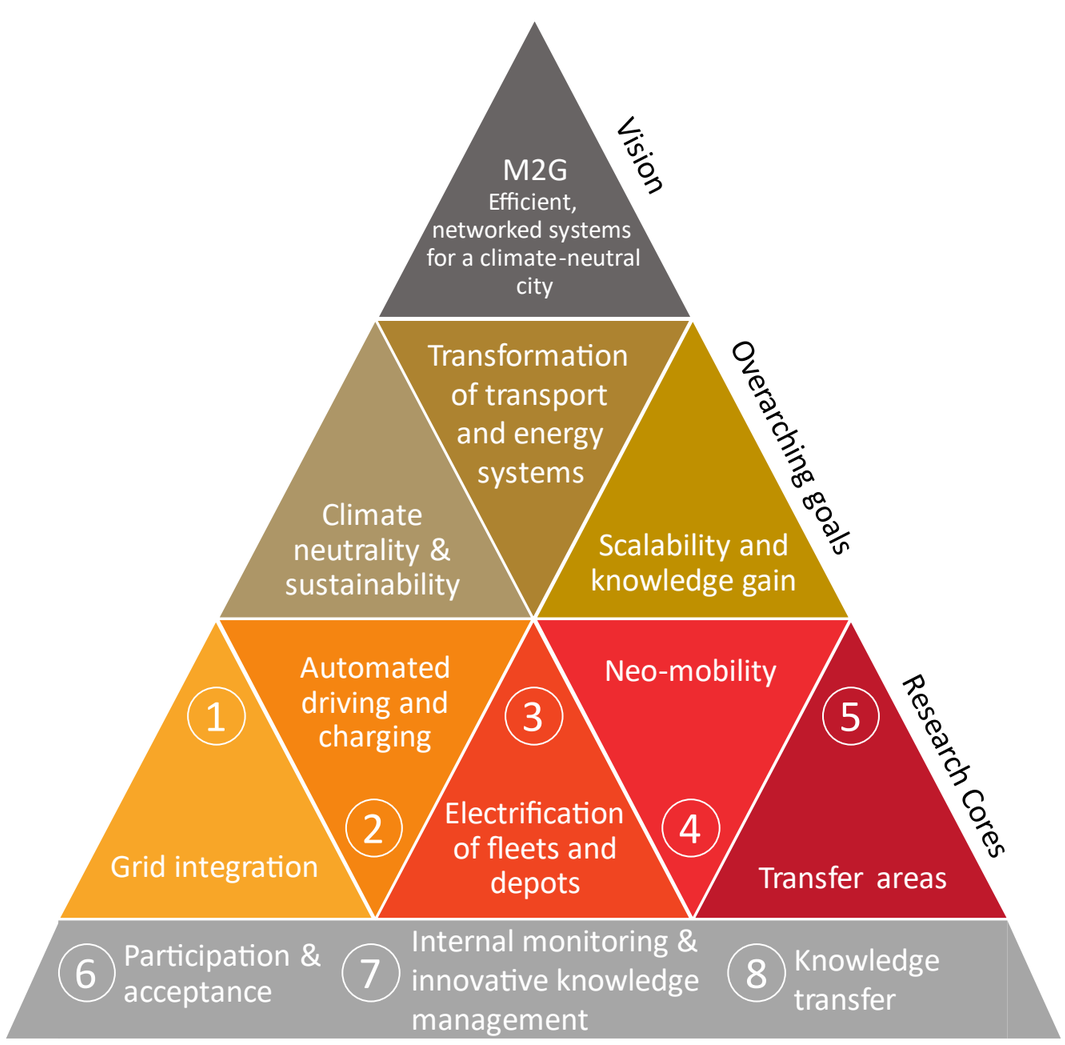
Efficient, networked systems for a climate-neutral city

Forschungscampus EUREF
Mobility 2 Grid

What is analysed and tested in the real lab on the EUREF campus has the potential to be transferred to urban communities. In 2022-2027, the network of 35 science and industrial partners will receive funding of €10 million from the Federal Ministry of Education and Research (BMBF). Specifically, this second funding phase will investigate how business models must be adapted to take account of changes in the market; how the use of network capacities will be shaped and how a network-serving controllability of vehicle fleets can be realized. How can the interests of citizens be taken into consideration? Mobility2Grid makes a strong contribution to the transformation of urban energy and transport systems.

