EVUE

Electric Vehicles in Urban Europe

European Union
European Regional Development Fund

Connecting cities
Building successes

URBACT

FOREWORD

The EVUE project has been a pleasure to work on over the last three years. Our involvement in this project was the result of the some of the leading work that Transport for London and the City of Westminster had been undertaking in London. However, we also recognised the benefits that would come from sharing our experiences and learning from other European cities undertaking the same journey.

The introduction of electric vehicles in EU cities is a major strategic economic and environmental priority for both individual countries and the EU as a whole. However, as demonstrated throughout the project, each partner city is subject to significant differences in their individual social, political, economic and infrastructural circumstances.

Against the backdrop of the economic crisis and the environmental challenges facing urban environments, the URBACT II programme, which supports sustainable urban development by connecting cities, co-funded the EVUE project which focused on capturing this knowledge and disseminating it; thus not only saving time and money, but also improving the efficacy of outcomes.

The benefits of partnership working are one of the core reasons that Cross River Partnership was founded and continues to provide benefits. While we operate under the auspices of the City of Westminster as accountable body, our focus is on bringing partners together on local, regional or transnational projects to address common issues. EVUE came about directly from our activities with London partners and through building a successful network this has resulted in a widely recognised, and regarded, project.

The success of the EVUE partnership is manifested not only in the knowledge exchange and capitalisation that has occured, but also in the successful bid to the EU for funding of its successor project, FR-EVUE. This transition from EVUE learning to FR-EVUE investment corresponds to an increase in the budget from €0.7million to €13.8million through the 7th Framework Programme to demonstrate EV's for clean urban logistics benefiting partner cities over the next four years.

I would also like to take this opportunity to thank all of the partners that have contributed to making this such a successful project as well as Sally Kneeshaw, who as lead expert kept us on the right track throughout.

I hope you find these reports to be of interest and if you have any further comments or questions, please do not hesitate to contact any of the EVUE team.

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EXECUTIVE SUMMARY

The challenge facing cities throughout Europe with regard to climate change, air and noise emissions are substantial. European and National government policies and objectives are setting increasingly stringent environmental standards and it is the responsibility of the local and regional authorities to achieve them.

The transport sector is one of the biggest contributors to these problems while at the same time being essential for the effective and efficient functioning of cities.

Electro-mobility and electric vehicles provides a significant opportunity to address the negative externalities associated with the internal combustion engine without constraining the vital role vehicles play. It must be noted however, that we believe the private vehicle is only one facet of sustainable mobility and all modes need to be incorporated to ensure the full functioning of our cities.

This report has been written to assist local authorities throughout Europe that are looking to aid the transition to e-mobility, while recognising the limited areas where the public sector can affect private mobility. The examples and topics covered reflect 2 ½ years of partnership working by the EVUE partner cities of Beja, Frankfurt, Katowice, Lisbon, London, Madrid, Oslo, Stockholm, Suceava. The report reflects the different circumstances-geopolitical, economic, cultural-of cities across the EU, and the different approaches taken to e-mobility, adapted to the local context.

The report has four sections covering the four themes identified by the EVUE project during the Baseline Study as being important actions for cities. They are: Business Models, Procurement, Infrastructure and Awareness.

EVUE Partner City Network

Business Models

One of the key barriers to increasing e-mobility is the fact that the business models have yet to be fully developed. As with any new industry, the ability to identify and realise the revenue streams is a necessary requirement to enable the development funding to be secured. As EVs have higher initial capital costs compared to traditional internal combustion engines (ICE) vehicles and require supporting charging infrastructure, the additional costs can be significant.

Manufacturers, utility and mobility service providers, information and communication technologies (ICT) companies and others are responding to these challenges with innovative models that change how they engage with their customers, whether that is through becoming 'mobility managers' rather than just car sellers or installing their own 'refuelling' infrastructure. The approaches being taken reflect the need to look along the value chain to develop the business models. In doing so, new partnerships may develop and local authorities can take an active role and facilitate these relationships to support these new ways of working.

Procurement

Through the appropriate use of the procurement process, local authorities can support the uptake of EVs through the direct purchase of vehicles in their own fleets or as a requirement for their suppliers. This enhances the visibility of EVs and demonstrates their viability in a range of areas.

Stockholm has led on the formation of a consortium that brings together the public and private sectors for the procurement of EVs. By working together significant cost saving can result through a streamlined procurement process for the participating organisations as well as potentially lower vehicle prices. Similarly, London developed a vehicle and infrastructure procurement process that sought to create a step change by simplifying the whole process by which organisations can purchase EVs. Other cities have taken to requiring their suppliers to introduce EVs into their fleets when delivering services on their behalf further demonstrating their effectiveness.

These approaches do not necessarily have to involve significant capital outlay from public funds, but seek to utilise the experience, knowledge and existing procedures within local authorities to introduce EVs into their communities.

Infrastructure

Whether, and how, local authorities should get involved with infrastructure provision is a key question. With increasing urbanisation and densities however, the assumption that people will be able to charge off-street at home is increasingly unlikely. If city authorities want to benefit from the lack of tailpipe emissions to improve the environment, the infrastructure needs to be in place to enable this.

This can be achieved through policy such as requiring developments to have EV charging facilities or the installation of on street charging points. In this initial stage of e-mobility however, most cities have taken to installing some type of public facilities which can vary from simple, open access systems through to innovative, smart systems that enable remote operation.

Whatever the approach taken, it is clear that it needs to be integrated into the wider urban planning considerations. Failure to do so may result in expensive and unnecessary activities as well as impact on the uptake of EVs.

Awareness Raising

While people understand the environmental impacts of vehicle emissions, only a few recognise what can be done to remedy and mitigate them. Although EVs provide a viable solution, overall awareness of them is still quite limited. Cities are also facing the challenges associated with congestion and overall sustainable mobility, by incorporating EVs into their plans, a total solution can be provided.

A common challenge faced by cities is that while walking, cycling and public transport can meet many needs, there will always be occasions or activities which can only be met by private vehicles. Through redefining mobility to include electric vehicles, progress can be made but cities need to take the lead to ensure that they do not remain only in a niche market, but that they are a viable alternative.

Conclusion

While electro-mobility itself is not an answer to all the challenges facing our cities, it does address a number of the pressing environmental issues associated with personal mobility. From the local, and indeed regional and national perspective, the benefits of supporting e-mobility are likely to far outweigh the costs.

From Athens to Amsterdam and Bucharest to Bristol, the financial crisis has created significant difficulties for public authorities across Europe. How our public administrations respond however will impact on our cities long into the future. The approaches, techniques and tools that have been identified through this project provide a range of methods that can be used to support e-mobility.

The journey to an electric future may not be quick, but as long as there is a community willingness to support it, it does not need to be expensive or difficult. Different incentives for electric vehicles can be introduced that show public support ranging from tax incentives through to simply allowing EVs to use priority lanes which can provide a time benefit that many individuals will value quite highly. Enabling the public and private sectors to work collaboratively to stimulate the market and raise community awareness will deliver significant benefits includingthe development of new business models that may increase revenues as well as the environmental outcomes.

Electric vehicles provide a significant opportunity to improve the environmental and economic performance of our towns and cities. It is up to all of us, to make sure that those benefits are realised and do not become a missed opportunity.

INTRODUCTION

EU policy and regulation is leading towards higher environmental standards for cities that impact on transport planning. Clean and energy efficient vehicles have an important role to play in the EU energy-climate policy, and the electrification of transport (electromobility), is a priority in for Europe's climate and energy efficiency strategies.

The European Commission has established ambitious goals for the gradual phasing-out of conventionally fuelled vehicles from the urban environment to reduce our dependency on oil imports and reduce greenhouse gas emissions and local air and noise pollution. The 2011 White Paper calls for a halving of the use of conventionally fuelled cars in urban transport by 2030 and a complete phase out by 2050.

The URBACT Electric Vehicles in Urban Europe, (EVUE) network has provided a platform for nine cities to learn more from each other about ways in which to address these challenges in the context of sustainable mobility. This document contains a series of four reports that have been produced by partners of the network. They address the four themes identified by the EVUE city partners as being the major challenges in accelerating electric vehicle uptake:

- Business models
- Procurement
- Infrastructure
- Awareness raising

While there are a number of views on the life-cycle benefits or otherwise of electric vehicles, looking at well to wheel efficiency, renewable vs non-renewable energy mix and life cycle analysis to name just a few, as a solution to the air pollution issues facing cities the benefits from electro-mobility are clear.
The reports are the results of two and a half year's work within the framework of the EVUE project.
Nine cities Beja, Frankfurt, Katowice, Lisbon, London, Madrid, Oslo, Stockholm, Suceava participated in a series of network meetings, site visits, expert seminars and peer reviews.

Contributing to these reports and the projects findings have been the URBACT Local Support Groups of important stakeholders, such as representatives from city departments, regional authorities, energy companies, auto manufacturers, transport operators, research institutes, mobility experts, and user organisations. These groups met regularly throughout the project to develop or monitor their local electric mobility strategy. Participants also participated in the EVUE transnational exchange and site visits in other cities, and benefited from the knowledge generated by EVUE reports, to inform better local strategy. All EVUE cities have developed a Local Action Plan as a result.

Each report has been written by the city leading on that theme, and each, therefore, has a distinctive voice and perspective. All of the reports outline the nature of the challenge for cities, the key questions to be addressed, and some concrete examples of how these challenges have been tackled. In this way, at the end of EVUE project, the reports are a legacy of learning, with some ideas for the range of tools cities can use to support electric vehicle strategies.

Each of the four EVUE themes are interconnected, and each report contains references to the other theme reports. You can easily navigate these reports using the index on the left hand side of this document.

The contents of these reports are the opinions of the EVUE city authors.

EVUE – BUSINESS MODELS

Report author Oscar Rodrigues, EMEL, Lisbon October 2012

BUSINESS MODELS

INTRODUCTION

Different business models, partnerships and investment strategies are needed to kickstart the electric vehicle market. This report illustrates some of the different approaches, and draws on the experience EVUE city partners, other cities and their stakeholders, such as vehicle manufacturers and energy companies, sharing the technical information, process and results achieved. The information and case studies included in this report have been developed though the EVUE project.

Why Electromobility in cities?

Almost one quarter of greenhouse gas emissions come from transport activities and urban mobility is responsible for 40% of all CO_2 road transport emissions. Additionally, it is estimated that 9 out of 10 European citizens are exposed to harmful particle emissions that are higher than acceptable levels.

But along with the environmental externalities of transport, this sector is also especially vulnerable to disruptions in energy supply and price volatility due to its dependency on oil.

Thus, growing concerns over security of energy supply, climate change and health have triggered a shift from fossil to alternative fuels and new vehicle propulsion systems with greater potential long-term sustainability.

At EU level, policy and regulation is leading towards higher environmental standards for cities that impact on transport planning. In fact, clean and energy efficient vehicles have an important role to play in the EU energy-climate policy, in particular the electrification of transport (electromobility), a priority of Europe's climate and energy efficiency strategy. The European Commission has established ambitious goals for the gradual phasing-out of conventionally fuelled vehicles from the urban environment to reduce our dependency on oil imports and reduce greenhouse gas emissions and local air and noise pollution; 2011's White Paper calls for a halving of the use of conventionally fuelled cars in urban transport by 2030 and a complete phase out by 2050.

As electric vehicles emit no tailpipe emissions their uptake can strengthen security of energy supply through a broad use of (indigenous) renewable and low carbon (or even carbon-free) energy sources in the transport sector, contributing to CO_2 emission target reduction and improved urban air quality.

Market Challenges

Different studies have demonstrated that the majority of people are willing to accept alternative mobility paradigms such as electromobility. Nevertheless, overcoming market barriers is vital to promote an effective user acceptance and challenge current market barriers faced by vehicles with alternative powertrains. The identified market barriers towards EVs relate to different aspects ranging from technology to social resistance to change factors, such as:

- Technological constraints (e.g. range, charging time, insufficient public charging network)
- Limited range of vehicle types
- High investment cost
- False expectations
- Lack/inadequacy of incentives
- Lack of information, disinformation and misinformation (total cost of ownership, lack of confidence, etc.)

As local authorities seek to encourage the uptake of EVs, new ways of thinking are required to assist their uptake. While public support for new technologies is not normally required, the many public (health and environmental) benefits arising from electromobility place them in a different position. This report seeks to provide city stakeholders with a different way of thinking about e-mobility business models and the support that can be offered to encourage their uptake.

THE STAKEHOLDERS

Stakeholders can be considered as the key actors with a specific interest in the development of a certain policy or measure. It is clear that the effectiveness (and efficiency) of any given strategy depends on the level of agreement between the stakeholders concerned. Cooperation and development of an integrated approach is therefore a necessary condition for success.

Electromobility is no different. Thus, a vital step to ensure a successful outcome is to engage all relevant stakeholders from the beginning.

This principle is a key element of the URBACT approach to urban sustainability. Each city in the EVUE network set up a local support group to bring together key stakeholders in an integrated planning process.

In the following sections some of the most common actors represented in local support groups for electric vehicle strategies are presented.

Vehicle Manufacturers (OEMs)

The automotive industry has an extremely important role with increasing the interest in electric vehicles. They are responsible for delivering attractive alternative EV, which also have to guarantee high safety and comfort standards. In addition, they are one important player in the assessment of the costs that end users will face. Moreover, original equipment manufacturers (OEMs) are also one of the technological agents that have to address several of the technical barriers, such as battery range.

Energy Providers

Energy providers play a key part in the operational feasibility of EVs. Their impact can be seen in the type of electricity provided by the generating mix e.g. renewables or fossil fuel based, down to the transmission of electricity to the end user. The potential impact of mass electrification of mobility could have significant impacts on the distribution network and substations. Alternatively, the possibility of vehicle to grid transmission could transform energy networks, reducing costs and encourage the greater uptake of variable energy generation such as wind.

With such a vested interest in the development of the market, they may also become significant investors or retailers.

Providers

From individual at home charging units to on-street charging points and fast charging operations, a new level of accessible infrastructure is required. This will also include the 'backroom' services of billing, account and data management which introduce a new key stakeholder that becomes the interface between the vehicle owner/driver and the charging network.

Transport Operators

Transport operators involvement has a twofold purpose: many transport operators are evolving their activity into innovative mobility services that differ from the traditional concept of public transport. These activities are more oriented to specific user needs and expectations, integrating a set of services overall that are considered to be more advantageous when compared to the use of the private car. On the other hand, transport operators themselves can become early adopters of EVs, setting the useful example for other potential users.

Users

The use of conventional fuels is the only reality that the majority of the population knows, and will remain the dominant source of energy for vehicles in the coming years. It is vital to understand popular beliefs mobility needs and the expectations that have to be met, so that these aspects are considered when developing and promoting new technological options.

STRATEGIES

As cities contemplate and implement the different approaches to electro-mobility, one of the lessons from the EVUE project exchange has found that there is no "one-size fits-all" business model. The success of local EV roadmaps depends not only on the measures but also on local conditions that influence the market's response and, consequently the effectiveness of the measures deployed.

The business models employed (or lack thereof) indicate whether the private market can solely deliver the necessary market incentives or whether public assistance is required.

Although a few instruments are feasible to act on the supply side (e.g. joint procurement), a city's ability to intervene is fairly restricted to demand side measures. The local administration's power allows the development of a wide range of policies and incentives. However, their ability to induce change on the upstream of the supply chain (e.g. vehicle development) or in wider scale contexts (e.g. standardisation processes, national policy frameworks) is more challenging.

Another important aspect that will determine the scope and effectiveness of the business model is the available budget.

Finally, a key point is to ensure that approaches are in line the national strategy and the geographical harmonization of measures.

Cost of Vehicles

One of the key barriers that consumers face is the high acquisition cost of vehicles. Even though the total operating costs are lower over the life of the vehicle, the initial capital expenditure is frequently an obstacle to the adoption of a new technology.

To address this problem, a number of new business models are being deployed to minimise the extra upfront cost of an EV purchase, as well as the financial risk and uncertainty of potential buyers.

As an alternative to the conventional vehicle ownership model (based on the concept of customers purchasing the entire vehicle, including the battery), some OEMs are offering a service based on the concept of selling a mobility service. One application of this approach is that the owner of the vehicle does not own the batteries; these remain property of the service provider.

A battery charge and exchange infrastructure system is set up, and the customer is charged a monthly basic fee. Besides offering a competitive price for the vehicle, this model overcomes the limited battery lifetime problem.

To follow are two examples from leading vehicle manufacturers in the electric vehicle market.

Case Study - Peugeot Spain E MOBILITY

Peugeot is moving from being solely a vehicle manufacturer to being a mobility supplier. This new type of business model (see figure 1) offers an "all inclusive" package of less than 500 Euro per month for an electric vehicle.

The deal includes a 48 - 60 month rental contract with 10,000 km per year and a 'Buy Back' offer. Leasing will be also available.

