and merging, the number of e-scooter providers is mostly stable or even shrinking, through merging and withdrawal of providers. In parallel, many cities have started regulating vehicle usage and operations through tender processes, revokable concessions, and other regulations. This includes caps of total vehicle numbers, the implementation of geo-fenced low-speed zones and no-parking areas, as well as mandatory use of parking spaces (including surrounding no-parking areas). Concessions are also deployed to ensure that operation areas stretch beyond inner cities, and that vehicles are also provided in suburban districts. Some cities even considered the use of e-vehicles (instead of combustion vehicles) for servicing and relocating vehicles as reward criterion for concessions. Unlike in many other cities, governance in

Hamburg still relies on a voluntary agreement with shared vehicle providers, and does not (yet) foresee binding regulations.

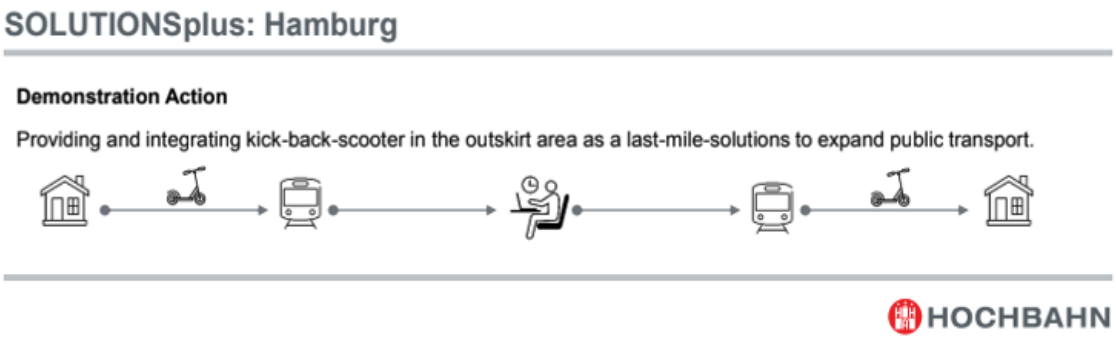
Implications for the demonstration project

The general legal and political environment in Hamburg is supportive of establishing intermodal mobility offerings. Strategies across various political levels emphasize the importance of integrating new mobility services with public transport networks. However, achieving this integration necessitates alignment among public transport operators, private service providers, as well as city and district authorities.

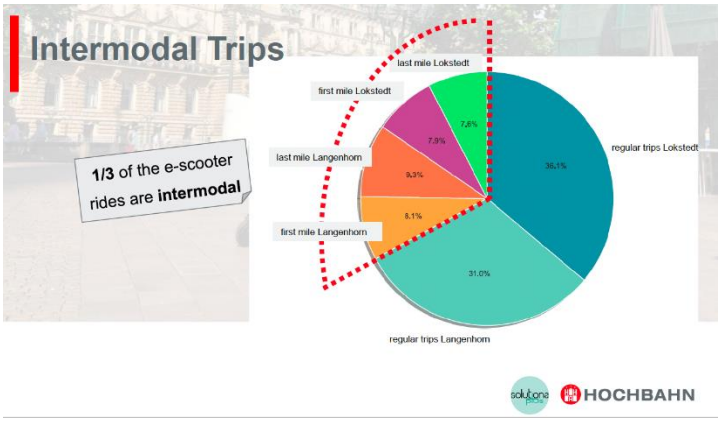
Contrastingly, national policies still lean towards favoring private car usage, particularly for commuting, without providing ample incentives to opt for public transportation. One notable area where Hamburg lacks is in the enforcement of stricter regulations concerning the provision and utilization of e-scooters. Implementing such regulations would alleviate pressure on urban spaces within the city center and ensure the availability of shared vehicles in suburban areas.

4. Demonstration project: Integrating shared e-micro-vehicles into the public transport system

The Hamburg demonstration project aimed at integrating new, privately operated mobility solutions into the existing collective public transport system. Hamburger Hochbahn AG, a partner of SOLUTIONSplus, provided seed funding to a tendered subcontractor and repurposed car parking spaces into return zones for e-kick scooters. The modality was a combination of free-floating vehicles with defined return zones in the proximity of subway stations in Hamburg's suburbs. In parallel, shared e-scooters had been integrated into the public transport provider's mobility app.



A user survey that was carried out during the demonstration activity found that one third of all scooter rides were part of intermodal travel chains. After the demonstration project ended, the e-kick scooter provider continued its service in the area. Subsequently, several other providers followed suit and gradually expanded their service areas.