Research Strategy



Highlights

Real-time representation of innovative actor constellations for the grid and market integration of e-mobility

Demonstration of automated megawatt charging with 40t e-trucks

Analysis of multifunctional commercial and mobility hubs for different fleet types

Modelling & simulation of future scenarios in passenger and commercial transport

Innovative operating solutions and business models for climate-neutral areas

Regular M2G conference to present our research and transfer knowledge

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Cooperation partners in the research campus

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1 Grid integration

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The work module Grid integration revolves around exploring how the roles for integrating e-mobile storage and charging technologies into the grid and market can be shared across the participating players most efficiently – both economically and environmentally – within the overarching system of a deregulated energy market and mobility sector.

- Optimised energy procurement and market participation:

  Identifying necessary and available information systems to achieve economically and environmentally efficient inter-player relationships with a view to integrating e-mobile storage and charging technologies into the market, taking into account the spread of player-specific optimisation processes.

  ➢ Innovation by observing players and interactions

- Operating and controlling micro smart grids:

  Penetrating as far as the low-voltage level from the grid-management level, as well as maintaining/increasing the reliability and availability of power grids through automated charging infrastructure, decentralised energy systems and actively operated smart meters.

  ➢ Advancement by digitising the low-voltage level

- Interface systems and smart networking:

  Scalable, cross-area integration of e mobile storage and charging technologies by using/further developing standardised interface systems and communication protocols, and by taking into account the requirements of internal and external players.

  ➢ Implementation through technology and user-oriented framework conditions

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2 Automated driving and charging

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The work module sees two self-positioning charging technologies being demonstrated at the EUREF campus and the BLG Logistics premises with (semi-) automated vehicles, in a bid to gain real-world insights into parking and charging behaviour. The module also involves developing concepts and tools for efficiently designing and using automated charging infrastructure at premises and integrating e-vehicles into smart power grids. In this context, the real-life operation of an electric logistics truck will be used together with a ≥1 MW charging station, acting as a live demonstration. Vehicles with varying degrees of autonomy will also be theoretically integrated into the existing factory traffic, and the entire system will be assessed in terms of economic, environmental and logistics KPIs.

Aims

Car sharing fleets
- Increased utilisation of public charging infrastructure through automated (re)parking and charging
- Targeted support of controlled and bidirectional charging processes

Bus and commercial transport
- Fast charging process and convenient handling through automated connection to charging stations
- Saving of charging infrastructure through multiple use in depots

Urban logistics
- Parallelisation of transshipment processes and High-power charging (> 1 MW) in heavy goods traffic
- Optimised operating processes in depots through autonomous transport

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3 Electrification of fleets and depots

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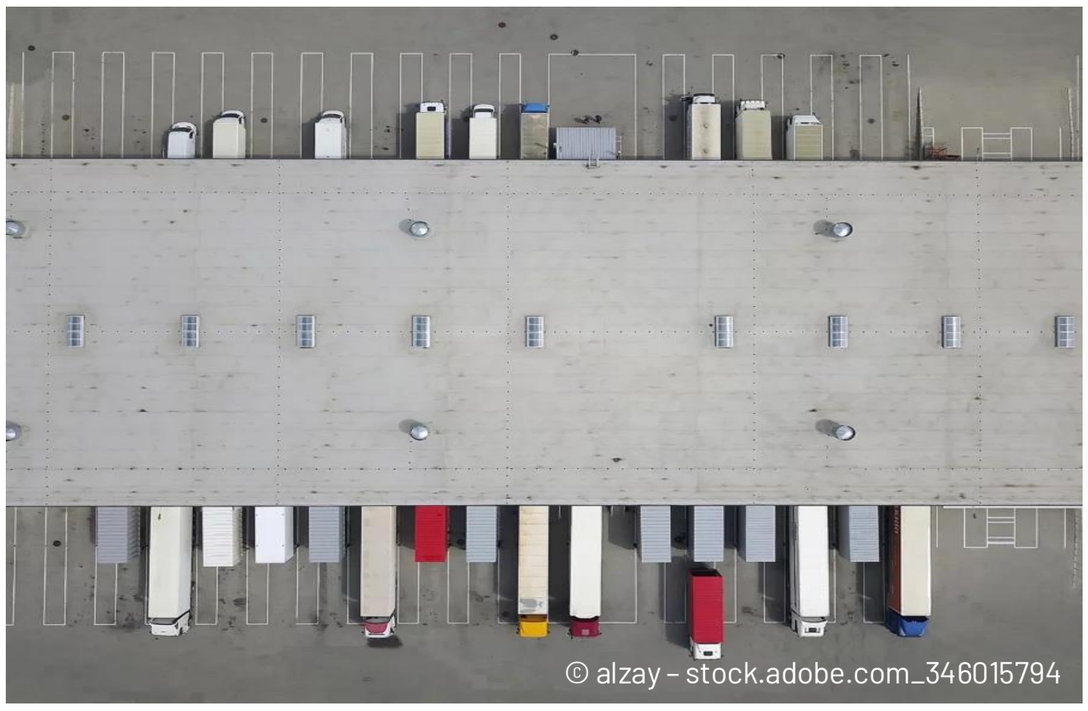