A new type of commercialisation

An "all inclusive" offer in VN → less than 500€ per month

A 48/ 60 month renting / 10,000 Km per year with By Back:

- Vehicle financing + battery
- 10,000 Km. included / year
- 2 year vehicle guarantee
- 5 year guarantee of the battery and electric motor
- Maintenance contract
- Peugeot Connect SOS
- Peugeot Connect Assistance

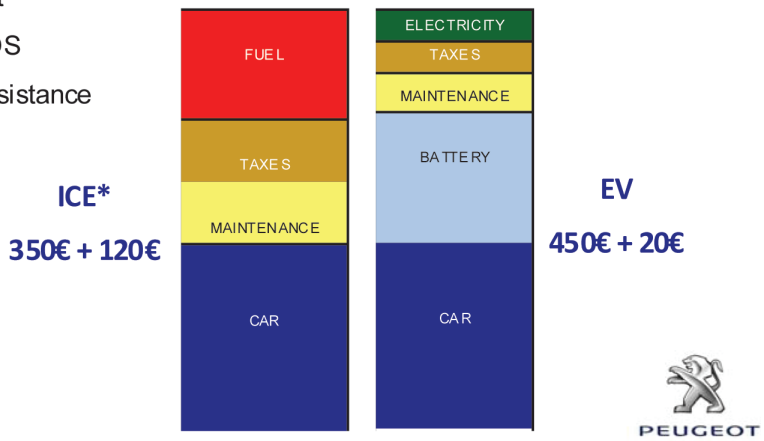


Figure 1

Peugeot launched a mobility service offer known as Mu by Peugeot, which is like an intermediate proposition between vehicle hire and vehicle sharing. It has been tested in six French medium sized cities. It is a client centred pre paid rental service for the general public and companies.

The Mu by Peugeot concept comprises two offers:

- Peugeot range products or accessories rentals Members will be able to rent a bicycle, a 50cc or 125cc scooter, a leisure vehicle (207CC, 308CC, Coupé 407, 3008), a utility vehicle, a replacement vehicle (2 or 4 wheeled), or a mobility accessory (GPS, roof box...).
- Partner service provider's offers

In liaison with a travel agent and via a simple telephone call, the cardholder can book an air or rail ticket, reserve a hotel room or organise a personalised trip. Driving lessons, courses to learn eco-friendly driving techniques or advanced driving training can also be booked via the same call centre.

This second approach reflects an increasing recognition that the business model will involve greater horizontal and vertical integration of related services, rather than the traditional model restricted solely to vehicle sales.

Case Study - Renault ZE

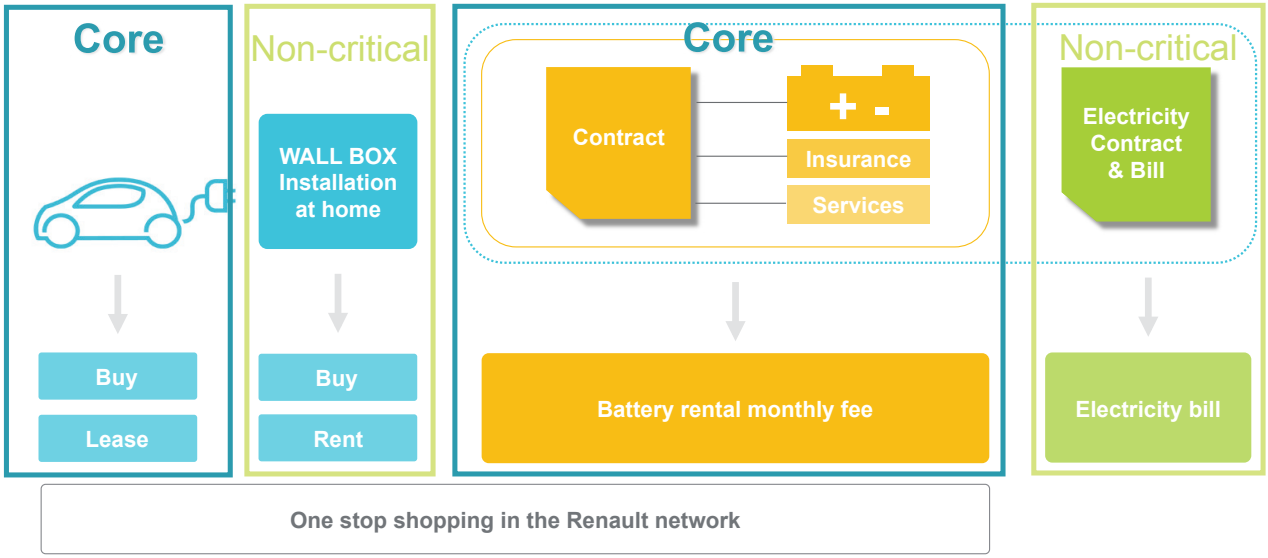
Renault aims to be a leader in the European electric mobility market and has introduced an innovative battery rental business model.

The major reason for the high price of EVs is the cost of the battery. To broaden the market appeal of EVs through the reduction of direct costs, Renault has an option where EV drivers can purchase the EV without buying the battery. Instead, EV owners will rent the battery at a cost of around 45 Euro to 80 Euro a month.

Although the total costs over time are still significant, this approach minimises the initial purchase price and reduces the financial risk to EV owners, in that the battery is guaranteed for life.

EV offer One stop shopping

Simple and reassuring



The four different models of electric vehicle from Renault, all with battery rental plans, have reached European markets with estimated prices from €7,000 for the small urban Twizy, to €21,000 for the larger Fluence Z.E. Sedan.

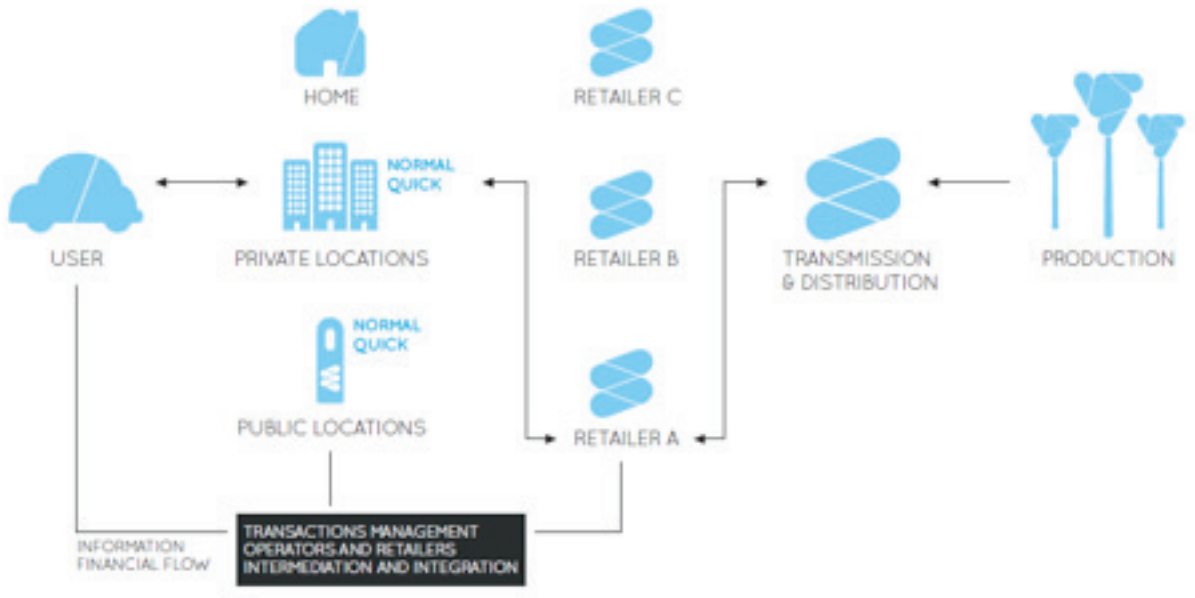
As battery technology improves, it may be possible for the vehicle owner to upgrade over time without the cost penalty of purchasing a new one.

Infrastructure

The take up of EVs is a classic "chicken and egg" dilemma: consumers will not buy the vehicles if no charging stations are available, and the investment to be made in infrastructure is dependent on the demand for it (i.e. a critical mass of EVs on the road).

Cities have to consider providing potential users with the necessary support system that ensures the smooth usability of EVs in the city, namely a public charging network. These networks provide both a physical benefit, in enabling the batteries to be recharged and a psychological benefit through addressing another important barrier: range anxiety.

Although standardisation of charging technology has not yet been achieved, cities have to coordinate the deployment of infrastructure with national authorities to guarantee the technological continuity of the network. The ideal scenario is for customers to have the possibility to freely decide between different energy suppliers, in a user friendly operating system with a detailed billing structure harmonised at a national and EU level.



The above diagram illustrates the MOBI.E market structure

Case Study – MOBI.E Model

Early in 2008, the Portuguese government launched a working group on electric mobility that became MOBI.E, the national programme for electric mobility. This program was aimed at creating a new approach to e-mobility, based on an innovative business model designed with a view to create the first nation wide infrastructure.

MOBI.E is an open model suitable for any business or market format. MOBI.E is an integrator of systems, based on the following operating principles.

Interoperability

MOBI.E proposes an open business model that can be applied in a competitive market framework. MOBI.E is an integrated and fully interoperable system that includes all energy retailers, charging stations operators and automakers.

Scalability

Most electromobility initiatives developed thus far have a local scope and are isolated from other schemes and, as a result, a user from city A can't use the charging system in city B.

MOBI.E was designed to be implemented everywhere in a 'system of systems' approach, thus overcoming the lack of communication between the different existing systems.

Networked system

With a single MOBI.E Card it is possible to charge the battery with electricity supplied by any retailer at any charging station. As all infrastructure is networked, each addition reinforces the previous investments, MOBI.E contributes to a faster expansion of the system.

Integration of other services

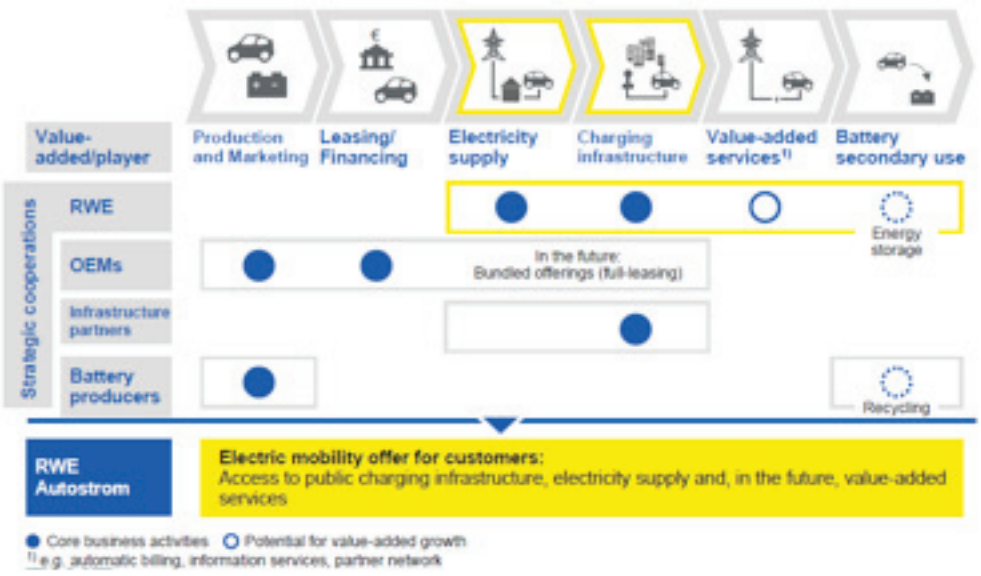
MOBI.E is capable of integrating other services, such as tolling, parking, public transportation, or carsharing. This means that the MOBI.E Card can be payment card for all mobility requirements.

Intelligence

MOBI.E is an intelligent system. Through the Mobility Intelligence Center (MIC) it integrates all the financial, information and energy flows among the users and all the companies involved, acting as a central clearing house. This mechanism reduces transaction costs and avoids duplication of systems.

Fundamental Principles for Electric Mobility in Portugal:

- Fair, advantageous and competitive pricing when compared to ICE vehicle;
- Universal access (open to every manufacturer, utility, private operator);
- Free and open market creating multiple options for the consumer
- Private investment (mostly)
- Fast nationwide infrastructure deployment



The graphic at left illustrates the vertical and/or horizontal linkages of the value chain.

While business opportunities for individual aspects may be limited, through combining aspects, significant opportunities may result

Source: RWE

Case study RWE E-MOBILITY

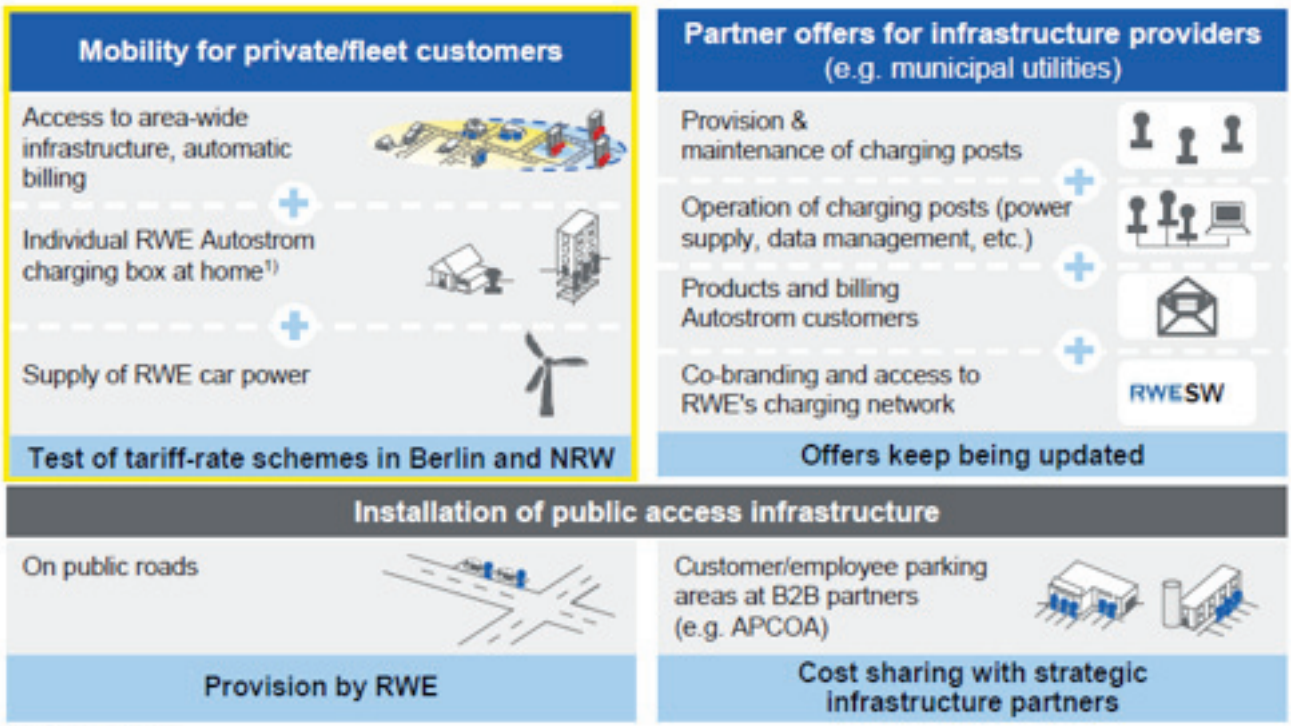
The German energy company RWE is developing e-Mobility services both to end customers and to business. The business model focuses on combining electricity for vehicles and infrastructure services.

Its business model takes a whole system approach, with a focus on both the private and fleet customer business. RWE believes that EV fleets will be the first market, ahead of mass adoption by individual drivers.

The strategy relies on cooperative ventures and technology leadership. RWE believes it is important to take into account the following points:

Leadership Technology

- Separate smart charging infrastructure
- Standardisation driven by electric vehicle/charging station interface
- Competitive edge through convenient charging infrastructure system (infrastructure development/cooperation)
- Winning over high profile partners for charging stations at the most attractive locations
- Cost sharing for infrastructure joint marketing /co-branding customer acceptance/marketing
- Comprehensive information on e-mobility
- Concrete product offerings for end customers
- Targeted media and advertising work
- Marketing jointly with OEM and other partners



A schematic illustrating RWE value chain linkages.

Services

Services refer to the broader range of policies and measures that complement the necessary pre-conditions of vehicles and infrastructure and include EV car-sharing and different approaches to parking management etc.

These services do not necessarily have to be deployed by public authorities, as many third parties are interested in exploring the opportunities underlying the growing share of EVs. These players are willing to deploy new concepts in order to offer a variety of mobility services that facilitates the penetration of EVs with financial gain.

The collaboration between transport operators and organizations that own vehicle fleets, through the establishment of partnerships, can also be a way to foster the take up of e-mobility.

Any discussion of electric vehicles must therefore engage with the issue of shared, multi-modal transport incorporating bike rental schemes, electric vehicle hiring schemes, and more traditional public transport provisions. The EVUE network saw evidence of this good practice during a study visit in La Rochelle in France, where e-mobility is integrated in a number of ways into a long-term citywide strategy.

Case Study - CAR2GO

In Amsterdam, Car2go, a pilot scheme run by Daimler-Benz, offers an innovative mobility program with an all-electric fleet. 300 Smart Fortwo electric drive vehicles are available for on-demand mobility, without the necessity of returning them to a fixed rental station.

Together with Amsterdam's electric vehicle charging infrastructure, which only uses energy from renewable resource, the Car2go fleet of local zero emission cars is improving air quality and saving valuable space in the city centre.