5. Approach – Methodology

Building upon experiences from the Hamburg demonstration project, the Roadmap identifies preconditions for activities that aim to integrate shared electric micro-vehicles into the existing public transport system and that foster intermodal trips.

This Roadmap considers e-kick scooters, e-bikes, and e-cargo bikes as electric micro-vehicles. Providers of shared vehicles can be publicly owned companies or private operators (in public-private partnerships). During the demonstration activity, Hamburger Hochbahn AG used SOLUTIONplus project funds for a tender that included the provision of 100 e-kick scooters in two currently unserved suburbs for a 1-year period.

The evaluation of the demonstration activity built upon collected data and available data sources. Trip data was collected from vehicles and anonymised before processing. Data about trip purposes and transport modes was derived from a user survey that was implemented in the mobility app. Information about public transport availability was derived using the DLR tool UrMoAc. Existing data on population, demography or vehicle fleets came from official statistics (Hamburg Statistical Office). Additional mobility-related data were taken from the national mobility survey “Mobilität in Deutschland 2017”, and its Hamburg regional report (infas et al. 2020).

6. The Roadmap – Where are we going?

6.1 Vision

Hamburg is positioning itself as the leading smart mobility city in Germany. The Hamburg ITS strategy, for instance, mentions the linking of public mobility, sharing and on-demand services, […] and the further expansion of mobility hubs as one means to reduce transport-related CO2 emissions (Free and Hanseatic City of Hamburg 2021).

In recent years, privately-operated sharing systems for micro-vehicles such as e-kick-scooters or bikes have proliferated in cities around the world at an accelerated rate. Despite attempts of some cities to ban some of those businesses, specifically e-kick scooters, new mobility services are on the ground and cities need to manage them. When properly implemented, shared electric micro-vehicles can help reduce air and noise pollution, greenhouse gas emissions, congestion and the highly inefficient use of scarce urban space.

However, shared mobility solutions currently operate mostly in inner cities where high levels of public transport are already available. Furthermore, privately operated sharing systems are often largely unregulated, including the number of vehicles and the operation area. To ensure that shared micro-mobility has a positive impact and does not harm vulnerable groups, it is essential to actively regulate it and integrate it into the public transport system through public administrations.

6.2 Objectives

The increasing number of cyclists and the growing popularity of shared micro-mobility in cities has sparked a debate about the allocation of urban space. Micro-vehicles are often parked and operated on sidewalks and in pedestrian zones, creating obstacles for pedestrians and people with reduced mobility. However, the integration of micro-mobility can contribute to more sustainable and resource-efficient urban mobility systems. This is notably the case if they help to fill mobility gaps in the collective transport system, which remains the backbone of sustainable urban mobility, and replace private car trips. Micro-mobility options have the potential to serve as first- and last-mile connections for collective transport in intermodal trips. Shared micro-vehicles should primarily facilitate access to public collective transport as a 'first and last mile' solution in urban areas with low accessibility, offering an alternative to motorised private transport.

The key objective of the demonstration activity was to replace private car trips with intermodal trips, combining shared micro-vehicles and public transport. This is a fundamental aspect of more sustainable mobility systems, although the specific impact of one individual measure may not be immediately discernible. Broader policy packages, however, should include push-measures to make private car use less attractive.

6.3 Timeline

Phase	Demonstration	Scale-Up	Mainstream
Timeline	1 year	2 years	
Target/ Focus area	Shared micro vehicles have been rolled out in suburban demo areas. Providers have received a kick-off funding for providing a defined number of vehicles in the areas. Parking zones at major public transport stations have been set up, and incentive schemes have been tested. Data collection for project evaluation has been accomplished. Public awareness campaigns have been developed and implemented.	Shared micro-vehicles are available in selected urban districts and integrated into the public transport system. Physical or virtual mobility hubs are available at selected major public transport hubs. Providers of shared vehicles are committed to extend service areas and to provide vehicles in selected districts.	Shared micro-vehicles are available in most urban districts and integrated into the public transport system.
Finance	Public grants	Public transport operator, Provider of sharing services	Public transport operator, Provider of sharing services
responsible			
Actions	- Seed funding for subcontracting or public provision of shared vehicles in underserved areas	- Define the future role of shared micro-vehicles in the public transport system (e.g. in SUMP or Climate Action Plan)	

	- Provision of return spaces at major public transport stations - Public awareness campaigns	- Integration of shared micro-vehicle services into public transport app. Minimum: Availability of vehicles, Payment functionality - Explore options to commit shared vehicle providers (e.g. via Concessions) - Explore options to regulate the use of shared vehicles (e.g. no-parking zones) - Explore options for fare integration -	

7. Implementation plan – How do we get there?

The beneficial integration of shared micro-vehicles with public transport requires measures in different areas, including the provision of mobility offers beyond the city centre, the regulation of the use of vehicles to avoid negative impacts, but also measures to disincentives the use of private vehicles. The following chapter examines activities in the areas urban planning, regulation and concessions, economic and financial support, and awareness rising.

