e-mobility NSR

NORTH SEA REGION ELECTRIC MOBILITY NETWORK

FINAL RESULTS
2011 - 2014

European Union The European Regional Development Fund

The Interreg IVB North Sea Region Programme

EDITORS

Prof. Dr. (mult.) Dr. h.c. (mult.) Walter Leal
Franziska Mannke
Kathrin Rath

Hamburg University of Applied Sciences,
Faculty of Life Sciences,
Research and Transfer Centre
"Applications of Life Sciences"

CONTACT

Hamburg University of Applied Sciences
(HAW Hamburg) Research and Transfer Centre "Applications of Life Sciences"

Prof. Dr. (mult.) Dr. h.c. (mult.) Walter Leal
Ulmenliet 20
21033 Hamburg
Germany

Email: e-mobility@ls.haw-hamburg.de
Project website: www.e-mobility-nsr.eu

COLLABORATING AUTHORS

WP1+2
Lead Franziska Mannke, Kathrin Rath
HAW Hamburg, GER

WP3
Lead Jan Jacob Trip
Delft University of Technology, NL

WP4
Lead Martin Borgqvist
Lindholmen Science Park, SWE

WP5
Lead Sidharta Gautama
Gent University, BE

WP6
Lead Steen Olesen
Municipality of Høje-Tåstrup, DK

WP7
Lead Michael Stie Laugesen
FDT – Association of Danish Transport and Logistics Centres, DK

YEAR

2014

EXECUTIVE SUMMARY

This results booklet offers a compact overview of the INTERREG IVB North Sea project "North Sea Electric Mobility Network", in short E-Mobility NSR, and its achievements over the past three years of transnational collaboration. The project fulfilled all its deliverables on time and within budget. With its 11 partners, the international consortium has established networks and collaborated with local authorities, government offices, universities, NGOs, SMEs and further stakeholders, and has, through its work, contributed to a better awareness of e-mobility in the NSR.

However, electric vehicles remain in their early years. The electrification of the transport sector is an ongoing, dynamic process where certain variables and contexts change rapidly. This is true for both the development and deployment of electric vehicles (EVs) and the charging infrastructure as well as for certain policy developments. Consequently, making long-term plans on the subject of dynamic e-mobility is a challenging task.

The realization of a public recharging infrastructure is a prerequisite for the adoption of electric vehicles (EVs). However, the implementation of electric mobility, most notably of the charging infrastructure, has to take into account relations between various scale levels (micro to macro level), the characteristics of the built environment, existing travel patterns, and the interests of the various stakeholders involved. Regarding the physical charging infrastructure, interoperability issues remain. A stimulating infrastructure build-out in strategic locations could increase the possibilities for transnational EV travel.

With regard to policies regarding the transition to electric mobility, attention should be paid to the dynamics between the different governance levels. Concerning smart grids, there is an on-going need to combine the actions of all the connected actors, energy producers and consumers, as well as the distributors in order to benefit from the EVs, and to make the overall system more efficient, sustainable, reliable and safe. Technological developments will positively influence the quality and costs of e-mobility, but efforts should also focus on transforming user behaviour.

Concerning charging, E-Mobility research findings suggest that fast charging may not be essential for the introduction of EVs, normal charging seems sufficient. There seem to be other factors more important for scaling-up e-mobility.

A lack of awareness and information gaps remain barriers to a large scale implementation of EVs. Electric mobility information centres have the potential to be central points of awareness generation, information dissemination and learning about sustainable travel behaviour.

For urban freight transport, electric freight vehicles are a feasible solution, especially for last mile deliveries, where the route is somehow fixed and structured around deliveries in urban areas. EVs include a set of functionalities that are advantageous for companies which perform freight deliveries in urban areas: low emissions, silent driving, good acceleration, manoeuvrability and easiness to use.

The tasks performed within the E-Mobility NSR project were structured within seven work packages. The contents of this booklet follows the structure of the project tasks and provides a compact review of the results and deliverables. Further information about E-Mobility NSR and all project publications as well as a comprehensive collection of conference and seminar presentations are freely accessible, also subsequent to the project closure, on the project website at

e-mobility NSR

The area of electric mobility (e-mobility) is a fast growing field and one of great strategic value to the North Sea Region (NSR). Several cities and regions in the NSR are seeking to develop strategies and action plans to stimulate electric mobility and encourage the use of electric vehicles in Europe and beyond. However, these activities are not fine-tuned or interlinked, meaning valuable human and financial resources are not being put to full use. This may limit the concept of electric mobility to individual cities or regions and constrain the use of e-mobility to these cities or regions, suggesting an untapped potential and indicating that many opportunities for further development and growth of this future key mobility sector remain as yet unexploited.

Against this background, the INTERREG IVB North Sea project "North Sea Electric Mobility Network", in short: E-Mobility NSR, was developed and implemented. The project aimed to help to create favourable conditions to promote the common development of e-mobility in the North Sea Region in order to foster current and future developments, paying due attention to its links with both freight and logistics. Moreover, the project aimed at connecting various existing networks and creating a transnational 'backbone' within the NSR to increase accessibility in the region and allowing travel in electric vehicles within the NSR more easily. E-Mobility NSR also contributed to unlocking the potential for investments in the field. In particular, E-Mobility NSR published state-of-the-art information that may support policy development in e-mobility in the North Sea Region. The project consortium also provided latest insights on the gaps and needs in respect of infrastructure, freight logistics, and preliminary standards for multi-charging techniques.

Ultimately, the project outputs may contribute to providing a long-term basis upon which regional and local governments as well as other relevant stakeholders in the NSR may engage on e-mobility.

