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Key Findings of German Showcase Region for Electric Mobility: E-Mobility Works! Economic Feasibility and Legal Frameworks as Main Challenges

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Summary

The Showcase Region for Electric Mobility *LivingLab BW*^{e} *mobil* takes place in the two largest cities of Baden-Wuerttemberg in the south-west of Germany. The results of large-scale regional government-funded demonstration projects are described in this paper. Electric mobility works in various use cases and different types of vehicles, but economic feasibility is still a challenge in some use cases. For this reason continuous R&D activities are needed and appropriated legal frameworks help to overcome obstacles and offer incentives.

Keywords: Case Study, Policy, Demonstration, Municipal Government, Federal Government

1 Introduction

In consideration of climate change, technology is a key issue for energy transition. Additionally to electricity and heat, the transportation sector (30 percent of final energy consumption in Germany) is an important part of the so-called *Energiewende*. Electric mobility powered by renewable energy can be the key factor for a clean and sustainable transportation system. Germany's ambition is to become both the top provider and the leading market for electric vehicles. The starting position of Baden-Wuerttemberg as an important automotive region in the south-west of Germany is outstanding: Vehicle manufacturers, automotive suppliers and research institutes corporate to develop and to produce affordable (electric) vehicles. On the way towards sustainable mobility behaviour, the State of Baden-Wuerttemberg was proclaimed as one Showcase Region for Electric Mobility to develop and test new technologies and business models. It was supposed to deal with electric mobility as a system of vehicle technology, energy supply and information and communication technology.

In 2012 four regions in Germany started setting up more than 100 government-funded pilot projects. With the Showcase Region Programme the Federal Government has introduced an instrument of market preparation for electric mobility. The Showcase Regions are large-scale regional demonstration and pilot

projects in which companies, scientific institutes and government can cooperate to try out innovative elements of electric mobility and make it possible for people to really experience them. [1]

Within each system, framework conditions are tested, such as measures through experimentation clauses, and knowledge is gathered concerning e.g. user behaviour, customer needs, infrastructure requirements, coupling of electric vehicles with renewable energies and the effects on the environment and climate. By providing innovative technologies, German supplier companies are able to connect the automotive, the energy and the information and communication technology (ICT) sectors with one another. Therefore introducing electric mobility requires a systemic approach. Project partners combine the expertise across the systems of energy supply, electric vehicles and traffic systems to work on electric mobility solutions.

2 Showcase for Electric Mobility in Baden-Wuerttemberg

In Baden-Wuerttemberg more than 100 partners from industry, science and the public sector focus in 34 individual projects on the question of how electric mobility can be integrated into today's transport system and modern life. The projects of the *LivingLab BW^e mobil* in the region of Stuttgart and Karlsruhe have a total volume of around 110 million euros and are funded with 45 million euros by the Federal Government and with additional 15 million euros by the State of Baden-Wuerttemberg and the Stuttgart Region. Overall, the nine key topics of the *LivingLab BW^e mobil* picture the system of electric mobility: (1) intermodality, (2) fleets and commercial transport, (3) energy, infrastructure and ICT, (4) living and electric mobility, (5) urban and traffic planning, (6) vehicle technology, (7) communication and participation, (8) training and qualification and (9) interdisciplinary research. [2]

The *LivingLab BW^e mobil* proves the practicality of electric mobility, but also identifies needs for further research and development in terms of technology and political framework. Testing of innovative technology solutions is the task of projects concerning hybrid and battery-electric buses, delivery services, aircraft tow tractors, taxi and car sharing fleets, charging infrastructure, company cars and commuting traffic. The key findings of the *LivingLab BW^e mobil* pave the way for market rollout of electric mobility in Bade-Wuerttemberg. The results contribute to the solution of barriers in different fields. The projects were realized between October 2012 and June 2016 and achieved high public visibility of EVs and mobility services in a closed system with strict geographical boundaries: In the region of Stuttgart and the city of Karlsruhe 1,000 charging points were installed. 2,000 EVs were introduced additionally with more than 10 million miles travelled purely electric in total.

3 Results

First of all, the good message: EVs are **suitable for everyday use** and the benefits are clear. Electric mobility works in various use cases and different types of vehicles. Technology has already partially demonstrated itself in everyday life. EVs are on business in projects as corporate fleets, commuter traffic and logistic services. An economical use of EVs in special fleets is possible, if high annual mileages are reachable in spite of determined battery-range. Due to high fixed costs and low variable costs EVs run economically in case of high vehicle occupancy.