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Work module 3 examines the notion of connecting cars, public transport, commercial vehicles and logistics fleets to the infrastructure as modes of transport. The focus is on supplying energy through various infrastructures at one location – the multi-purpose mobility hub. A demonstration version of a multi-purpose mobility hub will be set up. The module analyses the usage profiles of different fleet types, and conducts technological assessments of infrastructures for vehicle energy supplies. This addresses the question of how fleets and infrastructures can be combined in terms of energy requirements, and operated at a technological, economic and cross-player level. It will examine the impacts of alternative drive technologies on logistics processes, as well as how new processes and process times are integrated into logistics management systems. Aspects relating to integration of the hub's data will be examined by developing an independent charging management system. Ways of providing system services for the grid will be developed and tested – both through simulation and in test cases.

Aims

Power-supply grid
- Customised system services by using different energy-supply solutions for e-mobility
- Reduced grid load by combining fleet usage profiles

Mobility
- Co-ordinating different fleet types and energy sources with the energy-supply methods
- Developing methods for calculating energy requirements, potential flexibility and space for the multi-purpose mobility hub

Data
- Involving players, services and interfaces in data platforms for electromobility with a view to benefiting the grid
- Utilising and further developing independent charging management systems at the labs: EUREF, transfer area and mobility hub

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4 Neo-mobility

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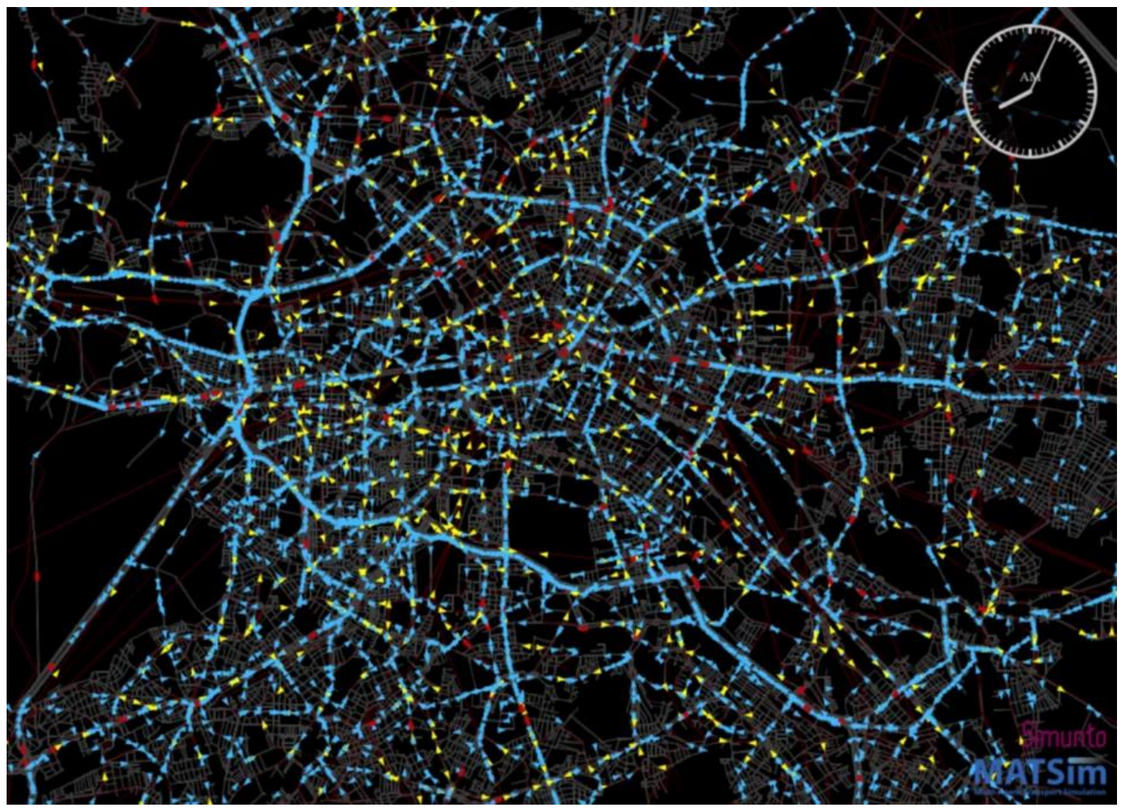

Urban spaces are all about traffic, and traffic in turn makes up a substantial part of greenhouse-gas emissions. WM 4 on neo-mobility focuses on the extent to which it is possible to achieve the goal of a climate-neutral city through efficient, networked transport and energy systems, despite increasing mobility demands.