E-MOBILITY NSR IN A NUTSHELL

PROJECT CONSORTIUM:

11 organisations covering all countries in the North Sea Region: Belgium (Flanders Region), Denmark, Germany, Netherland, United Kingdom, Norway, Sweden

The partnership includes universities, economic development agencies, cities, local and provincial governments, NGOs and public enterprises (see back cover)

LEAD PARTNER:

Hamburg University of Applied Sciences, Germany

PROJECT DURATION:

1/10/2011 – 30/09/2014

TOTAL PROJECT BUDGET:

EUR 6.693.532 (ERDF EUR 3.239.466)

PROJECT WEBSITE:

www.e-mobility-nsr.eu

MAIN PROJECT OBJECTIVES:

- Provide state-of-the-art information on e-mobility in the NSR
- Provide insights on gaps and needs in the field of e-mobility in the NSR
- Develop a NSR smart grid concept with charging points supporting e-mobility in the NSR
- Integrate the urban freight logistics dimension into the e-mobility network, promoting better accessibility and cleaner cities

WP 1 & WP 2

LEAD
HAW HAMBURG

PROJECT MANAGEMENT / PUBLICITY & COMMUNICATIONS

CONTEXT & SCOPE

Framing the content work of the other work packages, these two work packages ensured the sound project implementation and international promotion of project activities and results. Led by Hamburg University of Applied Sciences, work package 1 entailed the overall management and coordination in terms of operations and finances. Work package 2 focused on the wider promotion of the project and its results both within the NSR and outside it.

ACTIVITIES

Whereas the first work package facilitated the successful project implementation on overall level, the second work package ensured an effective multi-channel promotion and communication of the activities and results, including social media. Large international conferences, specialist seminars and other public information events facilitated networking and the exchanging of experiences on multiple levels.

OUTCOMES AND MAIN FINDINGS

E-Mobility NSR has successfully fulfilled all of its deliverables on time and within budget. Well known beyond the NSR, the project has established and extended networks and collaborated with local authorities, government offices, universities, NGOs, SMEs and further stakeholders and has, through its work, contributed to a better awareness of e-mobility in the North Sea Region. For the lead partner, it was a pleasure to work with a project consortium comprised of such experienced, professional partners. Moreover, the established partner network is committed to carry on its work in e-mobility and related fields within the scope of new project endeavours.

OBJECTIVES WORKPACKAGE 1

- **Project Management and quality assurance**
- **Partner Reporting and Monitoring**
- **Cross-sectoral engagement**

OBJECTIVES WORKPACKAGE 2

- **Publicity and communication strategy**
- **Multi-language communication measures**
- **Transnational dissemination**

E-outreach tool: project website with social media functionality

WP 3 | LEAD TU DELFT

STATE OF THE ART INVENTORY & STAKEHOLDER ANALYSIS

Gathering expert insights in the Group Decision Room

CONTEXT & SCOPE

Within the project E-Mobility NSR, this work package focused particularly on the governance and spatial aspects of the transition to electric mobility on the local and regional level. On the one hand, this provided a sound knowledge base for project operations; on the other hand it also resulted in a number of insights and recommendations for policy in this field.

Suitable scientific research methods such as surveys, quantitative analysis, policy analysis and interactive expert meetings (applying for example a Group Decision Room method) were applied in order to gather information and generate research findings.

OBJECTIVES

- **Mapping and analysis of existing policies and practices regarding the transition to electric mobility**
- **Exploring various issues related to the implementation of electric mobility in the built environment**
- **Gaining insight in the specific roles of public and private actors**
- **Analysing the potential for electric mobility on the basis of consumers' travel behaviour**

Charging infrastructure in Sweden

ACTIVITIES

The work package entailed the following activities:

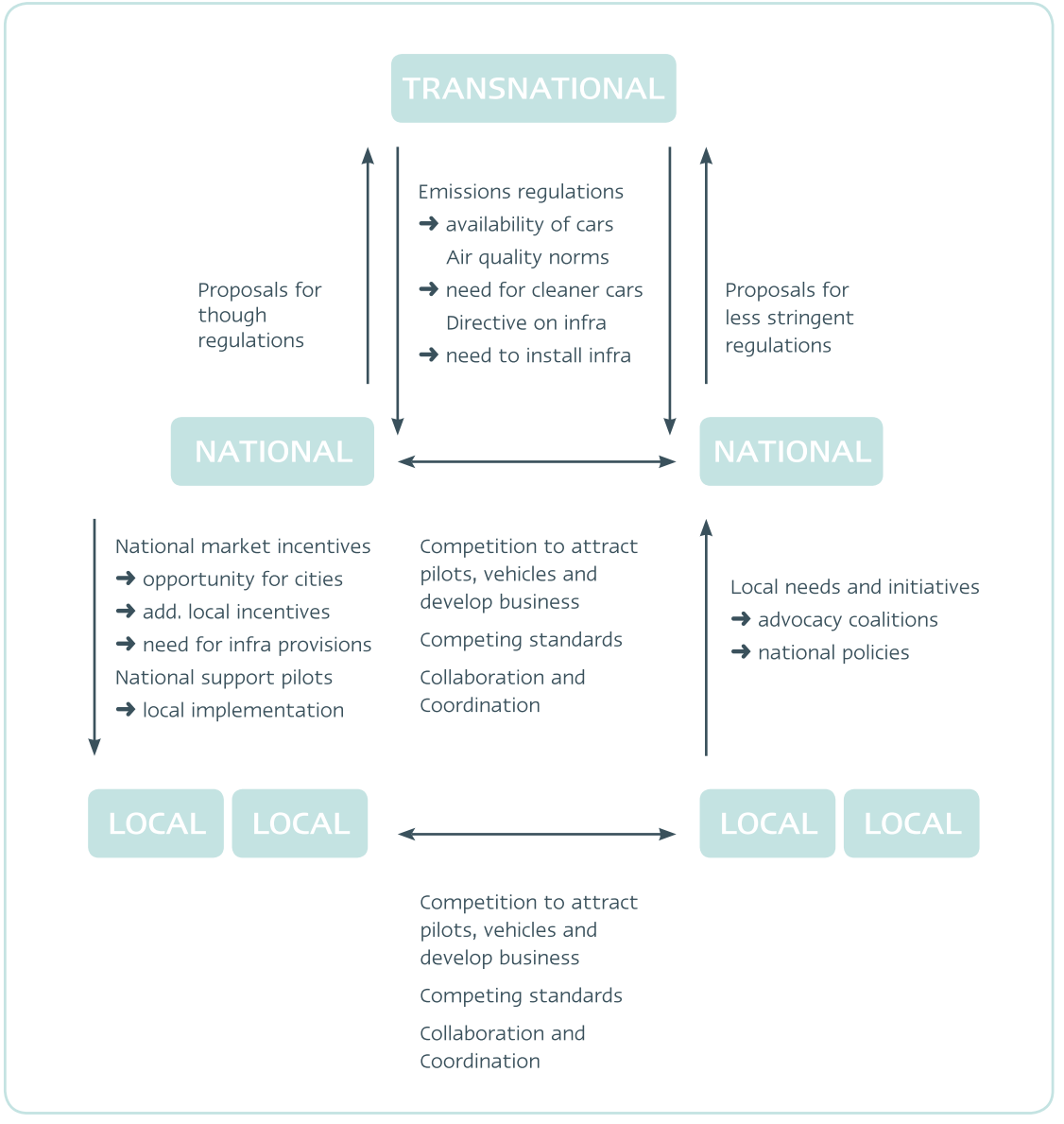
- a stakeholder analysis
- an inventory of the state of the art regarding e-mobility policies in partner countries as well as on the European level
- an expert meeting including local policy makers from partner cities
- an analysis of the implementation of charging infrastructure on the macro and micro level, and the relations between these levels
- a study of the governance complexity related to the transition to e-mobility
- in-depth papers and discussion meetings on the spatial and policy effects of e-mobility
- an analysis of consumers' preferences regarding e-mobility