Amsterdam is well-know for its efficient public transport network and various bike and car-sharing programs, which are well regarded by its citizens. This innovative mobility program complements these existing transport systems by providing a service for short and spontaneous one-way trips with electric vehicles, which could open the door for a better modal split of urban transport.

Car2go Amsterdam operates in a defined area of 80 square kilometers, which covers large parts of the city. Customers can drive their Car2go everywhere during the rental period, but must return to the area to finish the rental. The vehicles can be picked-up and dropped-off at any public parking spot inside the area or at one of 36 specially marked Car2go parking spots in six "Q-Park" garages in the city centre.

The rental does not need to be ended every time at a charging station. However, if the battery capacity (state of charge) is lower than 20 percent, rentals must be finished at one of the charging stations, which are displayed in the on-board navigation. If the battery level is lower than 40 percent, drivers receive 10 free minutes for re-charging the vehicle. The charging does not need to be completed before a Car2go can be rented again: if there is a minimum 50 percent state of charge, the vehicle is available for the next customer.

All 300 smart Fortwo electric drive vehicles are equipped with latest telematics technology, allowing fully automated, easy and convenient rental operations. It allows customers to rent the vehicles spontaneously without having to commit to a specific return time or location. The cars have a lithium-ion traction battery, an automatic gearbox and a range of 135km. On-board are air-conditioning, a radio and a navigation system.

Pricing Model

Amsterdam introduced a new Car2go pricing model, which makes on-demand mobility by car more favourable than ever and will be also introduced in other existing and future European Car2go cities. One minute of Car2go driving costs 29 cents, the hourly rate is €12,90 with the daily rate of €39 (24 hours). If Car2go is used for stop-overs, a special parking rate of 9 cents per minute (€5,40 per hour) is calculated. Insurance, taxes, electricity and parking costs are fully included in this price.

In Amsterdam, due the range limitations associated with electric vehicles, drivers are only limited by battery capacity and not a daily distance maximum. In the other European cities where Car2go is operating combustion engine vehicles, the first 20 kilometres are included in the rate.

Additional kilometres will cost 29cents per kilometre. Based on the experience of hundreds of thousands Car2go rentals in four cities worldwide, more than 95 percent of all Car2go rentals will not hit the 20 kilometres mark, so that for the majority of the customers the new pricing scheme is a significant reduction.

Incentives

A number of both financial and non financial policies promoting the EV market uptake can be deployed by public authorities at a national and/or city level.

Included in the **financial incentives** there are:

- Direct subsidies on EVs purchase
- Differentiated vehicle taxation (e.g. due to CO_2 differentiated vehicle registration and/or circulation tax
- On a local level, policies such as free parking spaces (or differentiated parking tariffs)

The category of non financial incentives is also very diverse and the adequacy of these relies on the local conditions. Nevertheless, a few of **non financial incentives are:**

- Regulatory framework - positive discriminatory measures such as limited access to certain areas of the city (low or zero emission zones), eligibility for using restricted lanes e.g., bus or high occupancy lanes
- Capacity building

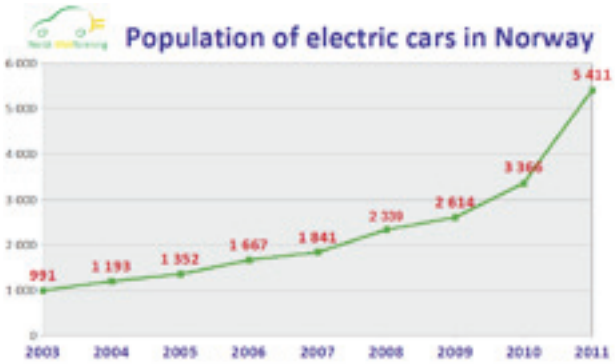
Case Study – Oslo Norway

During the last 20 years Norway has established a framework to promote the use of EVs and support Norway's former EV manufacturers. This was not introduced as a master plan, but refined and expanded year by year to facilitate the market. The EV owner association, Norstart, played a key role in lobbying all political parties and industry for a conducive policy environment over many years.

Key national and city EV incentives today:

- Drive for free on toll roads
- No VAT (25%) on vehicles
- No "first-time registration fee" on new vehicles
- Allowed to drive in lanes reserved for bus and taxi
- Park for free in public spaces, but need to abide by maximum parking time
- Do not have to pay for the EV on local ferries

These incentives have contributed to the solid growth in use of EVs in Norway.



A lack of available EVs in the market however, has been the limiting factor. From 2000 to 2010 the market was served almost exclusively by small Norwegian manufacturers and by the import of used EVs. Even so, Norway became an exciting test lab for e-mobility, and in recent years the Norwegian market for EVs has grown substantially.

By April 2012, Norway had 6,587 elec¬tric vehicles for a total population of 5 million. Both the number of EVs and last year's sales are by far the highest in the world per capita. Sales estimates for 2012 point in the direc¬tion of yet another 3,000 electric vehicles on Norwegian roads. The large majority of EV buyers are private individuals spending their own money to replace one of their ICE vehicles with a non-polluting electric vehicle.

Unashamedly we describe Norway as a world leader for EV use and Oslo as the EV capital of the world, with the highest EV density of any capital city.

Awareness Raising

The lack of information, or worse misinformation, regarding EVs is a major barrier that needs to be tackled.

Raising awareness is one form of capacity building. Providing accurate information and sharing knowledge is frequently overlooked. However, while return on investment of awareness campaigns is usually delayed, building stakeholders' skills is one of the most efficient ways of promoting behaviour change in the long term.

Different national incentives to encourage e-mobility

Norway

- VAT exemption (25%) for EVs
- Free travel on toll roads
- No "first-time registration fee" on new vehicles
- Allowed to drive in bus and taxi lane (HOV-lane)
- Free parking on all public (municipally owned) parking spaces
- Free travel on ferries part of the national road network

United Kingdom

- Planning legislation amended to recognise the installation of charge points as a permitted development right – removing the need to apply for planning permission
- Electricity used for plug-in vehicles will not included as a business emission under carbon reduction commitments
- Vehicle tax exemption for battery electric vehicles
- Plug in Car and Van grants for the purchase of new vehicles up to £5,000 & £8,000 (€6,000 & €9,600) respectively.

Portugal

- Parking is free during charging (new parking municipal regulation will consider free parking in Lisbon for EV's – green permit)
- Electric Vehicles are exempt from both ISV – Vehicle tax – and IUC – Single Circulation Tax (law Nº 22 – A of 2007)
- Tax deductions for companies buying EVs - The purchase of electric vehicles enables deductions for IRC (Imposto sobre o rendimento das pessoas Colectivas). The expenses of electric vehicles are exempt from autonomous taxation rate that apply to company vehicles (Artº 88 do Código do imposto sobre o Rendimento das Pessoas Colectivas). The IRC code provides an increase in the rate of depreciation for electric vehicles compared to vehicles with internal combustion engines

Sweden

- No vehicle tax the first 5 years
- Reduced company car tax
- National Chargepoint Registry identifying the location of all charging points
- € 4000 state funding for every new passenger EV
- Various different kinds of parking incentives for EVs (i.e free parking or reserved parking) in several Swedish cities

Germany

- No vehicle tax: Electric vehicles are exempt from motor vehicle tax for a period of 10 years. There are subsidies for vehicles with a date of first registration between May 2011 and December 2015. After 2015 the exemption from motor vehicle tax shall be limited to a period of five years.
- Reduced company car tax
- Model region electro-mobility: The 8 model regions have received a funding from the German government (2009 to 2015) in the amount of EUR 630 million
- Showcase region electro-mobility: In the period from 2012 to 2015 the German government will financially support the four selected model regions in an overall amount of EUR 180 million

Spain

- The National Government gives grants for the purchase of EVs (up to the 25% of the price with a maximum of 6000€ per EV) under the MOVELE framework
- The Spanish Government is currently working on the new technical and safety regulation for charging infrastructure (ITC BT 52) which is expected to be ready by December 2012
- EVs do not pay the national "first-time registration fee" as they don't generate CO_2 emissions locally.
- EVs have local tax reductions and free on-street parking in most Spanish big cities
- The national urban planning legislation has been amended to ease the installation of charging points at private residential parking facilities, removing the need to apply for permission of the residents community (Modificación de la Ley de Propiedad Horizontal , not applied in Catalonia)

Poland

- There is ongoing work at the national level on developing the financial and nonfinancial incentives for e-mobility. First implementations are expected in 2013
- In June 2012 The Ministry for the Economy has published a document entitled "Conditions for the implementation of an integrated e-mobility system in Poland", where the interdepartmental team and the specialists of the automotive, energy and local government sector concluded its recommendations. Basing on the report some of the local authorities are planning to introduce the non-financial incentives

Romania

In April 2011, new policies were adopted to promote clean and energy efficient road transport vehicles – (hybrid and electric). These have been implemented in two ways:

1. Grants for purchase of EVs (up to 20% off the price, not more than € 3,700) – at the end of 2011 the regulations for applying this provision were published but stipulated only during specific periods. To date, these periods have not been specified. Individuals, public institutions and public administration are eligible

2. A scrappage scheme for public administrations and institutions, individuals, NGOs and SMEs whereby scrapping vehicles results in a voucher (worth ~€3,600, 4 times the regular grant for 1 vehicle) for the purchase of new vehicles which can be used for EVs. However this is for limited time periods*

Electric Cars are still at the promotion and testing stage, but not operational on the market, due to the high costs and lack of incentivising legal provisions.

*** NB:** It comes in yearly sessions. In the beginning of 2012 it was open for public institutions and administrations, in August 2012 it was open for individuals. Due to austerity measures, the purchase of new vehicles is prohibited for public authorities but it can be accepted only in special circumstances, through the scrappage scheme solely.

FINANCING

Through the network activities EVUE cities discussed how to ensure a successful shift towards electric mobility it is important to guarantee the financial support that is necessary to the development of the proposed measures and activities.

The following sections present some of the potential financing possibilities, based on inputs to EVUE meetings.

National/local public funds/ Private investment/PPP (Private Public Partnerships)

A vital component of EV business models is private public partnerships. Cities need to develop new collaborations with commercial companies. However, local authorities are often risk averse and lack the experience or skills to do this. It implies a need for a culture change, with appropriate training, to enable cities to innovate and collaborate effectively.

Case Study - AUTOLIB PARIS

Paris has launched the Autolib car share programme focused on "zero-emission" electric vehicles to be a revolution in sustainable urban transport.
Autolib is a public private partnership. The city of Paris and its communes have set up the infrastructure, investing to create 12.5 kilometres of Autolib-only parking spaces and a network of battery recharging stations. But the costs of the cars themselves are being supported fully by the contractor who won the public tender, French entrepreneur Vincent Bolloré.

The scheme works by offering customers an annual, weekly or 24-hour package. Subscriptions fees are 144 Euro a year, 15 Euro a week and 10 Euro for 24 hours. In addition, drivers must pay between 5 Euro and 7 Euro for every half-hour. By the end of 2012, Autolib hopes that as many as 3,000 Autolib EVs could be running around Paris.

Key items in service architecture:

- High Density Network: 1200 stations (1 station/400 meters)
- 24h/7 days service
- Internet, Mobile and street hot points to subscribe, or reserve vehicles
- Cruise assistance (GPS) and emergency support
- Temporary stop allowed, not billed (15 minutes)
- Moderate pricing for large public usage
- Young drivers accepted without any premium charge
- Recharge allowed to private vehicles

The diagram on the next pages illustrates how simple and easy it is to register and start using the Autolib system.

How Autolib contributes to the environment and to sustainable growth

- 200 million Km/Year shifted from internal combustion engine cars to zero emission cars
- 15,000 parking places liberated from private to public usage
- Less street noise & air pollution for more outdoor activities
- 1,000 direct jobs to be created
- Enterprise fleet costs can be partially re-allocated
- A competitive advantage given to member cities

The role of the municipalities in the Autolib scheme

- User freedom maximized and seamless (one way, options not constraints, immediate assistance, guaranteed parking)
- Service accessible to every one (affordable, limited conditions to subscribe)
- Sustainability (electric vehicles, number of vehicles and tuning optimized)
- Intermodal (easy to interconnect with public and other car share services)
- Financially robust

Case Study – A joint-venture approach

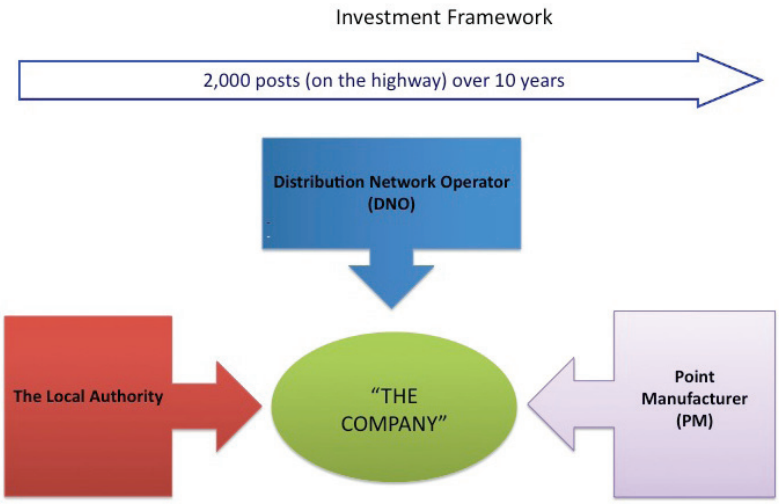
With the pressure on public finances as a result of the economic crisis, new mixed funding models are being investigated for infrastructure funding in local authorities. These approaches apply to on-street charging facilities on the public highway.

One method is through the creation of a public-private partnership that will provide funding for infrastructure installation while introducing a revenue sharing scheme. One local authority, in conjunction with a charging points manufacturer and an energy company, is looking to form a new joint company to manage the installation of 2,000 charging points over a 10 year period (figure 1).

The roles and responsibilities within the joint-venture have been detailed and cover infrastructure, data and system management.

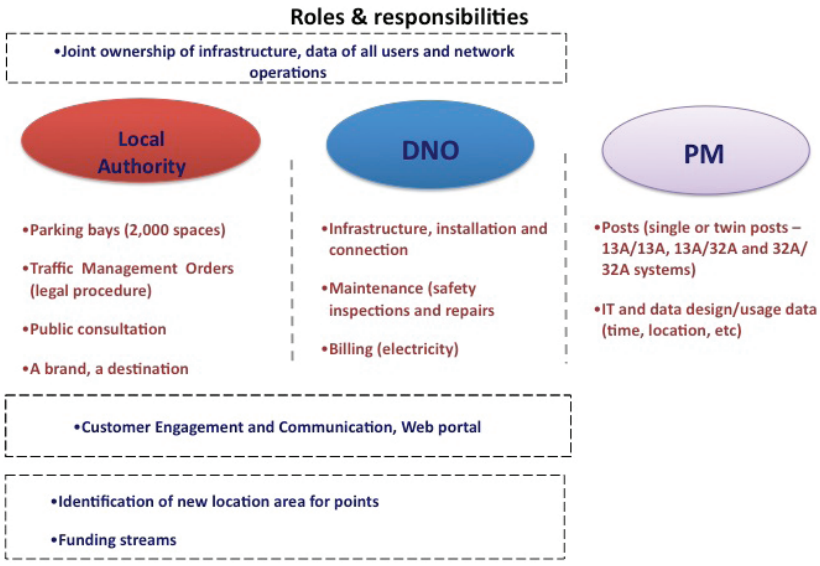
An alternative approach being considered in London includes those solely financed through the private sector. The model called StreetCharge, would operate in the following way:

1. A local resident orders an EV from the dealer.
2. The resident enters into a contract with StreetCharge who contact their local authority to request a charging post near their home in a designated bay.



In this example, the local authority would form a joint venture company with the Distribution Network Operator and a charging point manufacturer.

While ownership of infrastructure, data and operations is shared, clear lines of responsibility are maintained.



3. StreetCharge pays for all associated with the application, planning, installation and ongoing maintenance.
4. The new charging post is installed in a dedicated EV parking bay in the vicinity of the purchasers house, to which the resident and network members gain access.
5. The scheme would seek to ensure that there is the same number of charging points as there are EV drivers in a neighbourhood and would not require any points being dedicated for single usage.
6. User pays a monthly charge to StreetCharge for use of the posts at night as well as electricity used.
7. Charging posts are free for other charging network during the day.

This proposal benefits from removing any costs of the unit from the public to the private sector. However difficulties may arise over the partial 'privatisation' of the public highway either through exclusive usage rights at night to the space or the length of the contract. For example, if a 20 year contract was entered into and the local authority wanted to undertake street widening works or other changes that would force the removal of the points, what would be the contractual implications of this?

EU funding programmes

As described in the introductory section, e-mobility addresses a number of the priority policy areas of the European Commission – climate change, economic development, research and development and sustainable transport etc. EU funding programmes can potentially provide some sources of funding for actions relating to electro mobility in the context of low carbon economies and sustainable cities.

The Research and Development Framework Programme, currently FP7, and the future HORIZON proposals support projects on e-mobility, electric vehicles for freight delivery and e-buses.