Passenger and goods transportation in cities primarily occurs in the form of eco-mobility (walking, cycling, public transport), motorised individual transportation or using lorries and delivery vehicles. These days, there are added new forms of mobility. Bike and car-sharing, along with other sharing services, mean people no longer need their own cars. New mobility services and transport systems – neo-mobility – call for new concepts for designing urban spaces and areas. This and other developments are the focus of the Neo-mobility research hub, and will be presented in future scenarios.

It is expected that findings for and from the transfer areas (WM 5), among other things, will come into play here. The developments produced on the EUREF campus from the first funding phase will be applied to the transfer areas and the resulting findings will in turn be factored in when devising scenarios. The aim is to implement and simulate the modelled scenarios using the MATSim (Multi-Agent Transport Simulation) software and interlinked jsprit routing tool. This involves assessing the requirements of the future power and transport system and devising suitable measures and recommended actions at an area, district and city level, which will help Berlin become climate-neutral in 2045 (BEK 2030).

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5 Transfer areas

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The aim of the work module is to apply the findings obtained by the Mobility2Grid research campus to practical contexts. A method taking into account the specific factors of the different transfer areas, which identifies the conditions of transferability and simultaneously ensures the findings obtained by the Mobility2Grid research campus can be successfully implemented, is being specially developed as part of WM 5 for transferring knowledge from science to real-world spaces. The solutions package includes designing and planning sustainable, cross-sector operational-management strategies with innovative business models, consultancy for digitising a specific area or developing comprehensive transport and mobility concepts, taking into account future-oriented technologies such as driverless cars or plug & charge. The results will be continuously presented in a modern web application in connection with the area developments. . This will enable the tested and thoroughly assessed research findings to be circulated even beyond the research project, and will make them accessible to the broader society.

- Developing a cross-sector **operations-management strategy** with innovative, sustainable business models for districts
- Creating an area-specific **Building Information Modelling platform** (BIM platform) to map the operations-management processes as part of facility management
- Creating **guidelines** recommending technical and organisational measures for implementing Plug & Charge
- Devising **innovative transport and mobility concepts**, taking into account the resulting operations-management strategy for different area types
- Developing a modern **web application** for presenting the findings of all research hubs and implementing these in the transfer areas

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6 Participation & acceptance

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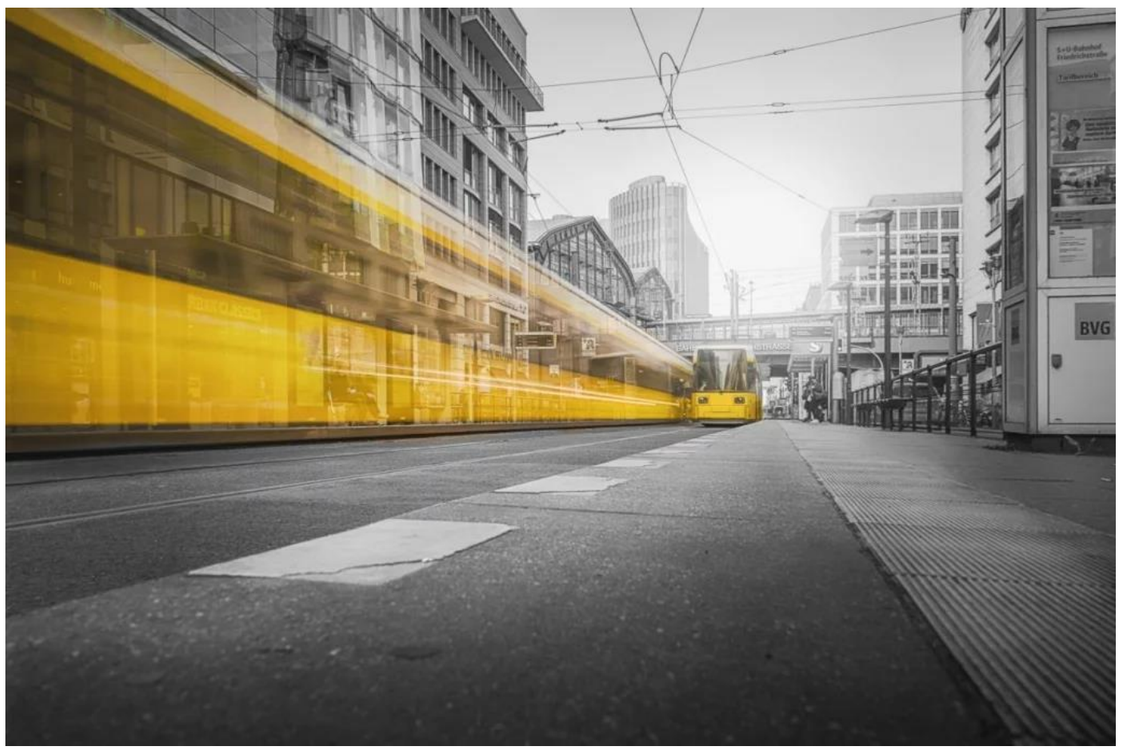