OUTCOMES AND MAIN FINDINGS

This work package resulted in a series of reports dealing with the above topics, as well as a number of publications in academic and professional journals and presentations at workshops and conferences which can also be found on the project website.

The realization of a public recharging infrastructure is a prerequisite for the adoption of electric vehicles (EVs). Even though most EV drivers charge their cars at home or at the office, a public recharging infrastructure is necessary for those without private parking facilities and for ad hoc charging during trips. The implementation of electric mobility, most notably of charging infrastructure, has to take into account relations between various scale levels (micro to macro level), the characteristics of the built environment, existing travel patterns, and the interests of various stakeholders involved. An example of this is the dependence on public charging points, which differs between various types of urban environment and may considerably influence the possibility for consumers to shift to electric mobility.

INDICATIVE SCHEME OF MULTI-LEVEL DYNAMICS IN POLICY-MAKING REGARDING ELECTRIC MOBILITY



With regard to policies regarding the transition to electric mobility, attention should be paid to the dynamics between different the governance levels.
Such multi-level dynamics raise, for example, the question if and to what extent conflicts of interest between policies at different levels may emerge, and whether this triggers competition, or rather cooperation between policies and governmental bodies at the same or at different levels. It may also give rise to the question whether and to what extent such issues actually hinder the effective development and the implementation of policies to stimulate the use of EVs. Local and regional policy-makers have to implement, for instance, a sufficient charging infrastructure, but are confronted with policies and ambitions on the national and European levels at the same time.
As the number of EVs continues to rise, issues such as the above become more manifest. Moreover, some existing policies to increase electric mobility have to be reviewed, while alternative ways are explored to 'nudge' consumers towards electric mobility.

WP 4 LEAD LINDHOLMEN SCIENCE PARK

FACILITATING TRANSNATIONAL E-MOBILITY

CONTEXT & SCOPE

The purpose of the work within this work package has been to provide state of the art information as well as insights on the gaps and needs regarding e-mobility and charging infrastructure. Its scope consisted of creating knowledge through research, demonstration and simulation activities, as well as sharing experiences and knowledge with stakeholders through workshops and conferences as a means of co-learning and dissemination of best practices.

OBJECTIVES

- **Research, create knowledge and develop tools related to mapping needs and route planning for EV**
- **Produce project reports, conference contributions, and journal articles and guidelines within e-mobility**
- **Create knowledge related to charging infrastructure**
- **Facilitate the exchanging of competences between stakeholders in e-mobility**

ACTIVITIES

The work package has had two main areas of focus: the charging infrastructure, involving actual tests and evaluation of state of the art(technology and standardisation), and mapping methods, route planning concepts and spatial analysis of e-mobility. Within these two main areas, a number of activities have been performed, ranging from research to demonstration and dissemination:

- Research focusing on map based tools for infrastructure investigations, gap analysis and route planning on the macro level as well as on the street level
- Research on the spatial analysis of e-mobility and charging infra structure planning
- Research on the standardisation process for the charging infra structure
- Subsidisation and implementation of fast chargers in North Holland
- Demonstration and tests of fast chargers in Gothenburg
- Lobbying and monitoring of e-mobility on a national level
- Lobbying and monitoring of e-mobility on a national level
- Monitoring of e-mobility activities, progress and developments within the North Sea Region, as well as joint discussions and the synthesis of findings through all partners

OUTCOMES AND MAIN FINDINGS

The electrification of the transport sector is an ongoing, dynamic process where some variables and contexts change rapidly. This is true for both the development and deployment of electric vehicles (EVs) and the charging infrastructure, and also for some policy developments. Consequently, findings can quickly become outdated, and conditions are subject to change. This means making long-term plans and providing specific recommendations on the subject of dynamic e-mobility is a challenging task.

The EV market is emerging, with a large increase in annual sales, but from very low levels. Markets like Norway and the Netherlands are ahead of the rest. This is due to the combination of attractive EV models available to purchase, fiscal and other incentives for EVs, as well as efforts to build out the charging infrastructure.

The main developments within the charge infrastructure area have been the standardisation of normal charging and the introduction of fast charging. Experiences from demonstration activities in Gothenburg suggests that available chargers were immature in terms of maintainability, certification, winter performances and adaption to national safety praxis. Moreover, the high cost associated with the establishment of a charging site ruins most of the business cases. A

"In 80 hours around the NSR" EV rally, at London Metropolitan University, UK

EV rally driver Frank Manders

Elisabeth Post, Vice Governour of the Province of North Holland

user study highlighted the location of chargers as determination of behavioural pattern. General public locations may have a limited effect on individual EV users. However, from a company perspective, fast charger may be useful as it directly influence the efficacy of the usage of EVs. Finally, no actual proof was found indicating that fast charging is essential for the introduction of EVs, and the „Denmark syndrome", compared with the „Norwegian success", indicates that there are other forces that are more important.

Today it is possible to travel longer distances with an EV between NSR countries, as proven by the NSR rally, which managed to travel in less than 80 hours from London to Oslo – yet it remains an effort that requires a lot of planning. The main reasons for this are the lack of physical infrastructure, the lack of comprehensive information on charging locations and the lack of interoperability between the charger networks. However, the first operators are now beginning to cooperate and to offer their customers convenient roaming services for transnational travel with only one charging card. Concerning standardization, an EU standard has been defined (although formally only proposed). However, in practice, many other standards are still in use in the NSR and this will continue to be the situation for the coming years.