Intelligent Energy Europe has three priority areas for which e-mobility corresponds quite closely:

- Promoting energy efficiency and encouraging the rational use of energy sources
- Increasing the use of new and renewable energy sources as well as encouraging energy diversification
- Stimulating energy efficiency and renewables in the field of transport

The Cohesion Policy proposals for the 2014 to 2020 period include priorities for sustainable transport, low carbon economies and innovation. The Operational Programmes in each region may well provide opportunities for developing and implementing new business models in electro mobility. As the 2007 – 2013 budget period is coming to a close, a number of funding programmes are either consulting on the new period or releasing draft programme documentation. These funding sources are to be encouraged.

CONCLUSIONS

The shift to electric vehicles promises significant benefits for the environment as well as the economy, as well as a step change to sustainable mobility in cities. However it requires new models of collaboration between cities and stakeholders such as manufacturers, infrastructure providers and energy companies.

This report, based on the EVUE transnational exchange, describes are number of approaches being taken in this developing market by cities and regions. The challenge of finding viable business models, adapted to the conditions of each city, is still underway. From the evidence to date, the need for vertical and horizontal integration of the value chain is clear. For local authorities embarking on this challenge, new ways of working with the private sector, as well as other public agencies, will be a necessity.

EVUE – JOINT PROCUREMENT OF ELECTRIC VEHICLES

Report author: Eva Sunnerstedt and Haide, Backman Stockholm

October 2012

PROCUREMENT

INTRODUCTION

Procurement is a useful tool for cities to increase the number of clean vehicles within their own fleets, as well as encourage their suppliers to use zero emission vehicles. This report focuses on joint and bulk procurement, and draws on the experience of two EVUE city partners, London and Stockholm, sharing the technical information, process and results achieved. Because it is a new technology and the market is still immature one of the most common problems when starting the introduction of Electric Vehicles (EVs) is to find vehicles. For EV manufacturers there is uncertainty of demand which may lead to car dealers abstaining from introducing a model in a given country. By bringing together a significant number of purchasers it is possible to overcome this. Through demonstrating to vehicle retailers the extent of demand, it may also be possible to lower the price per unit.

The market for cars, vans, minibuses and transporters is more or less pan-European. The total European fleet consists of approximately 200 million vehicles. This means that it is hard for any single actor to influence this market. A joint procurement can be done within one country or as an international project.

Joint procurement means combining the procurement actions of two or more contracting authorities. One characteristic is that only one tender is published on behalf of all participating authorities.

EV used by the Home Care services in Stockholm
Photo: Mosebacke Media

A joint procurement for electric vehicles can:

- Demonstrate demand to vehicle manufacturers
- Support the introduction of new models into the market
- Speed up the market introduction of new technology
- Result in lower prices
- Help to introduce the infrastructure for electric vehicles
- Help to introduce local EV service and maintenance arrangements

Is this something for us?

A joint procurement is a useful tool for public authorities wanting to encourage new EVs into a market or achieve lower prices when purchasing vehicles.

This approach is suitable under the following circumstances:

- When there is significant interest among potential car buyers
- With new or emerging technology
- When there is a low purchasing volume per individual purchaser
- When purchasers have the same performance requirements
- For any city size, joint procurement create a larger demand
- Short implementation time (less than 3 years)

Benefits

- Joint procurement is an efficient tool to overcome two of the main barriers for the development of EVs:
  - lack of models and
  - high prices on the few existing models;
- A consortium may gather both small and large customers, giving also small stakeholders a chance to obtain EVs, making the process more efficient by reducing unnecessary duplication
- Lower the price for EVs
- Speed up market introduction for new technologies close to the market through greater scale and participants
- With larger volumes, it is easier to introduce other sustainability criteria such as social and ethical requirements

Costs

As joint procurement involves a large number of stakeholders during the project period it may add to some of the costs involved. These costs are mainly connected to the set-up of a separate project organisation.

Potential additional costs include:

- Mapping of the market interest (including information campaign to reach as many potential buyers as possible)
- Forming a buyers' consortium
- Setting up the requirements for the procurement
- An international procurement consortium requires translation and knowledge about differing legal frameworks

A procurement project could receive funding from environmental or energy agencies in order to finance some of the additional costs for EVs.

Influence

Joint procurements can increase the buyers' influence on the purchase but this power can be used for different objectives. The approaches can follow one or several of the following categories:

- Technology driven procurements
- Procurements with the main objective to introduce new models
- Procurements with the main objective to lower the price in immature or mature markets

It is not necessary to go all the way and perform procurement; it is also possible to gather interested buyers by letters of intent. This can sometimes be enough for the automotive industry to see the demand and respond to the market opportunities.

"The main objective with the procurement was already met; potential suppliers of electric vehicles were now a lot better informed about Sweden's interest and advantages such as charging outlets at many parking lots (used for preheating of the engine of petrol cars during the cold season), relatively clean and cheap electricity and a pronounced demand for cleaner vehicles."

Eva Sunnerstedt,
Project Manager for the
Swedish EV Procurement,
City of Stockholm

USERS & STAKEHOLDERS

Users and target groups

Owners of large fleets (municipal, regional, national and private) are a key target group in order to get a sufficiently strong demand.

Potential buyers/target groups:

- Owners of large fleets: Local and regional authorities, private companies, leasing companies (see box right), public transport companies
- Vehicle producers: The vehicle producers have to be informed about the project at an early stage
- Energy providers: An interest from the energy providers is important in order to make a broader introduction of the vehicles possible

Key stakeholders for implementation

Joint procurement of electric vehicles can be performed by any organisation. Examples are:

- Local authorities
- Non-Government Organisations
- National authorities with responsibility to reduce emissions of greenhouse gases.

"The nature of the framework, with the ability for framework suppliers to add vehicles as they become available and eligible, and the fact that some framework suppliers are leasing companies, means that vehicles from any manufacturer could become available for call-off."

Philippa Gibbons, Head of Commercial, Congestion Charging and Traffic Enforcement, Transport for London

FROM CONCEPT TO REALITY

This section of the reports describes a typical timetable and process for a joint procurement, broken down into three phases, and including the steps to be taken in each phase.

Preparation (0 – 12 months)

A committed project sponsor must be the driving force behind the procurement.

Key aspects at this stage

• Pre-study/Feasibility assessment

The first step of the preparation is a pre-study that can include e.g.:

- Stakeholder contacts
- Vehicle supply analysis
- Communication strategy
- Procurement options
- Financing possibilities
- Demand and supply matching
- Incentives/legislation

The objective for the procurement has to be clearly identified. On the basis of the market analysis the objective can be defined:

- To introduce new vehicle technology
- To introduce new models of EVs on the market
- To gather buyers in order to get a better price on existing EVs

The prerequisites for the EV have to be clear: What is the charging situation now and in the near future? Is the technology available in other markets or is it close to market introduction? How significant a demand is needed to get a manufacturer interested in introducing the defined vehicle?

• Market analysis

A market analysis study could be performed by a survey of demand and technology. This gives a picture of the available technologies on the market.

Map the market interest for the type of vehicle that is the subject of the joint procurement:

- Contact large users of the vehicle concerned
- Cooperate with interested organisations and authorities in order to reach as many potential buyers as possible
- Send out surveys to potential buyers to get a picture of the size of the interest
- Assess the willingness of the parties to participate in a joint procurement activity

• Organise seminars

At this stage it may be necessary to organise seminars to increase awareness about the planned joint procurement. Most buyers need to fully informed before they commit to buy an unseen vehicle.

• Procurement options

After the first surveys of interest, a decision has to be taken on how the buying process will be performed. Should it be procurement according to the regulations or can it be enough to gather letters of interest or intent from the buyers to get the vehicle producers to offer a new model? Is a formal joint procurement process required or not?

• Public procurement

If municipalities are among the buyers it is necessary to make the procurement according to the rules of public procurement[1]. It is important that the municipalities actually can buy the vehicles that are the result of the joint procurement. A framework agreement can be used. This allows all participating authorities to establish individual contracts with the supplier(s) based on the conditions in the framework agreement.

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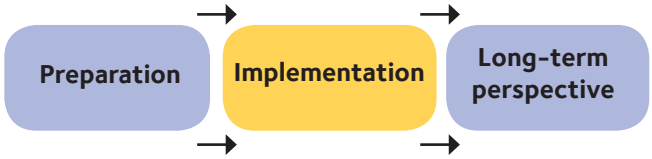
[1] *While EU member states have their own procurement rules, they all must comply with the European directives and regulations. More information can be found here: http://www.ojeu.eu/Directives.aspx*

Inform the vehicle manufacturers

It is important to inform the vehicle manufacturers about the project. They are the ones to decide about a tender and production of a new vehicle model as well as in which markets a new model will be launched. Keep the manufacturers updated about the procurement. Keep in mind that private companies can be unfamiliar with the regulated process of a public procurement. A decision to introduce a new type of vehicle on the market has to be taken at a high level in the manufacturing companies and this may be a time consuming process.

Implementation (12 – 24 months)



Key aspects at this stage

Set up a buyers' consortium

If the decision to proceed with a joint procurement is made, a buyers' consortium needs to be established. Credible and leading buyers are strong success factors for the joint procurement. The buyers should do a clear declaration of intent to buy a number of vehicles. It can be difficult however to get a binding commitment to buy unseen vehicles.

Public procurement procedures can be complicated therefore the consortium may consider using a procurement consultant.

Possible barrier

The buyers' consortium can consist of many different stakeholders. It can therefore be difficult to agree on a common product and on the requirements of the vehicle. It is important to mainly focus on the propulsion system. Other requirements and equipment can then be handled separately.

Key issues related to Electric Vehicles

In general, sustainable purchasing criteria for electricity and batteries need to take into account the whole life balance of the production of the electricity to be a serious alternative to fossil fuels:

- Reducing greenhouse gas emissions resulting from production, transport and use
- Minimising negative ecological impact
- Minimising negative social impact
- Minimising negative economic impacts

When analysing the differences between EVs and combustion engine vehicles, and associated risk factors in the social, economic and/or environmental area, the following issues have been identified:

- The types and amounts of material used in batteries – Lithium and Cobalt
- The use of Rare Earth Metals (REM) in engines and batteries
- The additional use of electronics
- The possible use of nano-materials

A clear understanding and agreement of these factors needs to be reached with all parties to ensure there is consensus as the process continues and expectations are met.

Specification or requirements

The consortium must then decide upon the vehicle/ contract requirements.

Examples include:

- Whether the vehicle shall be available in the whole country/region/city, or only in a specified location
- Where service and maintenance facilities shall be available - all over the country, or only in major cities
- The price offered shall apply at all points of sale
- Sanctions or penalties regarding late deliveries
- Options for transferring eligibility to third parties
- Whether the vehicle shall be at least as energy efficient as the same conventional vehicle
- Whether the emissions shall be at least the equivalent level of the comparable conventional vehicle

- Safety performance standards – are they the same as a conventional vehicle
- Minimum driving range
- Requirements regarding charging
- Social aspects concerning the production of EVs, e.g. working conditions

It is important to keep the requirement specification short and simple with focus on the desired technology. A list of requirements that covers too many areas can significantly limit the chances for success.

Invitation to tender

When the list of requirements is ready it is presented together with the interested buyers and instructions on how the tender will be evaluated. The buyers' consortium can send out the tender itself or through a company working with tenders.

The procedure is important if public authorities are among the buyers. The invitation to tender has to be done within the public procurement system (Official Journal of the European Union). It is also important to make sure that the vehicle producers have received the tender.

Evaluation of tenders

The tenders are evaluated in order to select one or more winners.

Agreements are signed with the winning supplier regarding product delivery.

Long Term Perspective

Key aspects at this stage

The procurement is finalised at this stage. The next step is market introduction. In some cases it can be valuable to offer time for pilot deliveries of the winning vehicle. The procurement should also offer support to the buyers and users, both before and after the delivery of the vehicles.

To facilitate their introduction the project can contribute with marketing of the winning vehicles. Information and awareness campaigns in order to increase the interest of the new EV are an efficient way to build up the knowledge about the project as well as of the vehicle. Inauguration ceremonies, press releases etc will put focus on the new EV. A close dialogue with the winning vehicle manufacturers is vital in order to keep the time plan for the introduction.

While EU member states have their own procurement rules, they all must comply with the European directives and regulations. More information can be found here:
www.ojeu.eu/Directives.aspx

CASE STUDY – SWEDEN

Why a national Swedish EV procurement?

The stimulus to start the procurement exercise was that production of electric vehicles was announced from several auto manufacturers but it was not certain that the electric vehicles would be supplied to the Swedish market. This was despite the fact that Sweden has been very active with clean vehicles of different kinds since the late 1980s. Many other countries appeared to offer stronger incentives to buyers and automakers of electric vehicles. Sweden therefore needed to strongly market its interest, benefits and advantages as a pioneering market for electric vehicles.

Partners

The EV procurement was undertaken by a partnership initiated by the City of Stockholm and the state-owned electric utility company Vattenfall. The City of Stockholm had participated and/or led in many clean vehicle procurements before, both nationally and internationally. Vattenfall has been one of the strong actors in electric vehicle development in Sweden over several decades.

Aim

The main aim of the procurement was to show that Sweden was a suitable country for first electric vehicle deliveries. Other objectives were to contribute towards a cleaner and quieter vehicle fleet, and make it possible to buy/lease EVs and Plug-in Hybrid Electric Vehicles (PHEVs) under the best conditions. For public organisations the joint procurement saves time and money since the process is done in partnership rather than individually.

Specific goals included: participation of at least 150 organisations in the group of buyers, demand for at least 6,000 vehicles in total and at least 8 offers given from the vehicle manufacturers.

National conditions - Sweden

- **Sweden is a country with good conditions for electric vehicles**
- **Electricity mix with low emissions – 90% from hydro or nuclear, and production system with good capacity**
- **Good infrastructure and distribution system for electricity in place**
- **Low electricity price, i.e. low EV driving costs**
- **World leader in usage of environmental vehicles**
- **Good test market - Swedes are "early adopters" of innovations**
- **Approximately 65% of the Swedish population has easy access to electrical outlets at home or at work - through the engine block heaters – and they are used to plug in a car!!**
- **New clean vehicle rebate as of 1 January 2012 for vehicles (Euro 5 or Euro 6) with max 50 gram CO_2 emissions per kilometre (This rebate was not available when the procurement was made.)**

Timeframe

The procurement process lasted approximately 12 months. An invitation to participate in joint procurement was issued in October 2010. This was then followed by phase 1 of the process to ensure all prospective bidders were qualified which was conducted between December 2010 and February 2011. The formal tender phase occurred from March to August 2011 and the contracts commenced on October 1, 2011.

Funding

The Swedish Energy Agency approved funding for the electric vehicle procurement project. The larger part of the public funding (SEK 55 million 6.65 Million Euro) is intended for vehicle funding. For each electric vehicle, the funding is 25 per cent of the additional cost to a maximum of SEK 50,000 (6000 Euro) per vehicle. This subsidy is available for the first 1 000 vehicles delivered. Each participant is granted subsidy for at least one vehicle.

Method

Swedish procuring entities (municipalities and county councils) and private organizations were invited to participate in the joint procurement process in the autumn of 2010. The procurement was a two phase procedure in line with EU and national Swedish public procurement laws. The first phase was a qualification of bidders and the second phase was an invitation to tender, including the vehicle specifications, submitted to qualified applicants.

The key aspects in the specification are listed in Table 1.

Table 1 Vehicle specifications

	Passenger car		Transport vehicle	
Type	EV	PHEV	EV	PHEV
All-electric range	>100 km	>20 km	>100 km	>20 km
Energy/CO_2	<0.37 kWh/km	<50 gCO2/km		
Recharging	Schuko socket, one phase, 230 V/10 A			
Top speed	>100 km/h		>90 km/h	
Max cost	400,000 – 650,000 SEK		600,000 - 800,000 SEK	
Extra credits given to	vehicles fulfilling the requirements below			
Euro NCAP or similar	> 32.5/28 p (total) > 9.5 p (pedestrians) >2 p (whiplash protection)			
Stability	ESC		ESC	
Alcohol lock	Possible to install		Possible to install	

Schuko socket a
s specified in the tender

Results

The invitation to participate in the procurement attracted 296 organisations, consisting of 260 public and 36 private bodies. Together the stated intent was to buy 1,250 vehicles per year. Over the possible four year contract period this corresponds to 5,000 vehicles in total. The City of Stockholm and Vattenfall both plan for 20 vehicles per year. A large effort was invested in obtaining realistic figures from the participants in the procurement. Concern regarding high prices and less than desirable safety levels for the electric vehicles to be procured was expressed by many partners. This led to several partners indicating that they were unlikely to purchase within the procurement framework.

Phase 1: Qualification of bidders

In December 2010, the qualification of bidders started. All bidders had to apply for participation in the procurement. In parallel, the project team contacted all known potential bidders and informed them about the procurement and the advantages of participating. These contacts were predominantly made directly with the European representatives of each auto maker but always with full transparency towards the representative in Sweden. The qualification led to 14 applications, with 12 passing the initial evaluation stage. Two companies were rejected at this stage due to incomplete information being provided. Unfortunately four auto makers that had showed great interest for the procurement did not apply; Toyota, Volvo Cars, EV Adapt (Swedish company converting Fiat 500 to EVs) and Hybricon (Swedish company converting Toyota Prius to PHEVs).