Involving citizens and users, and factoring their recommendations into the innovation processes for the mobility and energy transition, is a key requirement for successful diffusion of innovations in society. Based on the findings from the M2G research campus' first funding phase, work module 6 aims to further explore early implementation of participation for specific aspects of mobility and energy research and technical development, and apply this accordingly. Using innovative participation formats in all of M2G's focus areas, it will establish the perspectives and recommendations of various target audiences, and thus incorporate these into the research campus as a whole. It will also examine the role of participation in applying research findings to additional practical contexts.

Research questions

1. What does optimised grid integration mean for the users and participating businesses, and what role do legal and political framework conditions play here?
2. How do driverless cars and charging change operational processes and end-user routines?
3. What challenges do businesses face in electrifying their fleets?
4. How well accepted are comprehensive, networked mobility-system offerings in individual neighbourhoods and districts?
5. How do the transfer areas promote acceptance of new mobility offerings at a district and, in particular, city level?

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7 Internal monitoring and innovative knowledge management

The aim of internal monitoring and innovative knowledge management is to obtain findings on the collaborations within the heterogeneous structure of key players at the Mobility2Grid research campus. The findings will be incorporated directly into the management processes of the M2G campus and transfer areas – even more intensively than in the first funding phase – and will help improve the knowledge transfer between players. This will involve both quantitative data collection and qualitative methods of formative evaluation. The focus here is on measuring not only the scientific, but also political, economic and social, impact – i.e. the effects/influence of the research.

And this is where impact pathways models come in. They operate based on a methodology geared around central questions exploring the reason and motive for the research, concrete research interactions and as many output dimensions as possible for all stakeholders involved in the project. The aim is to describe the project in definable phases. Following an initial phase, the model is used to formulate new sub-goals and potentially revise others. As such, the project will grow out of itself incrementally. It will thus serve as a means of internal communication regarding project issues and objectives, and is designed to provide the M2G executive board and managing directors with qualitative data for strategic decisions.

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8 Knowledge transfer

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Work module 8 supports and examines the knowledge transfer between the research campus and the (transfer) areas, (expert) public, vocational education and EUREF campus' Masters courses. New technical knowledge and findings from social-science surveys will be shared with the research campus' partners within the context of the networked energy and mobility transition. . It will take into account the requirements of the various players in the transfer areas, as well as the possibility of integrating networked mobility and energy solutions into the areas themselves. Empirical studies will be used to explore how innovations need to be applied and adapted in social spaces.

Knowledge transfer from living labs like the EUREF campus is geared around disseminating findings and results from applied, transdisciplinary research. This approach is to be used to prepare well-founded recommended actions for environmentally, economically and socially acceptable transfer processes that promote efficient, networked systems.

Adapting the innovations created by the EUREF campus' living lab to the requirements of the respective areas and factoring in various target audiences in a participative manner are seen as relevant criteria for ensuring successful transfer to other areas.

In light of this, the work module not only assists with knowledge transfer, but also shares recommended actions with other areas and their key players.

(Vocational) education is another constructive lever for achieving these objectives, including over the longer term. In future, climate-friendly urban mobility will particularly require people with the relevant transdisciplinary specialist and practical skills. The work module thus factors in knowledge-sharing when it comes to education formats. The work modules task is to filter overarching findings from the research campus, discuss these with the relevant scientific and economic partners, and integrate them into the university courses and vocational education through formats and educational components tailored to the specific target audiences. The content gained will also be systematically applied to vocational education in a bid to ensure it also reaches the experts of the future.

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