

Paul Leibold

Initiator & Project Leader Adaptive City Mobility
paul.leibold@adaptive-city-mobility.de

Dr. Jessica Le Bris

Green City Projekt GmbH
le-bris@greencity-projekt.de

E-Mobility Striking New Paths – Implementing a Visionary E-Mobility System for Cities



Abstract

The Adaptive City Mobility project, also referred to as ACM or CITY eTAXI, centres on the development of a zero-emission e-mobility system in municipalities. Its objective is to make e-mobility on four wheels environmentally and city-friendly on the one hand, and as affordable and thus competitive as possible on the other.

To achieve this, the research project draws and is based on three technological innovations concerning a new vehicle concept, a new way of charging e-vehicles and the integration of an overall management and sharing system that allows the use of the vehicles by different user groups. In the following, its core elements and added value for regions, municipalities and companies will be described.

Diffusing E-Mobility

E-mobility is promoted as one of the sustainable solutions of the future. But apart from the reduction of local pollution, there are surprisingly few e-concepts that look at our transport system as a whole entity which is part of our life within society and space.

Hence, most innovations maintain the status quo and nearly none of them seeks to make a contribution to the reduction of all the negative effects motorized individual transport is causing: traffic jams, time costs, accidents, depletion of land resources, expansion of impervious surfaces, consumption of living space in our cities, etc.^{1,2}

It seems like a paradox of our time –in far too many cases, sufficiency and efficiency strategies³ aimed at increasing sustainability counteract one another instead of mutually complementing and potentiating their effects.

To benefit from the advantages the integration of e-mobility solutions offer in terms of sustainability⁴, it is necessary rethink these solutions. This is where the Adaptive City Mobility research project comes in.⁵

ACM is co-funded by the German Federal Ministry for Economic Affairs and Energy and was declared a flagship project by the Federal Government in summer 2015. It is a strong signal sent towards making the vision of e-mobility a reality. Especially when the goal is launching it on the market in a resource-efficient, environment-friendly and affordable fashion.

2

Technological Innovations of the Project

Three innovations built the base of the total e-mobility system: an electric light vehicle, a battery swapping system and the intelligent integration of the various systems.

2.1

E-Mobility Light

When developing the project, the central question was: how simplified and minimalistic can e-mobility on four wheels possibly be? The result is a completely new car concept which is an explicit counter-statement to the current trends of the automotive industry. Rather than launching another two-ton car equipped with all kinds of luxury extras, the CITY eTAXI is a light vehicle weighing only 550 kg, including the battery.

The low total weight is achieved by using a perfect and ultra-light mix of materials produced at minimum cost: an aluminium chassis, fibre-reinforced materials used for the safety passenger cabin and plastics for those parts which merely serve to cover the vehicle. The design of the vehicle⁶ follows the maximum usefulness it provides under the motto, "form follows function".

2.2

Manual Battery Replacement System and Renewable Energies

Two of the factors standing in the way of a more widespread expansion of electric cars are the currently high purchase costs on the market as well as the relatively small range compared to that reached by combustion engine vehicles. Even though, in most cases, the fear of insufficient range is unsubstantiated, in some scenarios, such as taxi transportation, 300 km (and more) per day is actually normal.



Figure 1: The CITY eTAXI and its manual replacement system

A core element of the ACM system is, therefore, the option to manually change the batteries thus maximising vehicle utilisation. Together with the use of renewable energies the reduction of CO₂ emissions can even be increased and the whole ACM system achieves the status of a zero-emission mobility system.

2.3

Intelligent E-Fleet Network by Using Real-Time Data

To guarantee maximum efficiency and vehicle utilisation, the basic idea of ACM is to run the vehicle as part of a CITY e-Fleet, whose overall operation is controlled using modern information and communication technologies.

In this system, all units, from the vehicles and battery replacement stations to the end-user apps and operating software, are interlinked and converge within the operator platform. In combination with the battery replacement system, this new sharing approach makes it possible to make the vehicles available to different user groups while at the same time supporting different modes of use.

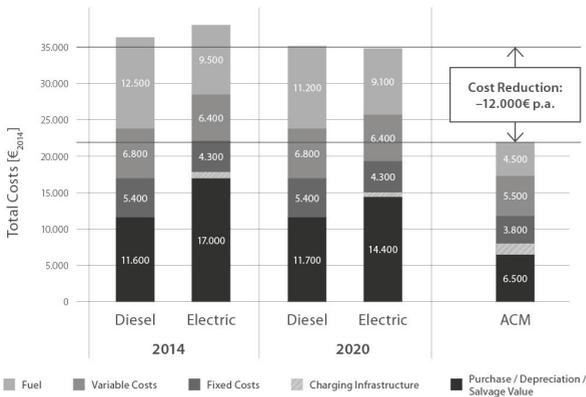
The aim is to maximise benefits and car utilisation by implementing a cross-sectoral concept whose centrepiece is a software system that makes it possible to employ these different modes of application at different billing rates. This way, the same CITY eTAXI can also be eTAXI, eLOG, eSHARE or eTOURI – available for both passenger and cargo transportation.