Phase 2: Tender phase

In April 2011, ten out of the twelve, prequalified potential suppliers submitted their tenders. In the evaluation of the tenders, six passed. Iveco and Mercedes were disqualified as the top speed (for transport vehicles) was not met and Peugeot and Opel because they did not provide information about the cost of service. Nissan and Ford did not submit any tender. In Table 2 the result of the procurement is presented.

Contracts started October 1, 2011 and the qualified suppliers have to accept orders by October 1, 2012, at the latest. They may add further models throughout the whole contract period. For public organisations, the framework approach implies that a renewed competition has to be carried out before orders are placed.

In order to obtain the subsidy, the organisations have to own or lease the vehicle for at least three years, and they have to participate in the evaluations led by the project partner Test Site Sweden and KTH (Royal Institute of Technology). Funding is available for the first 1,000 vehicles purchased within the framework agreement.

Table 2: Selected vehicle

	Make	Type	Price (SEK excl VAT)	Price (Euro)
Passenger Cars	Chevrolet Volt	PHEV	327,920	39,282
	Citroën C Zero	BEV	289,600	34,691
	Mitsubishi iMiEV	BEV	281,688	33,743
	Renault Fluence	BEV	210,400 + battery leasing 790/month	25,204 + 94
	Saab 9-3 ePower*	BEV	649,500	77,804
	Vantage SUV*	BEV	332,000	39,770
Transport Vehicles	Renault Kangoo Express ZE	BEV	194,000 + battery leasing 790/month	23,239 + 94
	Vantage Minivan **	BEV	323,000	38,692
	Vantage Pick-up **	BEV	294,000	35,218

*Saab is no longer a possible supplier after the bankruptcy
**Vantage are conversions of Nissan vehicles made by the firm Avancee HB

Reflections and lessons learned

By the beginning of 2012, only a handful of vehicles have been delivered but over 100 deliveries were due in the first quarter of the year. The delivery time is about three month after placing the order. Some of the vehicles are, however, not yet possible to order.
The main objective with the procurement was achieved; potential suppliers of electric vehicles are now a lot better informed about Sweden's interest and advantages such as charging outlets at home, in the offices and at many parking lots, relatively clean and cheap electricity and a pronounced demand for cleaner vehicles. Also the quantitative aims have been met and Sweden is now among one of the first countries where Mitsubishi and GM/Chevrolet have introduced or will introduce their BEVs/PHEVs.

One important observation is that the retailers of vehicles have had difficulties in following the tendering process, despite the information from the project and the well prepared, easy to follow, procurement documents. This resulted in several disqualified potential bidders. A bit disappointing was that Volvo Cars showed very limited interest and that Nissan and Ford, even though prequalified, did not submit any tenders. Compared to previous procurement projects, the addition of a prequalification for the bidders was a fortunate move, as it allowed for a lot more attention and information about the project to vehicle retailers on national and international level.

The EV market is a very immature market. The demand for EVs is much larger than the supply. This has made it hard to get lower prices or discounts on the EVs in the joint Swedish procurement. If the buyers in Sweden are not willing to pay the regular EV prices the vehicles will be sold in other European countries instead. The best offer in this procurement was from Mitsubishi who offered the IMiEV with a 3 percent rebate for the consortium compared to the regular price. This is low compared to other vehicles procurements.

"It was a surprise that the retailers of vehicles had such difficulties in following the tendering process with several disqualified potential bidders."

Eva Sunnerstedt,
Project Manager for
the Swedish EV Procurement,
City of Stockholm

CASE STUDY – LONDON

London Conditions

- **The Mayor wants to make London the electric vehicle capital of Europe to deliver cleaner air and reduce CO_2 emissions**
- **Road transport is responsible for 16 % of London's CO_2 emissions**
- **Road transport is responsible for 45 % of London's NOx and 56 % of its PM10 emissions**
- **Electric Vehicles emit 40 % less CO_2 using UK grid mix – potentially zero carbon in the future**
- **Londoners are "early adopters" of innovations and have 23 % of the UK's EVs**
- **London vehicle trips tend to be short (90 % less than 10 miles/ 16 km)**
- **The busy traffic conditions with lots of idling are ideally suited to EVs**
- **Incentives to reduce costs are in place - exemption/discount from the Congestion Charge**
- **UK government rebate on vehicle purchase, for 2011/2012 up to £5000 or 25 % for a car and for 2012 up to £8,000 or 20 % for a van under 3,5 tonnes.**

Why London EV procurements?

The Mayor of London launched the Electric Vehicle Delivery Plan (EVDP) at the C40 Conference in Seoul in May 2009 with the aim of delivering a step-change in the number of EVs in London, with 100,000 vehicles (or 2.3% of London's vehicles) on the capital's streets by 2020.

Through the Greater London Authority (GLA) Transport for London (TfL) was charged with the delivery of the Electric Vehicle Delivery Plan for the Mayor with key targets of:

- Delivering a comprehensive network of electric vehicle charging point
- A package of incentives, marketing and communications
- Leading by example - trialling and introducing electric vehicles into the (GLA) fleet. The GLA group is made up of the police, fire brigade, and Transport for London.

At about the same time the UK Government, through the Office for Low Emission Vehicles (OLEV), announced provision of over £400 million to support measures designed to promote the uptake of the next-generation of ultra-low emission vehicle technologies as an aid to the UK in meeting its longer-term climate goals which will require road transport to be largely decarbonised by 2050.

Partners

One of the OLEV initiatives was the creation of the 'Plugged-in-Places' (PiP) scheme which offers match-funding to consortia of businesses and public sector partners to support the installation of electric vehicle recharging infrastructure in lead places across the UK. London successfully bid to be one of the initial PiP and has expanded the membership of the consortia which currently includes London Boroughs, Car Park Operators, Supermarkets, Energy Suppliers, Technology Companies and others.

Aim

The main aims for Transport for London under the Electric Vehicle Delivery Plan were to:

1) Purchase and utilise Electric Vehicles within the Transport for London fleet and assist with the procurement of up to 1,000 within the Greater London Authority group fleet;

2) Manage the procurement and installation of charge points:

a) 500 on public authority land, either on or off-street;

b) 2000 on publicly accessible privately owned land;

3) Create and operate a pan-London Scheme that will allow members of the Scheme to access all the charge points above;

4) Run a range of marketing and other initiatives to stimulate the market for EVs aiming to achieve:

a) 25,000 charging points by 2015 (including (2) above); and

b) 100,000 EVs in London as soon as possible;

In order to deliver a comprehensive and holistic approach to the above, Transport for London undertook three separate procurement exercises:

1. Electric Vehicles
2. Charge Point Infrastructure
3. The pan-London Scheme – Source London

For Vehicles and Charge Points, in drafting the procurement documentation, care was taken to ensure that partners could use the resulting framework contracts thus saving time and money since the process is undertaken once for all partners rather than individually.

Charging of Electric Vehicle
Photo: Transport for London (TfL)

Vehicle Procurement Aim

The aim was to put in place a framework agreement that would allow the purchase or lease of ultra-low carbon vehicles in 5 separate categories. The framework agreement allows for the provision of up to 1,000 vehicles in London and up to 300 in the rest of the UK, with the framework available to any public bodies in the Greater London area and members of the Pro5 Group Central Purchasing Organisation.
Through the scale it was envisaged that economies of scale would be achieved and that it could stimulate the production of vehicles suitable for the UK market (i.e. right-hand drive).

Table 3: Vehicle Specifications

	L – M/cs	M1 - Car	M2 - Van	N1 < 3.5T	N2 < 12T
Co_2 Emissions (g/km)	Nil	75	125 mass normalised	125 mass normalised	Nil
Top Speed (mph)	>30	>60	>55	>55	>50
Range (miles)	>40	>70 or >10 PHEV	>60 or >20 PHEV	>60 or >20 PHEV	>50
Suitability	All Vehicles to be EC Whole Vehicle type approved production models normally provided to the UK market				
Reliability	Vehicles to be available for 90% of the available working time in any three month period, excluding scheduled service times vehicles shall suffer no more than four breakdowns in any three month period				
Recharging	Charging Cable plug to comply with either BS1363 or IEC 62196.				

Timeframe

Commencing in February 2010, a four month scoping period was undertaken to identify the key specifications required. This was undertaken with partners organisations including the police and fire brigades. Following the development of the specification, prospective tenders were assessed against minimum qualification requirements (March 2010 – June 2010). The tendering stage commenced in July 2010 and concluded in April 2011 with the contract starting in May 2011.

Method

The procurement was looking for either the purchase or lease of a vehicle with associated maintenance services as required. The procurement was a two phase procedure in line with EU and national UK public procurement laws. The first phase was a qualification of bidders and the second phase was an invitation to tender, including the high level vehicle specifications, submitted to qualified applicants. The key aspects of the high level specification are listed in the table above.

Results

Throughout the procurement bids were received from both vehicle manufacturers and leasing companies.

Phase 1: Qualification of bidders

- In March 2010 the OJEU Notice was published. Prior to and after publication the market was informed of the procurement at trade shows, through trade organisations, etc. 29 applications were received, of which 24 passed the evaluation and were invited to tender.

Phase 2: Tender Phase

- Of the 24 companies invited to tender, 19 submitted applications.

The framework agreements were signed with the suppliers in May 2011, a couple of vehicle manufacturers qualified to enter the framework agreement but declined to sign the contract. Some of the suppliers will only lease vehicles whilst others will only provide them for purchase. There was little interest from the market in battery leasing. For public organisations, the framework approach implies that in most cases a short renewed competition has to be carried out before orders are placed.

The framework runs for four years and suppliers may add further models throughout the contract period. The initial list of available vehicles is above with some vehicle models being available from multiple suppliers.

Reflections and lessons learned

Given the worsening economic situation and spending cuts generally, public organisations have struggled to justify the additional spending that an electric vehicle represents, and as a consequence the take up of vehicles has been very small. It is hoped that the recent extension of the OLEV discount and its new application to vehicles in class M2 will result in an increase in take-up. This situation has not been helped by the restricted supply of vehicles, with most manufacturers now planning to launch EVs in 2012/13. The inclusion of lease companies on the framework means that as manufacturers bring out new models, they can be added during one of the periodic vehicle refreshes.

Generally the motor manufacturers seemed to find the EU procurement process challenging as it is not a common route to market for them. The number of electric vehicles in London has increased, doubling the number of pure electric vehicles to 2,400 and the number of hybrid vehicles has increased considerably (though it is difficult to differentiate plug-in hybrids due to data constraints).

Table 3: Vehicle available at the start

L – M/cs	M1 - Car	M2 - Van	N1 < 3.5T	N2 < 12T
Ewarrior Vextrix, Sprint, Zero (S), ΩMJS5000W, MNY 2000W Zapino	Citroen C Zero Mitzubishi I-Miev Mercedes Smartcar Coupe Peugeot Ion, eExpert EuroBus eExpert TePee ePartner TePee eBipper TePee Micro-Vet: Fiat 500, Doblo, Fiorino, Ducato, Qubo, Scudo Nissan Leaf Tata Indica Vista EV Toyota Prius Plug-in	Mercedes Vito Peugeot eBipper, eBoxer, eExpert, ePartner Micro-Vet:Ducato Minibus Edison Minibus	Peugeot eBipper, eBoxer, eExpert, ePartner EVF chassis EcoMile, Jolly2000 Micro-Vet: Doblo, Fiorino, Ducato, EdyOne van Edison Chassis Cab and Panel Van	Peugeot eBoxer, Micro-Vet:Ducato Edison Chassis Cab Panel Van and Newton Chassis Cab

Charge Point Procurement Aim

- To allow the delivery of charge point infrastructure in publically accessible locations, both on and off street (e.g. supermarkets, train stations, car parks)
- To overcome the perceived 'range anxiety' of electric vehicle drivers by providing infrastructure for vehicle recharging
- To put in place a framework agreement that would allow the purchase of charge point infrastructure and its associated operation and maintenance in 2 separate categories, standard/faster and rapid.

The framework agreement allows for the provision of up to £20 million/€25 million spend in London and up to £10 million/€12.7 million spend elsewhere in the UK. The framework is available to any public bodies in the Greater London area and to members, both public and private, of any Plugged-in-Places scheme within the UK.

Timeframe

The specification was developed between February and May 2010 in parallel with the initial qualifying assessment of prospective suppliers. The tender phase was launched in May 2010 and ran through to January 2011, with the contract commencing in February 2011.

Method

This procurement was also a two phase procedure in line with EU and national UK public procurement laws, expanded to allow a competitive dialogue with bidders to better understand how the charge point market was developing.

EV charge point in London
Photo: Transport for London (TfL)

Results

13 applications were received and 9 were invited to submit a tender. Following receipt and evaluation of the initial offers at tender, 5 bidders were invited to dialogue. One of the suppliers withdrew at this stage. On completion of the dialogue final offers were submitted and evaluated.

Reflections and lessons learned

There have been a number of call-offs for the provision and/or upgrading of charge point infrastructure. As foreseen by the EV Project, given the nature of the companies and the fact that Plugged-in-Places funding has ensured that demand has increased across the UK at the same time, the charge point suppliers have struggled to satisfy demand, this has slowed the installation of charge points for both public and private partners.

Charging Network

The EV charge point network for London is called Source London. Source London is a convenient and highly accessible way of charging electric vehicles.

Given the embryonic nature of the whole market and the different charging mechanisms that were being suggested, this is being provided for London under a sponsorship arrangement. The sponsor, Siemens, gains experience of operating a scheme in this market and can react to market developments appropriately. The scheme is operating as a membership scheme where someone pays to join but then pays nothing further, so there is no payment for electricity consumed whilst charging (at present).

The Source London scheme has been successful in its aim of introducing charge points, such that there should be 600 operational in the scheme by the end of April 2012. These are a mixture of public authority and privately owned charge points, some of which have been procured via the framework.

CONCLUSIONS

From these case studies, a number of clear recommendations and observations have been made that should be considered if undertaking this approach.

- Joint Procurement has proved to be successful in several cases, but it has to be well prepared
- A two step procurement procedure with a prequalification for the bidders is recommended as it allows for a lot more attention and information about the procurement to vehicle retailers
- During the procurement preparation phase the type of procurement (eg joint procurement) should be analysed
- Do not involve too many stakeholders in a joint procurement, it can become difficult to agree on the vehicle specifications
- Public procurement procedures can be complicated, consider using a procurement consultant
- Give attention to the vehicle manufacturers, they are not always used to public (joint) procurement
- Small stakeholders can benefit from a joint procurement
- Smaller cities, and cities in less-developed markets, could also benefit from joint procurements, to create better scale, and to share the work involved in procurement
- If it is your first joint procurement do not take the lead
- Be realistic, understand your market (small providers can have problems to participate in tenders)
- Do not forget to include requirements on availability of service and maintenance

FURTHER INFORMATION & CONTACTS

Contacts and Further information

Clean vehicles in Stockholm:

Information about the Swedish EV procurement is available at:
www.miljobilar.stockholm.se (Swedish)
www.elbilsupphandling.se (English and Swedish)
Contact: Eva Sunnerstedt
E-mail: eva.sunnerstedt@stockholm.se
Phone: + 46 8 508 28 913 / + 46 76 12 28 913

London:

Information about the EV and Charge Point procurements is available at:
www.tfl.gov.uk
Contact: Roger Tedder, Transport for London
E-mail: RogerTedder1@tfl.gov.uk

Public procurement:

http://ec.europa.eu/internal_market/publicprocurement/index_en.htm
http://ec.europa.eu/environment/gpp/index_en.htm

EVUE- APPROACHES TO E-MOBILITY INFRASTRUCTURE

A Guide for Stakeholders.

Report author Matthew Noon, CRP, October 2012

INFRASTRUCTURE

INTRODUCTION

The development of charging infrastructure is a useful tool for cities to increase the number of electric vehicles driven by consumers and in commercial fleets. This report focuses on urban charging infrastructure and draws on the experience of EVUE city partner, sharing the technical information, process and results achieved by them.

The decision for cities to support a shift towards electric vehicles needs careful consideration to ensure that all aspects of implementation are integrated and sustainable.

Within the next few years, all major manufacturers will be offering Electric Vehicles (EVs) and Plug-In Hybrid Electric Vehicles (PHEVs) to the market. Unlike other incremental changes in vehicles and their operation, this is a step change which will forever alter urban environments. The benefits from reducing air and noise pollution will make cities healthier and better places to live, work and play.

To fully capture these benefits however, cities will need to ensure that there is effective integration between urban policies, planning regulations, charging infrastructure and market provision of vehicles.

At present, there is a "chicken and egg" situation whereby investment in infrastructure will only be a success if the vehicles are available and consumers will only purchase the vehicles if the supporting infrastructure is available. Cities may need to take the lead in the initial stage to stimulate the market to overcome this barrier through the provision of electric vehicle charging points (EVCPs).

The purpose of this report is to help those interested in developing electric vehicle infrastructure about the range of considerations to ensure a successful system.

Vehicles charging in Oslo

Types of Charging Points

Please note: All EVCP designs and installations should be approved by qualified electrical engineers and meet the necessary standards. Poor design and/or installation can be dangerous.