An excellent example for enhanced use of EVs in commuter traffic is the project *RheinMobil*. During two years of cross-border traffic between Germany and France seven BEVs drove more than 250,000 miles. The analysis of the total cost of ownership (TCO) indicates the economic breakeven point will be reached after 120,000 miles. The carbon footprint of battery electric vehicles compared with combustion engines is lower after 18,000 miles (green electricity) and 62,000 miles (conventional energy mix) respectively. [3] Consequently commuter traffic and business journeys between defined locations are suitable for the use of EVs. Electrified vehicles for airport ground support as conveyor belt vehicles, container transporters, passenger buses and push-back tractors are demonstrating suitability and up to 80 percent energy savings. The project *eFleet* at Stuttgart airport resulted in a concept for CO_2-neutral means of transportation on the airport apron. In the project *HyLine-S* the municipal transportation service of Stuttgart operates an inner-city bus route with hybrid buses exclusively. 120,000 miles battery electric journey (which means 30 percent of total distance) resulted in 10 tons CO_2 reduction. The electrification of 28 delivery traffic vehicles of three large parcel services was core of the project *Urban Logistics*. Practical suitability and a high ecological potential of EVs for inner-city parcel delivery are encouraging results.

Charging infrastructure is necessary to overcome range anxiety and therefore psychologically important. Easy access to charging points in public and semi-public areas is a precondition for a comprehensive introduction of electric mobility. For the moment setting up charging infrastructure is funded by government or municipalities. Construction and operation of charging infrastructure became parts of several *LivingLab BW^e mobil* projects. As a result hundreds of charging stations are installed in public and semi-public places such as car parks in the project *InFlott*. More than 85 percent of charging processes take place at home or at work. For this reason, projects as *Get eReady* and *charge@work* set up a remarkable number of charging opportunities for employees and private customers in private and semi-private spaces. The electric taxi project *GuEST* identified technological, economic and social determinants for the transition of EVs. One main success factor would be the availability of exclusive DC charging infrastructure nearby airports, train stations and other points of interest. Furthermore the project *InFlott* demonstrates the integration of charging infrastructure as part of an intelligent energy and charging management system. Moreover different payment solutions and e-roaming technologies are tested to increase the usability of the charging infrastructure. The e-roaming practice guide explains the technological requirements for national and international roaming

solutions. [4] The free-floating car sharing system *car2go* with a fleet of 500 EVs ensures the visibility of electric mobility in the city center of Stuttgart. By the way setting up a tight charging infrastructure with 500 public charging points in the project *ALIS* was a required enabler for this success story.

On the one hand further investments by the private sector are still needed; on the other hand the operation of charging points in public areas is still far away from profitable. Business models for charging infrastructure are still not convincing. By the way charging infrastructure isn't part of public services of common interest. The role of public authorities is limited to funding infrastructure, which is obviously crucial during the so-called market roll-out of electric mobility.

Municipalities are catalysts for electric mobility in terms of fleets, charging infrastructure and privileges for EVs. Considering environmental impacts of increasing volume of traffic the advantages of electric mobility are larger than previously assumed. Projects as *Stuttgart Services*, *E-Bike-Stations* as interconnected mobility service and *Ludwigsburg Intermodal* developed sustainable mobility products and services. Electric mobility plays an important role for the construction of intermodal nodes as trains stations and park & ride sites. Innovative business models for smart mobility services in cities, e.g. free-floating or stationary car sharing fleets, are developed and ready for use. In addition to activities in urban areas large parts of Baden-Wuerttemberg are rural areas. The *Toolbox for Electric Mobility* for small and medium-sized towns clarifies elementary processes, instruments and measures to set up charging infrastructure, to electrify fleets of public authorities and to integrate electric mobility into sustainable town planning. [5]

Public administrations and municipal energy supplier recognise the need for action in these different fields. Political makers are local role models regarding their own mobility behaviour and leading the way of towns and regions into readiness for electric mobility. The Electric Mobility Act enables municipalities to introduce privileges for EVs with special registration plates. Entering the market start-up phase the German Electric Mobility Act gives consumers incentives to purchase an electric vehicle, for instance with free parking and special access rights. Many cities in the Showcase region already implemented the act. Due to the key findings of implementation projects with cities and municipalities it seems important to enable local authorities to create appropriated conditions for a market roll-out of EVs and electric mobility products and services.