All in all, the key to developing a comprehensive and inter-operable charging network is knowing where the infrastructure gaps in the region are and where user needs are not catered for.

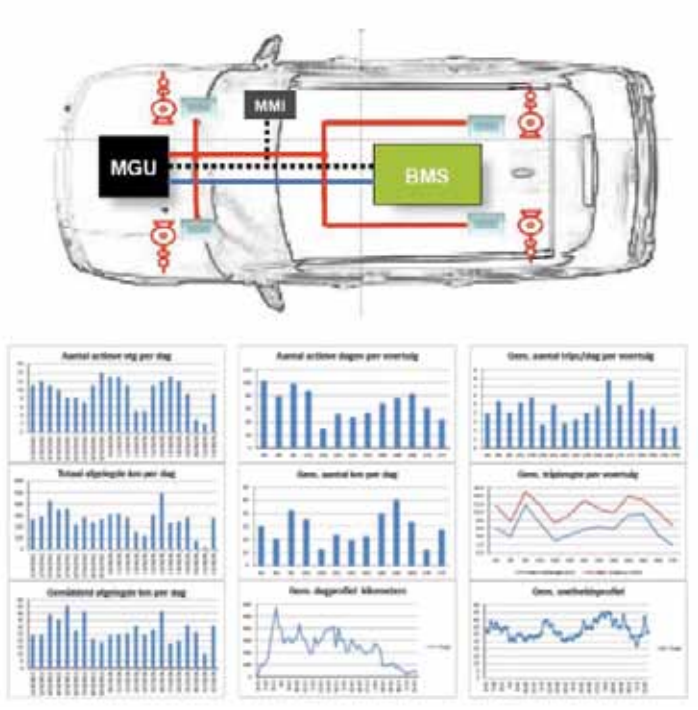
SMART GRID SOLUTIONS

CONTEXT & SCOPE

The scope of this work package on smart grid solutions comprised the development of new smart grid models for supporting sustainable electric mobility in the NSR region. Its rationale arose from the need to combine the actions of all of the connected actors, energy producers and consumers, as well as the distributors in order to benefit from the EVs and to make the overall system more efficient, sustainable, reliable and safe. The collaborating partners developed several activities for analysing the interactions between electric mobility - in terms of the vehicle performance, batteries, battery management systems (BMS), transportation service, users' behaviour, etc. - and the electric grid – in terms of the charging stations, metering, Vehicle2Grid-applications and other grid connections (see Figure right).

OBJECTIVES

- **Develop a NSR smart grid concept with Vehicle2Grid applications in order to support the e-mobility development.**
- **Produce project reports, conference contributions, journal articles and IT simulation tools in the field of users' behaviour**
- **Test existing EVs and batteries, and develop tests about users' behaviour**



Various insights gained through laboratory and field tests

ACTIVITIES

The work of the partners focuses on three main topics:
1) Lab and field tests on EVs and demonstrations
2) Monitoring & analysing battery issues and applications
3) Assessment of smart grid solutions

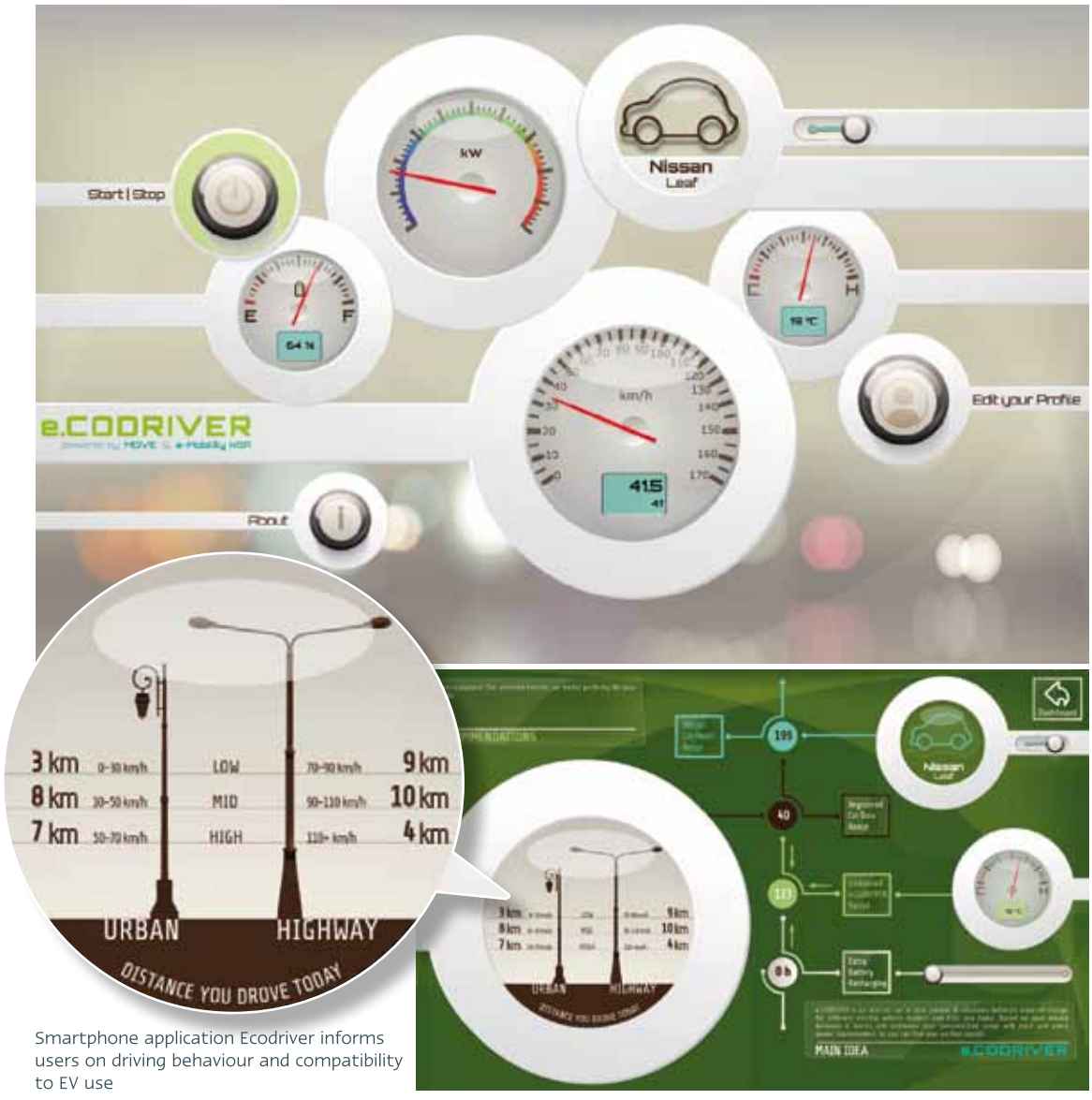
Within these three areas a number of activities have been performed, ranging from research to demonstration and dissemination, for example:

- Laboratory tests on battery powered electric vehicles (BEVs), in particular Think! City, Mitsubishi i-Miev, Renault Kangoo ZE and Nissan Leaf, establishing a reference framework for the tests which classifies significant vehicle parameters, also through accurate freewheeling tests. Results were collected in a report and the data series in a DVD, complemented by several academic theses
- Field tests on BEVs and e-Buses, with the scope of measuring EVs storage capacities, their charging needs and their energy consumption in different weather conditions and usages
- One-year car sharing field test in small communities (so-called co-housings) has been conducted. To evaluate trip behaviour, EVs were monitored and their position mapped in real-time by using an application for GPS-logging
- Feasibility study of a solar powered road by PNH
- Demonstration activities on e-Buses
- Danish experiences in setting up charging infrastructure for EVs with a special focus on battery swap stations
- Smartphone application which defines consumer behaviours for e-mobility and simulates preferred behaviours, to be used in many different contexts
- Applied research on the "Current and future development of battery technology and its suitability within smart grids"
- Analysis and report on the battery innovation state-of-the-art
- Assessment of different models of smart grid. Based on a selection of different battery user profiles and a consumer segmentation, a distinctive model has been defined and tested
- Smart grid micro model. The model is characterized by input from the grid and renewable energy sources (RES) injecting energy, a classic load consuming energy and a double charging station for two electric cars

Monitoring trip behaviour
in Gent; smart phone app

OUTCOMES AND MAIN FINDINGS

The WP5 has produced several reports on both the procedures for testing vehicles and the tests themselves, defining comprehensive metering systems and more information about EVs and battery performances and charging needs. Moreover, a demo of a smart grid has been realised for testing the interaction among EVs loading, the input from the grid, a RES injecting energy, and a classic load consuming energy. Finally, the majority of the data collected have been synthesized in a software application, which simulates different users' behaviour on the basis of a segmentation approach. In fact, WP5 outcomes demonstrate the importance for e-mobility for satisfying different user segments, with a reliable and flexible approach.



Smartphone application Ecodriver informs users on driving behaviour and compatibility to EV use

ELECTRIC MOBILITY INFORMATION CENTRES

Mobile EMIC on outdoor mission


Virtual EMIC featuring different use cases

CONTEXT & SCOPE

The purpose of this work package has been to plan, prepare and establish E-Mobility Information Centres (EMICs) and to share transnational experience and learning within the North Sea Region and beyond. The main objective of WP6 has been to analyse and understand the E-Mobility information gaps among private, companies and public authorities and to document ways of bridging these gaps with independent, valid information made accessible through EMICs.

OBJECTIVES

- **Mapping of private/public E-Mobility information gaps and awareness needs**
- **Showcasing E-Mobility market solutions and promoting the North Sea Region as a sustainable region through exhibitions, expert sessions, demonstrations and campaigns**
- **Preparation, dissemination of EMIC set-up guide**
- **Preparation and establishment of both virtual and psychical EMIC**
- **Increasing private/public E-Mobility awareness through public events, exhibitions, demonstrations and dissemination**

ACTIVITIES

In its initial phase, the work package focussed on generating the necessary knowledge and insight platform to enable the development of EMICs. The main activities relating to this phase were as follows:

- Stakeholder analysis to identify relevant private/public entities with the ability to contribute to the development of EMICs
- E-Mobility awareness and information gap analysis
- E-Mobility awareness and Strategy and recommendations for establishing virtual and physical EMICs

The second phase of this work package focussed on the development of physical and virtual EMICs. The main activities relating to this phase were as follows:

- Development and launch of a virtual (web-based) EMIC – www.elbiler.nu – including general E-Mobility information, targeting both private companies and public institutions, case stories from EV users as well as a Total Cost of Ownership (TCO) and CO2 calculator enabling users to estimate financial and environmental impacts of shifting from fossil cars to electric vehicles.
- Development and launch of a physical, mobile EMIC with general E-Mobility information addressed to private, companies and public institutions and on-line access to the virtual EMIC. The mobile EMIC booth is represented by an EV expert to answer questions

The government help desk of the Met

and to offer test drives in an electric vehicle, as part of the mobile EMIC set-up
- Establishing further EMIC service points in selected partner countries

The third phase of the work package focused on creating awareness, disseminating results, and knowledge sharing. The main activities relating to this part of WP6 were as follows:
- Transnational EV conferences, for example on the theme of "Electric vehicles – what needs to be done from the user perspective", with the participation of all E-mobility NSR beneficiaries, representatives from Interreg IVB and public visitors
- Participating in and hosting of a number of public EV events throughout the NSR by all partners
- Recommendation report on the establishment of EMICs in the NSR

OUTCOMES AND MAIN FINDINGS

Electrical vehicles remain in their early years. Not all mobility needs can (or should) be satisfied with electric vehicles at present – and even within relevant EV target groups one may find an evident lack of awareness and to some extent even a certain prejudice towards EVs. Among the relatively few who are aware of the EV opportunities and fond of driving electric vehicles, there remains a predominant information gap – it is very difficult to find independent, valid answers to distinctive EV questions should you be considering a shift from fossil cars to electric vehicles. The use cases and additional information and tools promoted by the virtual EMIC can be viewed as being appropriate technology to tailor information to the specific needs of potential EV drivers, fostering the awareness of the opportunities electric mobility can provide today and in future.