The basic requirements for a charging point are quite simple: an electricity feed with appropriate socket. While it may be possible to plug an EV charging cable into a standard, domestic socket, this is not encouraged. The high energy demand and time required is generally unsuitable for standard wiring connections.

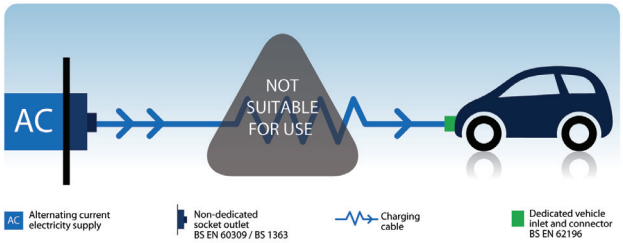
The first aspect for consideration is what charging speed is desired. The speed of battery recharge is constrained by the electricity input as well as the battery capacity. Due to the significant variation in vehicle types and technologies, this report will only focus on the charging point options and not the vehicles.

The terminology around charging points can also create some confusion regarding charging modes, connectors and speed.

Modes

The IEC[2] categorises charging equipment into four modes:

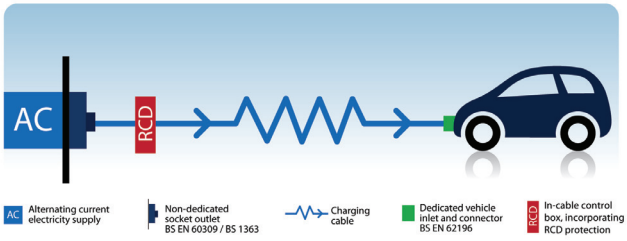
- **Mode 1** - standard charging from a regular electrical socket (1- or 3-phase). This is not recommended, and indeed illegal in some countries, as there are no additional safety features such as residual current device (RCD) incorporated into the charging system.



A
Mode 1 charging: Non-dedicated circuit and socket-outlet, charging without cable-incorporated RCD protection
Image: BEAMA

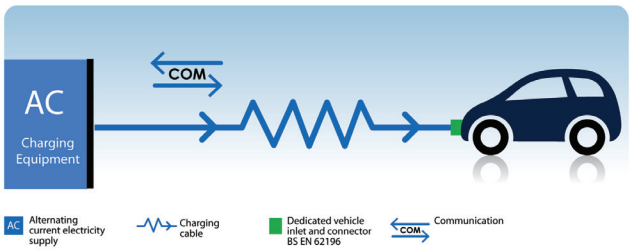
In addition, as the circuit to which the vehicle is connected may also be shared with other appliances, the risk of an overload/short circuit is quite high.

- **Mode 2** - standard charging from a regular socket but equipped with some EV specific protection arrangement included in the cable. This system will manage the load and control it a desirable maximum e.g. 10A.



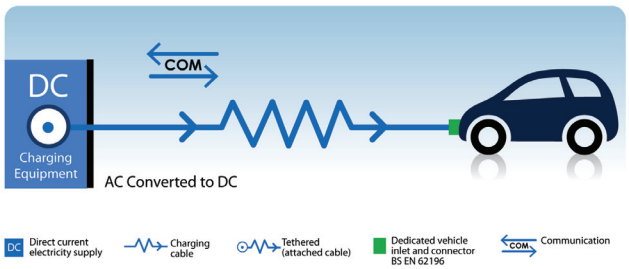
B
Mode 2 charging: Non-dedicated circuit and socket-outlet, charging with cable-incorporated RCD protection
Image: BEAMA

- **Mode 3** - standard or fast charging using a specific EV multi-pin socket with control and protection functions on a dedicated circuit. This enables '2-way' communication with the mains and other devices for overall load management and safety.



C
Mode 3 charging: Fixed and dedicated socket-outlet
Image: BEAMA

- **Mode 4** - fast charging using some special charger technology such as CHAdeMO. All necessary control and protection functions are included in the installed infrastructure.



D
Mode 4 charging: Dedicated rapid charging, DC supply
Image: BEAMA

As of September 2012, there is no European standard for EV charging modes or connectors. French and German Original Equipment Manufacturers (OEMs) favour mode 3 only charging, with mode 2 as a transitory solution for home charging only. There is user support for mode 1, which is safe if used correctly, and is quite common in Nordic countries where it is often used for engine block heaters in the winter. For mode 4 fast charging there is an industry standard called CHAdeMO, compatible with many Japanese vehicles such as the Nissan Leaf.

[2] *International Electrotechnical Commission*

Connectors

In addition to the charging mode, there are also four main types of connector (plugs).

Type 1 - single phase vehicle coupler with a maximum current of 32A and voltage of 250Vflecting the SAE J1772/2009 automotive plug specifications, with 5 pins.

Image: Michael Hicks

Type 2 - single and three phase vehicle coupler - reflecting the VDE-AR-E 2623-2-2 plug specifications (Mennekes plug). Rated at 70A for single phase and 63A three phase at a maximum voltage of 500V with 7 pins.

Image: Michael Hicks

BEAMA

Type 3 - single and three phase vehicle coupler equipped with safety shutters - reflecting the EV Plug Alliance proposal

While similar to the type 2 plug, the current is limited to 32A for either single or triple phase supply which reduces the cost of the unit. In addition, the socket has shutters over the socket side pins as a safety feature (currently required in 12 European countries). There is debate about whether this additional feature is required as mode 3 charging requires the socket to be dead when no vehicle is connected – eliminating any hazard that the shutters are designed to protect from. However, if mode 2 charging is used, the additional protection may be of benefit and allows for a simpler charging station.

Type 4 - fast charge coupler - for special systems

As a fast charging connector, this operates at up to 500 VDC at 125 A. No connector standard has been adopted all the most common is the CHAdeMO (pictured).

A combination plug that will enable a one socket connection to operate as either a normal or fast charging is also under development.

Table 1: Charging times

It should be noted that at present, there is no standard set in Europe for EV charging equipment. This constitutes a significant challenge for cities in deciding which technology, modes and types to use, in order to make the most cost-effective long-term investments in infrastructure. According to AVERE[3] the current timeline for international standardisation initiatives is:

- End-2011: ETSI & CEN-CENELEC was expected to deliver their recommendations to the European Commission for a European standard.
- End 2013: DC charging standard expected to be released by the IEC.
- 2017: ACEA's position paper Mode 3 Type 2 & Fast Charging Type 2/Combo 2.

Until such time as a standard is agreed, care should be taken when choosing the technology to be supported to ensure local objectives are met e.g., speed, cost, access etc.

Table 1, illustrates the approximate charging time and related electricity supply. Please note that Mode 1 (standard domestic socket & wiring) is not included as this type of connection is not recommended.

Regarding the speed of charging, there is a distinction between normal, fast and rapid charging. The approximate charging times for a 24kW battery are given below along with relevant energy demand.

Charging time for a typical 24kWh battery	Power Supplied	Voltage	Maximum current	Mode	Speed
10.4 hours	2.3kW	230	10A	2, 3	SLOW
8.3 hours	3kW	230	13A	2, 3	SLOW
6.5 hours	3.7kW	230	16A	2, 3	SLOW
3.2 hours	7.4kW	230	32A	3	FAST
1.6 hours	14.5kW	230	63A	3	FAST
1.04 hours	23kW	230	100A	3	FAST
29 minutes	50kW	400-500VDC	100 – 400A	4	RAPID
15 minutes	100kW	400-500VDC	100 – 400A	4	RAPID

Table 1
Source: BEAMA

[3] *The European Association for Battery, Hybrid and Fuel cell electric vehicles.*

Charging Points

For a city considering EVCPs, particular attention is required as to the type of user the charging points are aimed at.

While fast and rapid charge facilities provide the highest level of service and minimise the amount of time required, the costs are substantially higher than standard charging facilities. If it is considered that delivery or high use vehicles will be targeted, rapid charging facilities will be required to minimise the recharge time. However, most cities are focused on standard charging units due to the lower capital and operating cost of the units.

It must also be noted that fast charging can have a detrimental effect on battery life and some vehicle manufacturers do not recommend their usage.
In most urban, on street situations, charging facilities provide an opportunity for a 'top-up' charge and are not seen as the main charging solution. One of the primary objectives with on street charging is to create visibility and confidence for potential EV drivers.

Standard charging units can potentially use existing power supplies e.g., street light [4]connections , and can be installed quite easily. Rapid charging units, due to the high electrical demand will require significantly more integration with the energy distribution network and safety features need to be incorporated.

Off street charging points in Oslo

[4] *Although care is required to ensure that the system takes into account the variable power supply e.g., during the day time when the lights would normally be switched.*

Oslo

London

An example of a London "Electromotive" and Oslo charging point.

Fit for purpose.

While there are a wide range of CP options available, among the EVUE partners a useful comparison to review is London and Oslo.

Oslo is a world leader in the adoption of electric vehicles and has the highest per capita ownership of any city. Given their history with EVs, the CPs developed for on street usage have been kept very simple with a socket and fuse switch housed in a waterproof unit accessible to users with a physical key.

As a comparatively new city with regard to CPs, London has taken a more complex approach with units that also have individual meter boxes, contactless card access and most significantly, remote communication facilities. Utilising Wireless Local Area Networks (WLAN) such as WiFi, this enables the system manager to remotely manage and monitor the units providing usage data, the ability to charge for electricity and additional functionality such as on-line user reservations or monitoring of unit availability.

While Oslo's unit are considerably cheaper, London's offer a greater range of functionality. It is up to the system planners to identify the best approach for their organisation, city or region.

These are also examples of 'dumb' and 'intelligent' units.

Charging points types will also vary depending on location: on-street, off- street, wall mounted.

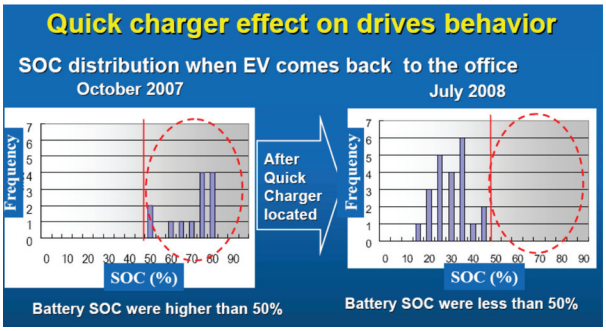
Dual head charging point in Stockholm

In general, on-street, publicly accessible charging points are placed on the kerb adjacent to the EV car park. In areas where 'street clutter' is an issue, or environmental conditions prevent kerb mounted charging points (e.g., due to operation of snow ploughs), off-street or wall mounted locations are favoured.

Public Fast Charging

Fast charging facilities are less common, due to cost and complexity. They have been trialled by a number of cities. An example of the benefits of the fast charging was reported[5] by Takafuni Anegawa from the Tokyo Electric Power Company.

Following the installation of public charging units in Tokyo, vehicle range increased by a factor of seven as it removed a significant psychological barrier on driver behaviour. Prior to the unit installation, vehicles were running with a battery state of charge (SOC) of well over 50% at all times – significantly limiting their effective range. Afterwards however, the SOC went down as the drivers were comfortable with extending their range.



However, overall usage of the units remained low with only occasional usage for 'emergencies' or as a range extender.

As such, the need for fast charging units in urban locations may be quite limited.

Wall mounted charging point in Stockholm

[5] *http://www.emc-mec.ca/phev/en/Proceedings.html*

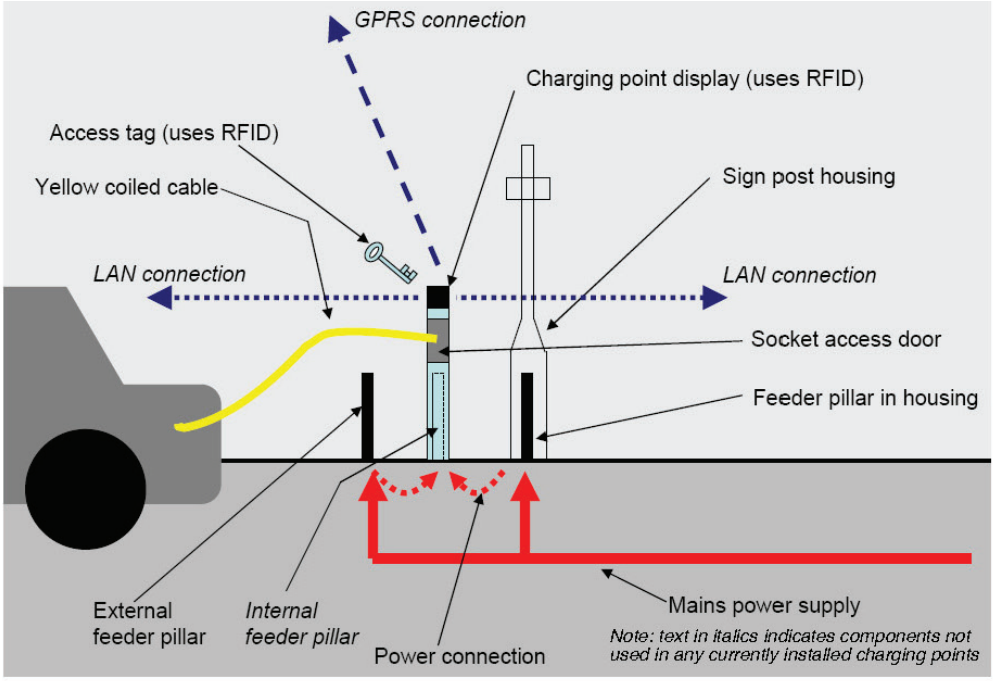


Diagram showing components of system (Source TfL)

When considering the business case for the introduction of fast charging units in urban areas, a lower usage should be considered unless there is significant demand i.e., regular long distance commuters or visitors.

To increase the effectiveness of the units, a number of cities encourage the installation of dual socket units. This enables two vehicles to charge simultaneously from the same charging point. This can also be helpful where there are competing demands for charging points for example with car clubs.

On street charging point - Madrid

Location strategy

The location of the supporting EVCP needs to be carefully considered. In the initial stages of programme implementation, areas of high visibility can provide good opportunities for increasing public awareness. Careful consideration should also be given to the process.

Location Types

There are four basic different types of location:
On-street – public and shared charging bays

- Town centres, high streets, tourist attractions
- Residential areas (including car club bays)

Off-street (car parks) – public and shared charging bays

- Leisure centres and sports facilities
- Retail outlets
- Community facilities
- Parks and other green spaces

Off-street – private charging bays

- Residential

With regard to their location in residential areas, as this is likely to be the main charging source for vehicles, it may not be suitable to follow this approach in all areas. For suburban locations with off street parking, planning policy should likely presume in favour of home charging. However in dense urban areas with limited (or no) off-street parking, the management of on street locations also needs consideration to minimise user conflict.

As well as the general factors for consideration, location specific features also need to be looked at such as:

- Availability of off-street residential parking facilitates charging at home
- Locations where vehicle owners drive substantial distances maximising environmental and financial benefits of EVs
- Multi-car ownership households. EVs suitable replacement for second vehicle

In many cities, the vast majority of the population live in multi-unit dwellings, with no garage facilities. For instance in EVUE city Katowice, only 7% of the population have a garage. Electric market development in Central and Eastern European states is expected to accelerate in 2014 and beyond. This gives time for the particularities of location strategies for residential charging infrastructure to be planned. Examples from similar cities in Europe, and in the USA can help this process.

Site Selection

Following identification of the general location, a range of factors should be considered that take into account the specific site conditions. These include:

- Demand: this may be either existing or potential e.g., through demographic profiling
- Visibility/Accessibility: highly visible, accessible and busy locations are desirable to increase awareness and usage. It can also provide an additional incentive to uptake for the consumers when preferential parking spaces are provided.
- Footway space: depending on the CP units specified, additional street furniture may have a negative impact on available pedestrian space. Also consider local constraints such as street sweepers, snow ploughs or other regular/ occasional requirements on the footways.

London – Putting the Pieces together

In addition to the range of considerations described here, London has also used segmentation analysis to identify likely locations.

Derived from consumer marketing tools, this approach has sought to identify who are likely EV innovators and adoptors.

By identifying the common socio-economic characteristics, it enables better understanding of their motivations, better communication with them.

Using the Mosaic Public Sector Data analysis tool, Transport for London identified five key groups who are more likely to use or purchase EVs.

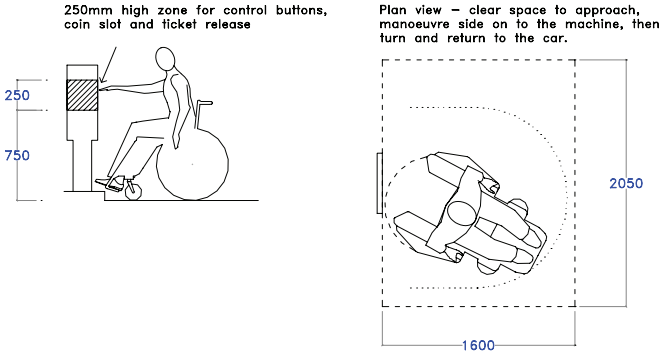
Mosaic Type	Description
Global Connections	Affluent middle-aged singles living in central London
Cultural leadership	Professionals living in middle ring suburbs and working in central London
New urban colonist	Ambitious singles or couples living in high density suburbs
City Adventurers	Young and single skilled workers living in inner suburbs
Corporate Chieftains	Business managers living in detached houses in outer suburbs

By mapping these groups across London, it was possible to identify the key areas for marketing communication and initial infrastructure installations.