Appropriated legal frameworks help to overcome obstacles and offer incentives. Apart from the Electric Mobility Act one of the first measures to foster electric mobility in Germany was the Motor Vehicle Tax exemption for EVs. Some Showcase *LivingLab BW^e mobil* projects helped to create and adopt the legal frameworks. Promoting conditions for the electrification of fleets are adaptations of the directives on public procurement. The federal state government implemented a fund for public procurement of EVs called *Landesfuhrpark*. Thus 94 battery electric and plug-in hybrid vehicles and 368 pedelecs have been included in

the fleets of public administrations during the project. Furthermore, several projects identified demands of legal regulations on state and federal level in Germany.

Facilitations in the areas of Tenancy and Residential Property Law are in preparation. The project *Living and Electric Mobility in the Urban Quarter Rosensteinviertel* integrated an electric bike and car sharing system as a sustainable mobility service for residents. In the course of the project recommendations on adapting the model building code, e.g. rules on the required number of parking spaces per accommodation unit, were developed. One important suggestion is to equip at least 25 percent of newly built parking facilities with charging infrastructure. Some legal barriers for EV owners are still to be solved, for example installing charging infrastructure at existing buildings is considered as structural change of property. This means that occupants with EVs cannot set up charging infrastructure without consent of the owner association. An exemption clause in the Law on Property is in preparation.

Summarising many projects contributed to adaptions of draft law or implications in legal sectors. In particular amendments in the following fields of law are required: tax law, energy law, road traffic law and building and planning law. Regulative frameworks, e.g. in the case of charging infrastructure in buildings, will pave the way for the large-scale introduction of EVs.

Without a doubt the main obstacle of the 34 projects in the *LivingLab BW^e mobil* are uneconomic conditions. In general **economic feasibility** of electric mobility is still a challenge, especially in terms of business models, operational capability, procurement, and consumer prices. Further development of technologies in terms of battery and storage will help to overcome obstacles such as range and vehicle prices. Thus continuous research and development activities concerning EVs are needed to achieve cost reduction. Consequently in addition to the *LivingLab BW^e mobil*, research is also being done in the context of the leading-edge *Cluster Electric Mobility South-West*, which is funded by the Federal Ministry of Education and Research. Here, in various projects on the industrialisation of electric mobility, around 100 partners are exploring the enormous opportunities in regard to economic development and labour market. The effects of the Showcase and the leading-edge Cluster complement each other perfectly. The State Government of Baden-Wuerttemberg is going on to support these activities beyond the duration of the Showcase Programme. [6]

References

[1] Gemeinsame Geschäftsstelle Elektromobilität der Bundesregierung. Introducing the Showcase Regions for Electric Mobility, 2014.
http://www.e-mobilbw.de/de/service/publikationen.html

[2] e-mobil BW. LivingLab BW^{e} mobil. Die Projekte des baden-württembergischen Schaufensters Elektromobilität stellen sich vor, 2014.
http://www.e-mobilbw.de/de/service/publikationen.html

[3] Karlsruher Institut für Technologie. LivingLab BW^{e} mobil. RheinMobil. Über 300.000 Kilometer unter Strom, 2015.
http://digbib.ubka.uni-karlsruhe.de/volltexte/documents/3644057

[4] Deutsches Dialog Institut. Begleit- und Wirkungsforschung Schaufenster Elektromobilität. Good E-Roaming Practice.
http://schaufenster-elektromobilitaet.org/media/media/documents/dokumente_der_begleit__und_wirkungsforschung/Ergebnispapier_Nr_5_Good_E-Roaming_Practice.pdf

[5] Universität Stuttgart Städtebau Institut. EMiS. Toolbox für Elektromobilität in Mittelstädten.
http://www.goeppingen.de/site/Goeppingen-Internet/get/params_E-1065019312/11042723/EMiS_Toolbox_Elektromobilitaet.pdf

[6] e-mobil BW. LivingLab BW^{e} mobil. Das Schaufensters Baden-Württemberg elektrisiert. Ergebnisse. Erkenntnisse. Ausblick, 2015.
http://www.e-mobilbw.de/de/service/publikationen.html

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