Expert panel


Best practice lecture, international conference


Interactive dialogue during expert meetings

PROMOTING EFFICIENT AND EFFECTIVE URBAN FREIGHT LOGISTICS SOLUTIONS IN ENHANCING REGIONAL ACCESSIBILITY

e-freight bike replacing a truck in Hamburg, 2014


M. Stie Laugesen at the last international CUFLOS event in Hamburg, 2014.

CONTEXT AND SCOPE

To pave the way for a further introduction and market uptake of electric vehicles used for urban freight transportation, this work package pursued the following objectives:

OBJECTIVES

- **Integration of the urban freight logistics dimension in the E-mobility network**
- **Promotion of cleaner and more efficient city logistics soltions based on the utilisation of EVs**
- **Communicating results to the respective national ministries, regional and local authorities and the freigh transport industry**
- **Ensuring transnational cooperation through activities covering the NSR partner countries**
- **Providing a long-term basis for E-Mobility in the NSR**

CONTEXT AND SCOPE

When developing solutions for electric vehicles, a combined focus on both electrified car solutions and electrified urban freight solutions is an obvious opportunity – this theme is at the heart of this work package. According to the EU White Paper for Transport (COM11, (2011) 144 Final) the European Union intends to cut the overall EU greenhouse gas emissions from the transportation sector by 60% by 2050 compared to 1990 levels. For urban freight transportation the goal is to achieve city logistics in major urban centres that are essentially CO2-free by 2030.

Today, electrified urban freight solutions can already be offered in many ways, e.g. by consolidating goods in logistics centres and transport hubs, where transhipment onto electric vehicles can be performed outside the core area of the city. In this context, the introduction of more quiet, environmentally friendly and efficient distribution methods may benefit the inhabitants of urban centres, the environment and the transport service providers as well.

Electric vehicle at the ZERO conference, E-Mobility NSR/FDT 2012

„Toll's Electric Vehicle" by Toll Group / https://www.flickr.com/photos/105603959@N08/13616240414/in/photostream/

ACTIVITIES

- Integration of EU policies into plans and programs
- Outlining urban mobility and electrified logistics concepts in the EU policy context
- Comparative analysis of European examples of utilizing EVs for freight
- Creation of action plans for sustainable city distribution with EVs
- Promotion of clean urban freight logistics solutions through the CUFLOS forum

A core focus in all deliverables has been a transnational view on the activities and findings. Each of the activities has resulted in reports, papers or action plans, which are publically accessible on the project website. In addition, the findings of most activities have been discussed at transnational workshops and at CUFLOS events which were organised together with the E-Mobility partners.

One of PostNord's 50 EVs, © PostNord E-Mobility NSR int. conference 2013

OUTCOMES AND MAIN FINDINGS

The main finding of this work package is that electric freight vehicles are found to be feasible for urban freight deliveries, especially for last mile deliveries, where the route is somehow fixed and structured around deliveries in urban areas.

Last mile deliveries performed between distribution centres and sales points and/or final customers are suited to the use of electric vehicles, as the functionality of the electric vehicles includes low emissions, silent driving, good acceleration, manoeuvrability and ease of use – all factors that are advantageous for companies which perform freight deliveries in urban areas. Urban consolidation centres with direct access to the TEN-T network and the utilisation of electric vehicles for urban freight deliveries can improve the environmental footprint of the deliveries while satisfying future EU requirements on emissions. In addition, the use of electric freight vehicles enables the use of night deliveries, as the electric vehicles are silent and therefore could be allowed to deliver during night hours.

A current constraint is the fact that the low payload, range (battery capacity) and total cost of ownership of the electric vehicles may cause some delays to an extensive market uptake of the vehicles. However, for the urban freight delivery field, many transport companies which use electric vehicles consider these complications to be minor when compared to the benefits of using the electric vehicles.

CONCLUSIONS

In the scope of the overall project, the following conclusions may be drawn: in each of the seven countries around the North Sea Region, stakeholders have taken up different roles and have adopted different strategies regarding the implementation of electric mobility. These differences relate to national and regional ambitions and subsequent policy measures, as well as to the structure of the energy sector and prevalent electricity production methods.

- A set of countries have created conditions for the emergence of nation-wide networks of regular and (semi-)fast chargers and the emergence of dedicated start-up companies, primarily by stimulating EV adoption through financial incentives for consumers and businesses and complementary support for infrastructure build-up, often by local branches of government. In these countries, enough momentum was created to trigger a wide variety of stakeholders to engage with electric mobility.

- Another set of countries rather concentrated their efforts in regional networks in order to realize a critical mass on a local level. Even though the conditions for technological innovation and learning are in place there, too, the momentum needed to realize a nation-wide recharging infrastructure has not yet been achieved. This also means that not enough stakeholders have experienced a sense of urgency to engage themselves with EVs and EV infrastructure at this point of time.

- Concerning transnational EV travel, efforts that would increase the possibilities for transnational EV-travel include a stimulating infrastructure to be built out in strategic locations. For example, for the route between Newcastle and Oslo, locations with gaps in their fast charging infrastructure that still need to be filled include North-Western Germany and Western Sweden. Moreover, solutions that allow drivers simple and convenient access to different charger-networks (roaming) may need further support and development. Finally, a comprehensive and up-to-date information detailing the charger locations and operations is a necessity for smooth travelling.

- Regarding the physical charging infrastructure there are still interoperability issues related to the fact that different plugs and sockets exist throughout the regions. The proposed EU-standard on the charging infrastructure will address this and will probably reduce this barrier in the years to come.

- The technological development will positively influence the quality and costs of e-mobility, but the main effort must be to change the culture and consciousness of the users. All of the laboratory tests undertaken in the frame of E-Mobility NSR emphasized a certain distance between the expected and real performances. The cohousing field-test demonstrated the feasibility of small-scale initiatives and their potential to shift from “economies of ownership” to “economies of access”, which should form the basis of a smart, sustainable way of living.

- A lack of EV awareness and information gaps are clearly barriers to a large scale implementation of EVs. Therefore, generating EV awareness and the supply of EV information needs to complement other EV incentives (such as financial incentives, development of charging infrastructure etc.). In this initial phase of the transition from fossil-fuelled vehicles to electric vehicles, this is of vital importance.

- In a mature market, both awareness and the provision of information are typically covered by commercial players in the market. However, the EV market is not yet mature, and public involvement may well be required here.