- Political and Community Acceptability: In the initial development of an EV network, there maybe local community considerations which can assist or impede implementation. it may be possible to secure high profile sites which would not be feasible at a later stage of development.

In Frankfurt, the bank Sparkasse, in a collaborative venture with an environmental organisation, has installed this 'simple' charging point for their customers – a high profile, low cost solution.

- Layout/Location: will it be a new bay or a reallocation of space from an existing carpark? As a 'destination' space, it may also be appropriate to use under-utilised spaces as drivers will specifically seek them out – this will impact on visibility.
- Electrical connections: a significant amount of groundwork may be required to install the necessary cabling, consider proximity to power sources e.g., street or traffic lights, the location of underground utilities which may inhibit installation or land ownership.
- Traffic engineering and enforcement: will it affect the operation of the road network? How will changes in parking regulations be implemented and enforced?
- Disability requirements: Consideration also needs to be given to ensuring that the charging points are fully accessible. This can include height and placement criteria. Additional factors such as the proximity to a wheelchair accessible (dropped kerb) crossing are also important.



Above: Westminster City Council's specifications for the placement of charging points.

Above: Rear view of the Sparkasse

Above: An example of a wheelchair accessible charging point.

Source: Sustainable Transportation Strategies.

In Lisbon the agency Lisboa Innova was charged with implementation of the infrastructure strategy. In order to achieve the targets and deadlines a multi-stakeholder working group was created, including water, utilities, parking companies and the city hall. The group met every week at the same time, to review progress, identify sites, solve problems, share information, and keep the process on track.

Feeder Pillars

With most on street electrical equipment, a 'feeder pillar' is used to connect the equipment to the electrical supply. Quite often this contains a fuse/ switch and meter and is separate to the equipment. With concerns about street clutter, some cities are requiring integrated feeder pillars.

Depending on local regulations, the feeder pillar may be internal, that is included in the charging point housing or external, located in a separate housing. Local regulations should be followed as to the most appropriate approach.

System Administration

Cities implementing publicly accessible CPs can choose between open and restricted access systems.
Open access generally refers to charging points where users can plug straight into without any constraints. Most common in car park buildings and private locations, they are simpler and easier to install and operate. Their drawback however is that they do not provide the system administrator any additional monitoring or management functionality which constrains future operation such as payment schemes. Restricted access refers to any charging point where access is controlled. These can range from pre-registered/ subscription systems to on demand/ occasional use access. Pre-registered schemes involve the user receiving an access key which enables them to access all affiliated charging points.

While open access systems are very suitable in specific, controlled environments such as private dwellings or secure facilities, restricted access systems provide much greater functionality to administrating authorities.

MobiE vs Source

Portugal has embarked on a nationwide EV charging system that integrates access, equipment, billing and payment in one system. Called Mobi.E it ensures an easy to use system is provided for users throughout Portugal.

In contrast London has developed the SOURCE London system which aims to integrate the system on a regional basis. While discussions are being undertaken to expand the operation to other areas in the United Kingdom, at the moment EV users need to register with different agencies to use the publicly accessible charging points across the country.

These are different examples of restricted access systems.

London and Portugal's smart cards to access their public charging points.

Where manual access systems are employed, i.e. physical keys, integration with parking enforcement can provide monitoring and management options. For example in Oslo parking wardens collect data at regular intervals about EV charging and parking whilst they're undertaking their normal activities and these feed into user surveys, to monitor EV driver trends.

Most restricted access systems are 'intelligent' which also control the electric supply. With electronic systems, users swipe an electronic tag which, upon user verification, releases the access door enabling the plug to be inserted and activates the electricity.

The additional functionality afforded by these 'intelligent' CPs include:

- Remote power management, enabling the supply to be disconnected if parking regulations have been exceeded e.g., maximum stay periods
- Internet based information systems enabling real time monitoring by users
- Grid load management
- Payment management systems
- Remote diagnostics and maintenance
- User data to understand EV driver trends
- Data and marketing opportunities

While in the initial phase of development, charging for electricity usage may not be desired by implementing authorities, as management and other costs increase, the ability to charge users may take on more significance. While 'dumb' units may have lower initial installation costs, retrofitting units to enhance capabilities may add substantial additional costs.

Image: Frankfurt has opted for a 'pay as you go' system where users pays at the unit which produces a receipt with a code on. This code is then used to access the charging unit.

With the selection of a restricted access system, careful consideration of how the system is to be administered is required. If the overall number of units is likely to be limited a simple in-house system may be suitable. However as the number of units increase and administrative demand grows, out-sourcing may be more appropriate.

Operation of restricted access schemes involve a subscription process whereby users can register and receive the access key. Depending on the complexity of the system, the responsible organisation may want to:

- Confirm or restrict vehicle usage e.g., limit access to private vehicles (non-commercial) or full electric only (excluding plug-in hybrids)
- Levy annual administration charges or electricity charges
- Impose other usage restrictions or insurance indemnities

A decision must then be made on how users will be able to access the charging point. For public on-street networks, usage is generally restricted and requires users to register and receive an access key. In off-street locations, other access methods are generally in place to manage usage e.g., in car park building or supermarket carparks.

Access options can range from traditional keys through to pre-registered smart cards utilising RFID tags. For casual users and visitors, some systems will also allow access via a credit card or telephone payment system.

Communication & Data Management

Local authorities supporting the installation of CPs should also ensure that suppliers adhere to Open Charge Point Protocols (OCPP). This is an international standard that allows charging stations and central systems from different vendors to easily communicate with each other between charging stations and a managing central system.

Most manufacturers also provide charging points with remote communication (WLAN or Wifi) functionality. This can provide a significant amount of data to system administrators as they can remotely collect and monitor the usage data. While of limited concern when usage and EVCP availability is low, with increasing numbers of units and demand, the volume of data may become substantial. Unless carefully managed, this can lead to significant costs which may impact on operational budgets.

Alternative charging technologies

Another approach to charging involves battery swapping. The best example of this is the Better Place model which involves the installation of switching stations. By working with vehicle manufacturers such as Renault, drivers of battery switch compatible vehicles can drive into a station and swap their depleted battery for a full one in under five minutes. This system is being trialled in Copenhagen and Tokyo.

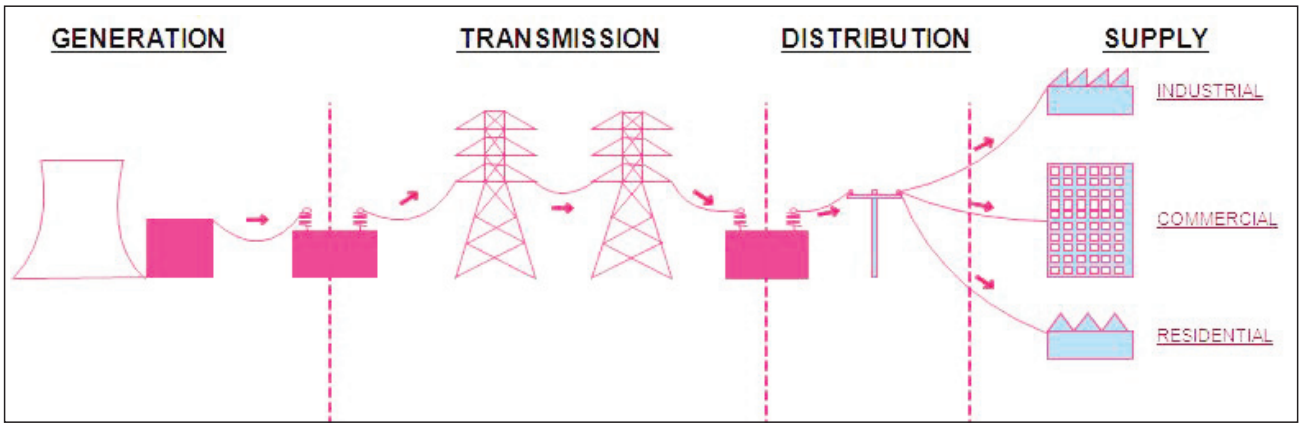
Source, Better Place battery swap station[6]

Another approach that is gaining attention, is the use of induction charging. Using the same approach as in electric toothbrushes, energy is transferred through an inductive coupling which charges the battery. As this removes the needs for cables or wires as a physical connection is not required, faster and easier charging may result. While not yet widely available on the market, a number of trials are being undertaken including at Frankfurt Airport (see image).

An example of inductive charging from Frankfurt. The vehicle positions itself above the pad on the ground to complete the connection (the above pad is offset for illustrative purposes)

[6] *http://www.flickr.com//photos/btrplc/sets/72157626372668022/show/*

Diagram 1



Electrical Supply

While it is easy to see EVCPs as just another piece of street furniture, as demand increases and more units are installed there will be impacts on the energy grid. Organisations installing CPs will need to engage with their energy providers and network operators as part of the installation process, consideration should also be given to including these organisations during the strategy development.

Diagram 1 illustrates the flow of electricity from the generating plants (coal, nuclear, hydro or wind etc) through the transmission chain to local substations and finally into the wires that connect our homes, factories, work places and EVs.

Generation and Transmission

While the general consumer may have only little knowledge or interest in how their energy is produced, from an EV perspective this can be very important. How the different sources of electricity generation contribute to a nation's electricity supply is known as the energy mix. This can involve coal, natural gas, nuclear, hydro, solar, wind or geothermal sources. Within the context of 'emission free' mobility, this can have an impact on the approaches to communication through to the net environmental benefits of e-mobility. Where this option is not selected, while the vehicles may be promoted as having "zero tailpipe emissions", the general zero emission line can leave promoters open to criticism.

For countries that have a high renewable energy sector e.g., Sweden, the overall CO_2 emissions from their energy mix is very low. Conversely, in the United Kingdom which still relies heavily on coal and gas fired stations, these emissions are considerably higher. Most countries that have a competitive energy retail market have options that enable the consumer to only purchase 'green' electricity. While tariff rates may vary, the consumer can be assured that they are paying for the production of renewably generated electricity. End customers, whether individuals, businesses or local authorities can then decide if they want their charging points to be powered only using green electricity. Once generated, electricity is transmitted via the electricity grid to local substations which manages the energy supply for the end consumer.

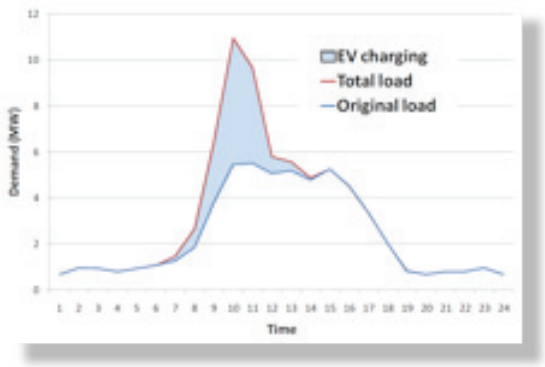
It is at this point, consideration needs to be given to the local network capacity.

Network Capacity

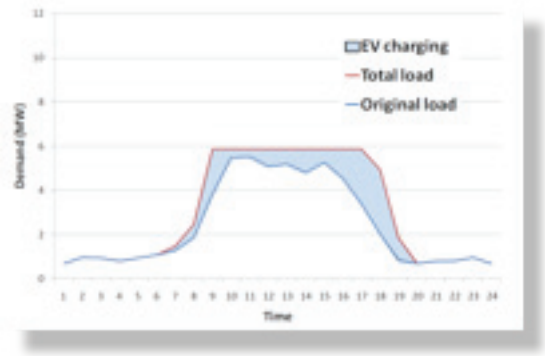
While the installation of charging points is relatively straight forward, it is good practice for the implementing organisation to discuss the electrical requirements not just with their local electricity supplier but also the distribution network operator (DNO). In the initial roll out, the additional demand from vehicles charging is unlikely to significantly impact the electricity grid. However, as the proportion of the vehicle fleet increases this may have negative impacts on the grid.

For example, diagram 2 below shows the potential impact of 5,000 commuter EVs on the energy supply grid. The substantial increase in the electricity demand can have significant impacts on the grid capacity e.g., can the local substation cope? Will an upgrade be required that will impose costs on the wider community?

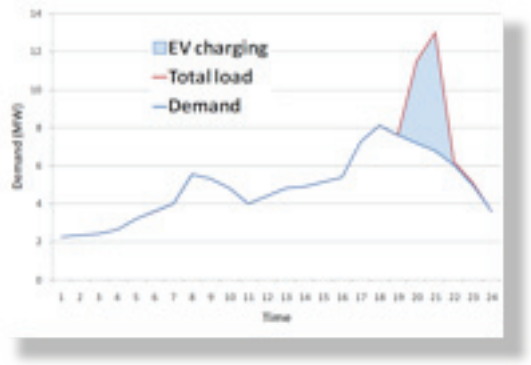
Diagram 2



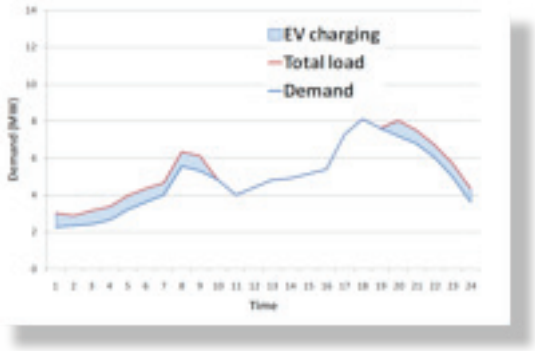
District Network Operators DNOs are therefore encouraging the use of smart meters that help manage this base load and ensure an efficient supply of electricity is managed.



In a residential environment, while the peak shifts from the middle of the day to the evening, the additional of 5,000 vehicles will be just as substantial.



Above: 'Business as Usual' charging



Above: Smart charging

The Policy Framework

When considering the installation of charging infrastructure, a range of policies can be applied to support both e-mobility in general and the installation and funding of infrastructure. Here are a few examples from Oslo, London and Madrid.

Oslo's supporting policies are working very well regarding in assisting the uptake of EVs. They provide free parking in public carparks, road toll exemptions and allow EVs to use bus/taxi lanes. The ability to use the restricted lanes is seen to be particularly beneficial as it considerably reduces the travel time for commuters in the city.

"Driving an EV gives me an extra 7 hours a week with my children"

An Oslo driver's satisfaction with driving EVs

London has a well developed and extensive policy framework supporting e-mobility including:

- Exemption from the central London congestion charge (currently £10/12.7 Euro per day)
- Land use planning policies specify that:
  - new developments must ensure that 1 in 5 spaces (both active and passive[7]) provide an electrical charging point to encourage the uptake of electric vehicles
  - in retail developments, 10% of all spaces must be for electric vehicles with an additional 10% passive provision for future uptake.
  - In employment car parks, 20% of all spaces must be for EVs with an additional 10% passive provision
  - In residential developments, 20% of all spaces must be for EVs with an additional 20% passive provision provided

Within London, some of the local authorities have added to these regional requirements through:

- Provision of free parking spaces for EV in on and off street parking locations
- Specific programmes of on street charging infrastructure installation (this is especially important due to the general lack of private off street parking for residents within some areas).
- Reduced cost parking permits for alternatively fuelled vehicles
- Awareness raising campaigns to inform commercial fleet operators about the benefits for adopting low emission fleets
- Exceeding the regional policies to specify that every parking space within new developments has access to an electric charging point. Where parking is not provided on site, contributions towards the provision of on-street charging points are also sought
- Where businesses are developing a travel plan and they have an off-street parking facility for employees and/or visitors, they will be encouraged to consider the installation of electric vehicle charging points
- Vehicle replacement policies which prioritises vehicles in the following order of preference: electric, electric hybrid, LPG/CNG, petrol and diesel[8]

The costs of these measures vary and also spread between the public and private sector. An interesting example of how policy can influence the introduction of EVs in the private sector can be seen in the collaborative approach taken by the Council to the operation of car clubs.

[7] Active provision requires that an actual socket is connected to the electrical supply system (ready to use) while passive provision relates to ensuring the network of cables and power supply necessary is available so that at a future date a socket can be added easily .

[8] Vehicle must be able to perform its function to a satisfactory standard and some vehicle types, particularly larger vehicles, will not be available with electric or hybrid engines.

Car Club Case Study

The Westminster Car Club was launched in May 2009 as an on-street car sharing scheme offering Westminster residents a self-service, on demand alternative to car ownership. Westminster has partnered with Zipcar to give residents the accessibility and freedom to use a car for leisure or business without the hassle of owning or running their own vehicle. Westminster's 'car sharing' scheme offers a range of benefits to local residents, including a reduced membership fee of £25, £25 driving credit and one hour's free parking where permitted.

There are currently 120 car club vehicles across the City within 10 minutes' walk of every resident. It is one of the greenest car club fleets in the UK with 23 hybrid cars and two plug-in electric vehicles. While not specifically limited to EVs, it is a good example of how a collaborative approach can enable the private sector to better support public policy outcomes at no cost to public funds.