7.1 Focus area 1: Urban Planning

The demonstration activity employed a combined approach of free-floating shared vehicles and designated parking zones in the vicinity of major public transport stations. Parking zones can be designated by physical signs and markings or as virtual zones in the app. Providing urban space for mandatory shared vehicle parking is an urban planning element to encourage intermodal travel, to make shared micro-vehicles reliably available in a concentrated area, and to avoid the blockage of station entrances and exits by inappropriately parked shared micro-vehicles. Parking zones should be linked to surrounding no-parking areas and/or to reward schemes if vehicles are returned to those zones.

In a further stage, parking areas for micro-vehicles can be designed as mobility hubs, which offer additional services such as parcel lockers, other shared vehicles or access to micro-transit.

Finally, since micro-vehicles are primarily used on cycling infrastructure and safety is a major determinant of use, parking zones and mobility hubs should be connected to the cycling network or be accessible via low-speed roads with smooth surfaces to ensure safe and comfortable access.

7.2 Focus Area 2: Regulatory measures and concessions

The basic requirement is to classify the used vehicles by law and to define their conditions of use. This includes technical parameters such as maximum speed, braking power, and lighting equipment; legal modalities such as insurance, roadworthiness checks, minimum age for users, or driving licences required; and regulations on road use, safety equipment, or vehicle parking. These aspects are typically defined at the national level.

Cities can influence the operations of shared-micro vehicle providers through concessions. While in the early stages of shared micro-mobility services, most cities did not regulate the operation of providers, or tried to influence their deployment and use through voluntary agreements with the private operators (such as Memorandums of Understanding). In the meantime, more and more cities are moving towards regulating private shared mobility offers.

Cities can award concessions for a limited number of operators through public tenders, depending on the national legal environment. Licenses can be granted to the best-performing applicants based on environmental and social criteria. Issuing such concessions that may be revoked in the case of non-compliance with stated requirements puts cities into a stronger position towards private operators. Typically, concessions restrict the number of shared vehicles and establish parking regulations. Concessions can also regulate the service area and prescribe the availability of shared vehicles also beyond the city centre.

As vehicle production and operational services are the main determinants of energy use (exemplary: dena 2021), tenders should consider environmental and operational aspects. For example, the use of e-vehicles for servicing and relocation, the amount of recycled content in micro-vehicles, the procurement of electricity from renewable sources, and measures to support multi-modality. For instance, the use of e-vehicles for servicing and relocation, micro-vehicles with recycled content, the procurement of electricity from renewable sources, or measures to support multi-modality (exemplary: City of Paris 2019).

7.3 Focus Area 3: Economic and Financial measures

Most shared vehicle operators are profit-seeking private companies, and they generally restrict their operation area to profitable inner cities. Levers for public administrations are concessions (see above) or – exceptionally – subcontracting private providers to serve less profitable areas.

To encourage the intermodal use of shared vehicles, trips that start or end at public transport stations could be financially incentivised, for example by waiving initial fees or granting free minutes. Additional costs for operators could be partly balanced by public authorities.

In the medium term, payment systems may be integrated between public transport and micro-vehicles to facilitate seamless transfers for passengers. At present, a number of public transport operators provide information on available shared vehicles, price estimates and payment options for shared mobility services in their app, but do not offer integrated door-to-door tickets.

An accompanying approach to promote the intermodal use of shared micro-vehicles is to dis-incentivise private car use. This can be done by introducing or increasing parking fees in inner cities, by reducing the availability of on-street car parking, or by implementing congestion charging.

7.4 Focus area 5: Information and public awareness

Information regarding new mobility offers and public awareness is essential for improving the acceptance of intermodal travel options. Awareness initiatives aim to educate users on the advantages of intermodal mobility. Emphasising the benefits of combining transportation modes, such as buses, trains, bicycles, and shared transport options, can highlight enhanced flexibility, potential time savings, or greater convenience. Moreover, public awareness campaigns should address concerns regarding reliability and unfamiliarity with new transportation options, striving to increase confidence in embracing diverse modes.

Measures could include basic information on the general availability of the service or the display of micro-mobility hubs at public transport stations on on-board displays, but also the integration of shared mobility vehicles and intermodal travel options into public transport and mobility apps.

Finally, shared vehicle trips that start or end at intermodal hubs could be subsidised or even made free of charge for a limited time to attract new passengers and to encourage the testing of the service.

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