- EMICs (both virtual and physical) have the potential to be central points of public EV awareness generation, information dissemination and learning about sustainable travel behaviour. Therefore, public but also private actors are recommended to utilize and replicate the findings, experiences and lessons learned from the E-Mobility NSR EMIC work package throughout the North Sea Region and possibly even beyond.

- Concerning electric freight, the level of EV utilisation is heavily diversified around the NSR.

- The low range (in average around 100 km) of the electric vehicle is not an obstacle to the reliability of the urban freight transport business: The travel distance is often known in advance and the routes can therefore be optimised to fit with the range of the electric vehicles. Vehicles can also easily enter city centres (with certain precautions) during night hours.

- Many tests have been performed, often supported by public subsidies - it may be concluded that some public support is still required during a transition phase. Large scale testing will be the next phase towards market exploitation

- Charging stations for freight vehicles should be placed at strategic locations, next to the biggest loading (logistics centres) and unloading sites (stores and consumption areas). Moreover, there is still a need for additional ICT EV supporting tools for the transport sector.

- Consolidation at logistics centres plays an important element in improving the quality and efficiency of the EU‘s transport and logistics networks when it comes to the integration of electric vehicles for urban freight transportation. Logistics centres facilitate the use of electric vehicles for freight and can provide added value in form of commercial and environmentally interesting solutions

- The EU policy provides an appropriate framework, the next step is for the market to adapt to the new requirements.

- Finally, concerning project operations, a sound project management can provide a strong backbone and catalyse project implementation. A dedicated project consortium, ideally as enthusiastic as the E-Mobility NSR partners, is key to deliver state-of-the-art results and overall project success.

SELECTION OF PROJECT OUTPUTS

POLICY AND ANALYSES

EVs in bus lanes - controversial incentive
Benjamin Myklebust, Zero Emission Resource Organisation, Norway, 2013

Transition to electric mobility: spatial aspects and multi-level policy-making
Sjoerd Bakker, Kees Maat, Jan Jacob Trip, Delft University of Technology, The Netherlands, 2014

Comparative Analysis of European Examples of Schemes for Freight EV's - Compilation report
TU Delft, HAW Hamburg, Lindholmen Science Park, ZERO and FDT, Denmark, 2013

Stakeholder strategies regarding the realization of an electric vehicle recharging infrastructure
Sjoerd Bakker, Jan Jacob Trip, Delft University of Technology, Delft, The Netherlands, 2013

E-mobility policies in the NSR countries
Jan Jacob Trip, Joana Lima and Sjoerd Bakker, Delft University of Technology, 2012

European Consultation on E-Mobility
Sjoerd Bakker, Jan Jacob Trip and Kees Maat, Delft University of Technology, 2012

Amsterdam Action Plan - Supporting electric vehicles in freight transport in Amsterdam
Jan Jacob Trip, Rob Konings, Delft University of Technology

Copenhagen Action Plan - Supporting electric vehicles in freight transport in Copenhagen Municipality
Hanna Baster, Kent Bentzen, Lars Bentzen, Michael Stie Laugesen, FDT - Association of Danish Transport and Logistics Centres

Hamburg Action Plan - Supporting electric vehicles in Hamburg
Tessa Taefi, Tobias Held, Jochen Kreutzfeldt, Hamburg University of Applied Sciences

INFRASTRUCTURE AND ROUTING

Study on best practice and requirements for procuring fast chargers - Workshop report
Peter Lindgren, Lindholmen Science Park AB, Sweden, 2013

Best practice: Implementation Regulation Subsidy Fast Charging - Province of North Holland
The Provincial Government of Noord-Holland, The Netherland, 2013

Standardization of EV Recharging Infrastructures
Sjoerd Bakker, Delft University of Technology, Delft, The Netherlands, 2013

Analysis of user needs for ICT solutions assisting the Driver
Stefan Jacobsson, Lindholmen Science Park, Gothenburg, Sweden, 2013

A review of electric vehicle charge point map websites in the NSR - Interim Report
Sara Lilley and Richard Kotter, Northumbria University; Nathaniel Evatt, Cities Institute, London Metropolitan University, United Kingdom, 2013

Micro to Macro Investigation
R. Kotter, Northumbria University; S. Shaw, Cities Institute, London Metropolitan University, 2013

Micro to Macro Investigation
R. Kotter, Northumbria University; S. Shaw, Cities Institute, London Metropolitan University, 2013

Micro to Macro Investigation (supplementary paper to main report)
Stephen Shaw, Nathaniel Evatt, Cities Institute, London Metropolitan University, 2013

Integrating space-syntax and discrete-event simulation for E-Mobility analysis
Eiman Y. ElBanhawy and, Ruth Dalton, School of the Built and Natural Environment, Northumbria University; Khaled Nassar, Department of Construction and Architectural Engineering, American University in Cairo, 2013

Experiences from the Gothenburg fast charging project for electrical vehicles
Robert Granström, Heléne Gamstedt, Lindholmen Science Park, 2012

Experience Electrical Vehicle - The case of fast charging
Maria Nilsson, Lindholmen Science Park, 2012

Report Workshop fast charging
Martin Borgqvist, Lindholmen Science Park, 2012

Experiences from the Norwegian - Swedish cooperation on electric vehicle infrastructure
Martin Borgqvist, Lindholmen Science Park, 2012

BATTERY AND SMART GRID

A Modelling Tool to Investigate the Effect of Electric Vehicle Charging on Low Voltage Networks
Lacey G., Putrus G., Bentley E., Johnston D., Walker S. and Jiang T., Northumbria University, Newcastle, UK, 2013

The Use of Second Life Electric Vehicle Batteries for Grid Support
Gillian Lacey, Ghamin Putrus, Anwar Salim, Northumbria University, Newcastle, UK, 2013

The Effect of Cycling on the State of Health of the Electric Vehicle Battery
Gillian Lacey, Ghanim Putrus, Tianxiang Jiang, Richard Kotter, Northumbria University, United Kingdom, 2013

The Effect of Cycling on the State of Health of the Electric Vehicle Battery
Gillian Lacey, Ghanim Putrus, Tianxiang Jiang, Richard Kotter, Northumbria University, United Kingdom, 2013