Business Model and the Reduction Costs

Different studies predict that by the year 2020 electric vehicles will have achieved cost equality compared to conventional cars.⁷ There is especially great potential in high mileage commercial applications where utilisation periods and route parameters are known beforehand.

Apart from this general cost scenario of e-vehicles the ACM business model brings in some additional aspects to reduce the total costs of ownership (TCO). The organisation and operation as a business fleet within cities based on the intelligent network is just one part of it next to the displaying of advertising content, in which operation costs can be reduced even more. The core message “Mobility as a Service” is completely in line with today's zeitgeist of sharing rather than owning.

Figure 2: The reduction of the total cost of ownership of the ACM e-mobility system in comparison to diesel vehicles and electric vehicles in general and the ACM vehicle



4

Outlook and Partners

The technological developments and multiple application scenarios ACM is setting out to realise are ambitious goals. Future transportation must be different from today's and leave the old paths of transport patterns behind.

Not only must the engines powering the vehicles become more environmentally-friendly; a new system is needed in which mobility is a shared and publicly accessible asset, while the different modes of transport are inter-modally linked.

Along these lines, the ACM project offers a new solution targeted at a specific niche segment, presenting neither a car nor a rickshaw but a lightweight vehicle which is part of a business fleet available to all. This system will be piloted in Munich as part of a field test including six to eight vehicles.

The research project is part of the technology program „ICT for Electromobility III: Integration of commercial electric vehicles in logistics, energy and mobility infrastructures“, co-funded by the German Federal Ministry for Economic Affairs and Energy (BMWi).⁸ Only projects with holistic and integrative solutions were chosen.

The partners involved in the project are Ametras rentconcept, the battery assembly centre BMZ, EuroDesign, Fraunhofer ESK, Green City Projekt, PEM of RWTH Aachen University, Plexiweiss, Roding Automobile, Siemens and StreetScooter.

References

- ¹ J. Perschon, Nachhaltige Mobilität. Handlungsempfehlungen für eine zukünftige Verkehrsgestaltung, Policy Paper der Stiftung Entwicklung und Frieden, ISSN 1437-2800, 36 (2012)
- ² M. Held, Nachhaltige Mobilität, Handbuch Verkehrspolitik, ISBN 978-3-531-90337-8, 851-875, Wiesbaden, Springer, 2007
- ³ Wuppertal Institut für Klima, Umwelt, Energie, Von nichts zu viel. Suffizienz gehört zur Zukunftsfähigkeit, Wuppertal Papers, ISSN 0949-5266, 125 (2002)
- ⁴ Gro Harlem Brundtland, Our Common Future, ISBN 0-19282-080-X, Oxford University Press, 1987
- ⁵ Adaptive City Mobility, <http://www.adaptive-city-mobility.de/>, accessed on 2017-01-18
- ⁶ naumann-design, <http://www.naumann-design.de/>, accessed on 2017-01-18
- ⁷ Öko-Institut e.V., Wirtschaftlichkeit von Elektromobilität in gewerblichen Anwendungen – Betrachtung von Gesamtnutzungskosten, ökonomischen Potenzialen und möglicher CO₂-Minderung (Abschlussbericht), Berlin, 2015
- ⁸ Förderprogramm Elektromobilität für IKT III, <http://www.digitale-technologien.de/DT/Navigation/DE/Foerderprogramme/IKT-EM-3>, accessed on 2017-01-18

Authors



Dr. Jessica Le Bris

Dr. Jessica Le Bris is ACM Project Manager at Green City GmbH in Munich and an expert on sustainable mobility and city development. For several years she has been actively dealing with the field of e-mobility and has co-initiated and implemented various projects. Her main focus is on city-friendly, socially-responsible and environmentally-friendly future mobility solutions. She is a geographer who wrote her PhD on electric two-wheelers and has developed economic and political approaches for the diffusion of innovations. Since 2015 she has been with the Green City Projekt.

In the ACM project, Green City Projekt adopts the perspective of users and municipalities. It is responsible for designing field tests and implementing the project in Munich. The focus of Green City Projekt is to encourage and support municipalities and companies on their way to sustainable transformation in order to initiate and to endorse social change in the field of sustainable development for cities, regions and enterprises.

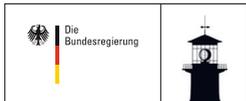


Paul Leibold

Paul Leibold is the initiator of and Technical Project Coordinator at Adaptive City Mobility (ACM). Five years ago, Paul Leibold initiated ACM, built the current partnership and raised funding from BMWi. As early as 15 years ago, the industrial engineer headed micro e-mobility projects for BMW Group. After, he played a significant part in building two successful German e-mobility start-ups.

In the eyes of Paul Leibold, rather than being a mere product solution, e-mobility is a comprehensive system solution consisting of different modules: the electric vehicle, the energy system and an intelligent real-time network. Paul Leibold is convinced that e-mobility will only be able to face the competition coming from combustion engine solutions if the business model both generates more benefits for the environment and becomes more economically viable. This approach is the core idea underlying the Adaptive City Mobility project. Meanwhile, current TCO considerations persistently confirm this hypothesis.

Leuchtturmprojekt der Elektromobilität 2015



IKT FÜR
ELEKTROMOBILITÄT

Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages



riding



SIEMENS