A Heuristic Approach for Investigating the Integration of Electric Mobility Charging Infrastructure in Metropolitan Areas: An Agent-based Modeling Simulation
Eiman ElBanhawy, Ruth Dalton, Emine Mine Thompson and Richard Kotter, School of the Built and Natural Environment, Northumbria University Newcastle upon Tyne, United Kingdom

Danish Experiences in Setting up Charging Infrastructure for Electric Vehicles with a Special Focus on Battery Swap Stations
Danish Association of Transport and Logistic Centres, Denmark, 2013

AWARENESS AND INFORMATION

Report to Inform the Setting up of Regional E-Mobility Information Centres
Stephen Shaw, Louise Bunce, Rita Kottász, London Metropolitan University, London, United Kingdom, 2014

Comparative Analysis of Electric Car (EV) Information Available on Key Stakeholder Websites: Application of the Danish Framework
Rita Kottász, Reader in Marketing, London Metropolitan University, London, United Kingdom, 2014

Mapping of public & private E-Mobility awareness needs in the North Sea Region.
Cities Institute, Hertfordshire Country Council/London Met. Høje-Taastrup Kommune, August 2013

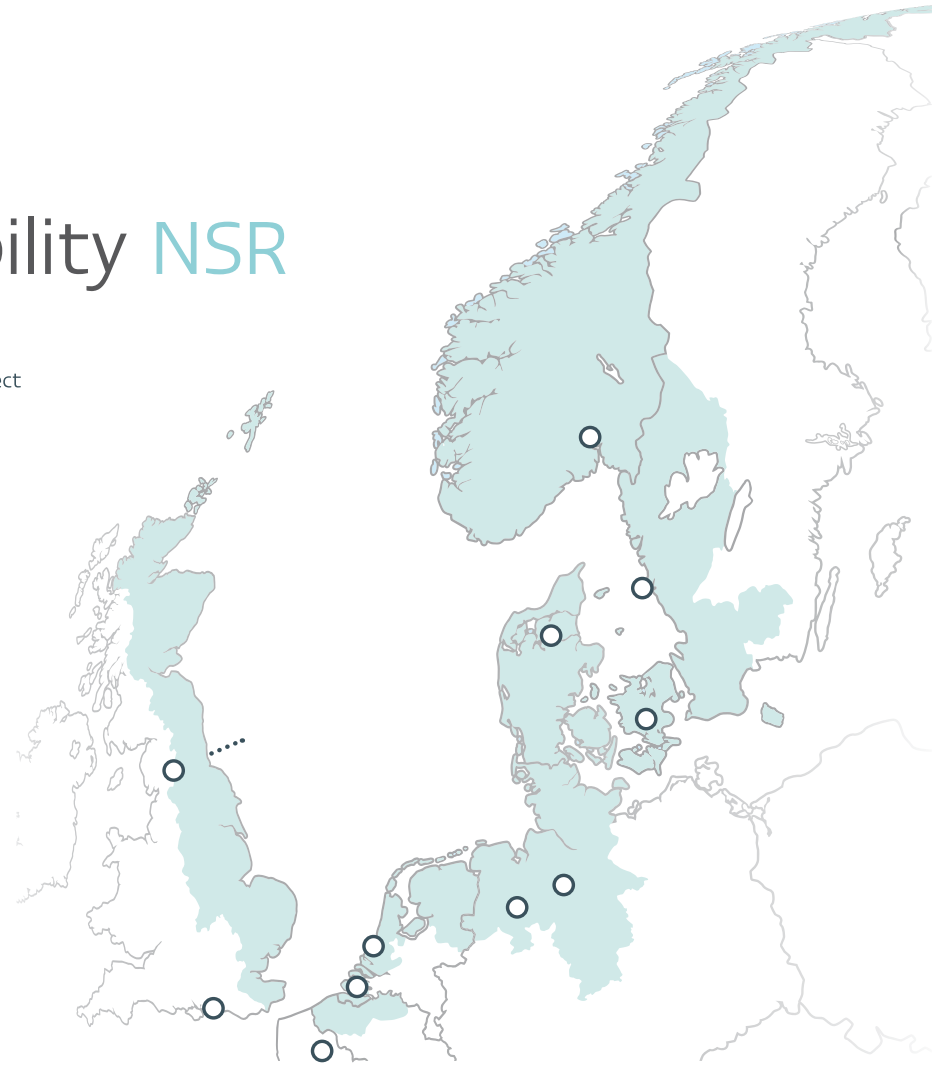
Mapping of public E-Mobility events, showcasing projects, demonstrations and dissemination in the period of 01/09/2011 to 31/07/2012
Cities Institute/London Met. & Northumbria University. Høje-Taastrup Kommune, August 2013

Mapping of current E-Mobility activities, campaigns and information channels aimed at penetrating the market in the North Sea Region
Hamburg University of Applied Sciences, FDT, Lindholmen Science Park AB, Delft University of Technology, WFB Bremen GmbH, Northumbria University, Province of North Holland, Cities Institute, Zero Emission Resource Organisation,Høje-Taastrup Kommune – August 2013

ABOUT
e-mobility NSR

The Interreg North Sea Region project North Sea Electric Mobility Network (E-Mobility NSR) will help to create favorable conditions to promote the common development of e-mobility in the North Sea Region. Transnational support structures in the shape of a network and virtual routes are envisaged as part of the project, striving towards improving accessibility and the wider use of e-mobility in the North Sea Region countries.

www.e-mobility-nsr.eu



PROJECT CONSORTIUM

Hamburg University of Applied Sciences (DE)

FDT – Association of Danish Transport and Logistics Centres (DK)

Lindholmen Science Park (SE)

Delft University of Technology (NL)

WFB Wirtschaftsförderung Bremen GmbH (DE)

Høje-Taastrup Municipality (DK)

Northumbria University (UK)

Province of North Holland (NL)

Faculty of Business and Law, London Metropolitan University (UK)

Zero Emission Resource Organisation - ZERO (NO)

Universiteit Gent (BE)

IMPRINT

Hamburg University of Applied Sciences
Faculty of Life Sciences
Research and Transfer Centre
'Applications of Life Sciences'

Ulmenliet 20
21033 Hamburg, Germany

Tel.: **+49 (0)40 42875-6313**
Fax: **+49 (0)40 42875-6079**
E-mail: **e-mobility@ls.haw-hamburg.de**