Madrid's support for EVs includes:

- Local tax reductions
- Free on-street parking within the city for registered EV' through the display of a "zero emission" label
- Free charging at on-street CPs
- Using public procurement processes to incorporate EVs into fleets

CONCLUSION

The approach taken to the installation of EV related infrastructure can have wide ranging ramifications for both providers and users. Vehicle manufacturers expect most charging to occur at home or at regular destinations such as work places, but there will still be a need for publicly available charging points. Whether this is in areas where off street parking is limited, such as in city centres, or is simply to cater for visitors, a solution needs to be provided.

As the transition to e-mobility is still in the early stages, there is no right or wrong answer to how this can be achieved. However, there are a growing range of examples as to how this may be delivered and with careful consideration, elected officials, municipal officers and other stakeholders can ensure that the approach taken is correct and appropriate for their location. Electric vehicle policy planning needs to be integrated with many other urban planning functions, and respect the hierarchy of sustainable mobility, road and land use, and parking policies.

The lack of standardisation is a key challenge facing both the public and private sector but should not dissuade politicians, municipal officers or other stakeholders from seeing them installed. Cities can adapt infrastructure strategy to local conditions, and use the learning and experience of EVUE cities, described in this report, as a tool to ensure integrated and sustainable planning for electric vehicles.

FURTHER INFORMATION & CONTACTS

URBACT and EVUE:

Further information is available on the websites:
www.urbact.eu/project
www.urbact.eu/evue

Incentives guide for cities developed by the IDAE (Spanish National Institute for Diversification and Saving of Energy).

http://www.movele.es/index.php/mod.pags/mem.detalle/idpag.9/relcategoria.1010/relmenu.23

Clean vehicle guide developed by the Government of Madrid Region (Fundación de la Energía de la Comunidad de Madrid)

http://www.cleanvehicle.eu/fileadmin/downloads/Spain/Guida%20del%20vehicolo%20Electrico.pdf

Sustainable Transport Strategies

www.hrccc.org/wp-content/uploads/EV-Charging-ADA-Version-1.0s.pdf

Guidance for implementation of Electric Vehicle Infrastructure April 2010, Transport for London

Guide to Electric Vehicle Infrastructure, BEAMA, May 2012, www.beama.org.uk

EVUE–AWARENESS RAISING FOR ELECTROMOBILITY

Concepts for the introduction of electromobility.

Report author Ansgar Roese,
City of Frankfurt, October 2012

AWARENESS

INTRODUCTION

Raising awareness of electric mobility is an important function for cities to increase the number of electric vehicles, driven by consumers and in commercial fleets. This report outlines some of the key concepts behind raising awareness of the benefits of electric mobility for cities. It draws primarily on the experiences of Frankfurt am Main, federal German policy, initiatives being developed by major German auto manufacturers, the experience of the Frankfurt URBACT Local Support Group and wider EVUE partner engagement.

Background

For many years policies in the European Union have been supporting the introduction of electromobility. Since 2009 electromobility has experienced a global renaissance. Between the 1940s and 1990s, regular attempts to revive electromobility were made but ultimately unsuccessful. The last attempt failed in the mid-90s, 36 months after the roll-out of the last vehicles of the "EV 1" by General Motors. GM produced an electric Coupé with 139HP in a limited run of 1100 vehicles on the basis of a tailor-made lease finance concept. With a cruising range of 240km and a maximum speed of 160km/h the vehicle was well received and popular among celebrities such as Tom Hanks or Mel Gibson. Nevertheless, GM discontinued the project after only 3 years and scrapped all cars despite enormous protests of the owners[9].

That was the end of the most recent attempt to resuscitate the electromobility industry.

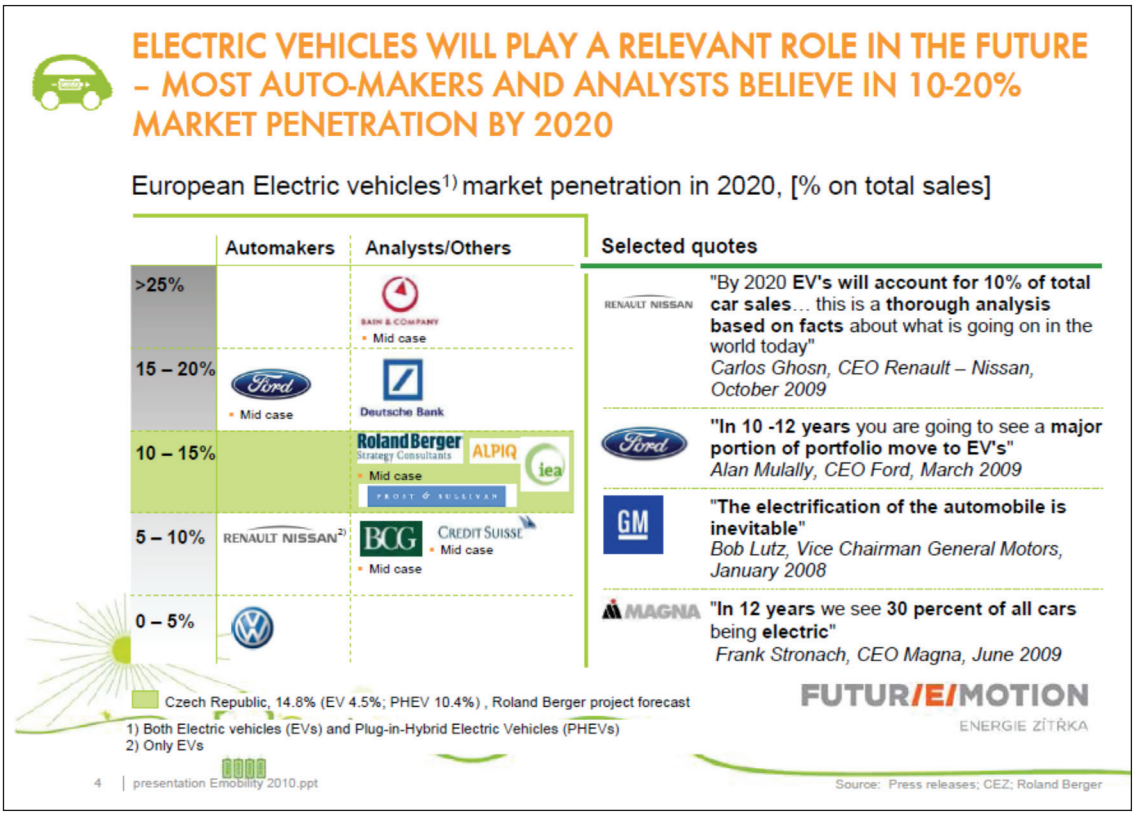
Now, 15 years later, there is another revival of the electromobility industry; but now there is difference. The revival is not driven by the automotive industry; but by EU and US and environmental and energy policies which support electromobility as a form of sustainable mobility. The discussions about CO_2-emissions, the globally increasing demand for fossil fuels and the environmental problems in our cities due to an increased traffic volumes require that both politicians and citizens change their way of thinking. The constantly increasing demand for travel requires a strategy for sustainable mobility. In this context, public policy identifies electromobility as a possible solution and supports the use of electric vehicles.

In 2009 the latest attempts to introduce electromobility in the cities started to gain pace. For cities to encourage electromobility the provision of public charging infrastructure was very quickly identified as a decisive factor. An important point is the fact that the operation of electric vehicles is constrained by the ability to charge outside of their normal parking areas. At that time, many cities and electricity suppliers developed strategies and action plans with which they wanted to promote publicly accessible charging infrastructure. This was to address the issue of range anxiety as people would only use electric vehicles if they felt confident about having enough range for the journey. While the vehicle manufacturers assume people will charge at home, there are significant urban areas, for which EVs are most suited, that this is not possible. For this reason many cities invested large sums to establish an extensive network of charging stations in the city areas in order to support the purchase of electric vehicles.

Another challenge was the high capital cost of most charging infrastructure coupled with the low charges for electricity. This has limited the development of business models and imposed high costs on local authorities when public budgets are being reduced.

In 2011, some disillusion with the uptake of e-mobility was becoming apparent. The acceptance of electric vehicles is still quite low and that many of the charging stations are used very infrequently or are not used at all. Electric vehicles are still an unusual sight in most European cities. The reasons for this are very complex. On the one hand the limited availability of vehicles by the manufacturers coupled with high purchase prices has limited the potential buyers for the car and on the other hand as a "new technology", as it is called by many people, it faces many associated prejudices.

[9] *www.whokilledtheelectriccar.com*



This diagram shows EV market penetration forecasts by various groups for 2020 with the range varying from 0 – 25%.

What does such a large range tell us? That nobody really knows. If we want to see e-mobility develop, external support will be required.

Source: Tomas Chmelik (www.futuremotion.cz/emobility)

EV versus ICE: realities perceptions and prejudices

The vehicle powered by the combustion engine has experienced a very successful development over the last 120 years. In most cases the vehicle is more than just a vehicle of mobility. Since the 1950s vehicles have developed to become a status symbol and have evolved to epitomize a lifestyle. The vehicle ensures its user a certain "liberty and independence" and thus the possibility to go wherever the user wants to go, at any time of day and night; even if this is simply a psychological benefit. This phenomenon has influenced the success story of the car during the last few years.

Did you know: Toyota Motorsport has the record for the fastest electric vehicle around the Nurburgring racetrack in Germany. With a lap time of 7m47sec this is equivalent to Lamborghinis and Ferraris! [10]

From a technical side the internal combustion engine (ICE) car offers the user the possibility to cover distances between 600 and 1200 km, depending on the cruising range of the car, without having to charge it in between. If the fuel tank is empty the car can be filled within three minutes and is then immediately ready to travel exactly the same distance again. These framework conditions currently characterize the image of the car and mobility.

From Awareness to Behaviour Change

While most people know about electric vehicles, getting them to change their behaviour to adopting them is a different matter. A common approach taking in product marketing revolves around the mantra of 'without interaction – little awareness'. Awareness is not simply publicity though; we may interact with it – "it's horrible" or "I want one", but publicity is often untargeted and in itself does not create change. Through awareness, we seek to produce a reaction which changes behaviour, trigger decisions and actions – whether spontaneous or considered. Awareness is often a result of feelings provoked by the environment like heat, smells, sounds; resulting behavior and reaction also produces in turn reactions like suffering or happiness, "stick or carrot".

[10] *http://en.wikipedia.org/wiki/Nordschleife_fastest_lap_times*

When we consider the different approaches to awareness raising regarding e-mobility, we therefore need to consider how we can ensure it is positive and it becomes reinforcing[11].

Comparison of the framework conditions of electric vehicles and vehicles with a combustion engine

The electric vehicle offers its owner/user similar possibilities to a car with a combustion engine but with three essential differences:

- The cruising range of electric vehicles is considerable lower. Current models of electric vehicles have a cruising range of about 120 to 150 km.
- The battery charging time is up to 6 hours. During this period of time the vehicle is not available and cannot be used by its owner.

How many electric vehicles are registered in EVUE countries?

- **Germany: 4,541 (January 2012)**
- **United Kingdom: 3,600 (March, 2012)**
- **Sweden: 1021 (August, 2012)**
- **Norway: 7970 (August 2012)**
- **Portugal: 314 (June, 2012)**
- **Spain: 4400 (September, 2012)**
- **Poland: 100 (September, 2012)**
- **Romania: 0**

How many electric vehicles have been registered in EVUE cities?

- **Frankfurt: 221 (September 2012)**
- **London: 2,400 (April, 2012)**
- **Stockholm: Data not available**
- **Oslo: 1719 (June 2012)**
- **Lisbon: Approximately 150**
- **Beja: Data not available**
- **Madrid: 524 (September, 2012)**
- **Katowice: 10 (September, 2012)**
- **Suceava: 0**

- In most European countries the purchasing costs for an electric vehicle are much higher. An electric vehicle in the small car segment, for example, is just as expensive as a normal car with combustion engine in the mid-range segment.

The users consider these three differences to be disadvantages so that currently most people decide to buy a car with combustion engine.

User-specific influencing factors for the purchase decision in favor of en electric vehicle

- Besides the differences between an electric and ICE car, there are further influencing factors which are decisive for user of a vehicle to make a purchase decision in favor of an electric vehicle. People have a misconceived perception of their own mobility needs i.e. over or underestimating annual driving distance or load carrying capacity. A purchase decision in favor of an electric vehicle may be in direct contrast to the mobility awareness of the user. The user has to decide how often the car is needed for holiday travel or everyday journeys such as commuting.

- Interested purchasers often do not know the current state of the art with regard to EVs and do not believe they are suitable for their needs. This impression is reinforced by limitations such as the impact on vehicle range when air conditioning or heating is used. Generally the potential buyer is not willing to do without the conveniences he/she is used to when driving a conventional car with combustion engine.

- The reputation of electric vehicles compared to conventional cars with combustion engine is currently considerably lower as related to speed and driving enjoyment. EVs are associated with a slow and sedate style of driving, whereas conventional cars with combustion engine are associated with driving enjoyment and sportiness.

[11] *For more information, please see Awareness Raising & Engagement, R Stussi 2012.*

The car as a status symbol

Will the role of the car as a status symbol change in future? Does everybody need a car?

Is it the right time to think about a change in our mobility behaviour?

Why do manufacturers only market EVs as good for the environment whereas other cars are marketed as fun and sporty?

Defining success factors for promoting e-mobility

Current studies on driving behaviour show that in most European countries, over 80% of journeys are less than 60 km per day. Taking into account these framework conditions theoretically 80% of the traffic could be covered with electric vehicles. The studies emphasize the high potential of electromobility. In order to be able to integrate these findings in an efficient way, we need to define potential user groups and areas of application.

Thesis: People are one of the most important key factors for the successful implementation of electromobility.

Potential drivers and the wider community need to be actively encouraged with regard to electromobility. Currently most people do not know what electromobility really means or the possibilities there are to integrate it in everyday life. The proponents of electromobility need to demonstrate that electric vehicles available on the market can meet most requirements and that they are worth buying. While it is recognized that EVs cannot meet all requirements, for most types of urban uses their performance can exceed comparative ICE vehicles. It has to be communicated that the electric vehicles will play an important role in mobility of the future due to increasing fuel prices. The consumer also has to become aware of the fact that - besides increasing costs - electromobility has considerable environmental advantages compared to conventional ICE cars, such as reduced noise CO_2 emissions.

In this context it has also become clear that electromobility, without using 100% renewable energies, cannot deliver the full environmental benefits. However, especially in dense urban areas with significant air quality issues, these benefits are substantial.

All stakeholders, and especially cities, need strategies to inform and communicate these benefits to the potential consumer and wider public. The following questions and answers are a guideline to suport the changes in collective consciousness.

The framework conditions mentioned above leads to a quite minor presence of electromobility, despite the fact that it is presented as an innovative form of mobility for the future by the policies and now and then also by the industry.

This report discusses the various approaches of different stakeholders in the field of electromobility in Germany. In doing so the focus is on three areas where they combine:

1. Policies

2. Cities and Communities

3. Economy/Industry/Institutions

National policies (see pages 19&20) clearly show the desired direction is to create the necessary framework conditions for the introduction of electromobility. It will become increasingly important to ensure that existing laws are compatible with the needs of e-mobility. Possible alterations are rights to use restricted lanes and incentives or tax reliefs which are intended to stimulate the market over the next few years.

Who are the users?

- **Define potential user groups and fields of application – the 'sweet spot' for EV usage**

What does electromobility really mean?

- **Demonstrate that electric vehicles are designed for most needs, that they really work and are already available**

Why is electromobility important for the future?

- **Explain that the prices for mobility will rise in the near future**

What are the requirements for CO_2 free electromobility?

- **Explain the environmental advantages of electromobility (reduced noise level, decrease in ICE related pollutants, reduced CO_2-emission). While for maximum benefit, electromobility should be integrated with renewable energy sources, we are in a transition stage to cleaner energy and this will contribute to that process**

Why driving an electric vehicle fun?

- **Try to inspire the people by offering a test drive**

Across Europe, there are a range of governmental departments or ministries which have initiated incentive programs over the last few years in order to develop e-mobility on a scientific and economic level as well as to inform the public at large about this new form of mobility.

The Federal Republic of Germany has sought to employ the following approach to e-mobility.

Which incentive measures for the initiation of electromobility have been implemented and finalized so far?

Model region electromobility

Form 2009 until 2011 the German government supported the development and market preparation for electromobility with approximate funding of €500 million as part of an Economic Stimulus Package. Eight model regions have received funding of €130 million. For the purpose of implementing these model projects participants from science, industry and the involved cities have worked closely together to promote the installation of infrastructure and the popularity of e-mobility in public areas. The implementation of the first projects is intended to create a broad public acceptance of this new technology.

A further aim of the model regions strategy is to embed electromobility along the entire value chain in Germany. Besides the support of basic research projects, prototype development and production processes, the development of application-oriented research and demonstration projects are also sponsored. This supports both short and long term approaches to e-mobility activities.

Continuation of the model region electro-mobility

At the end of 2011, the Federal Ministry of Transport, Building and Urban Affairs started a new two year funding programme with the main emphasis on electromobility. A particular focus will be on fleet solutions. This means that a large amount of fleets users - in particular two-track electric vehicles - are regularly used on a daily basis. Additionally the individual projects of the model regions shall be connected in an integrated way. Furthermore the areas of security, infrastructure development and the integration of electromobility into local mobility concepts offers shall be incorporated in the different concepts of urban development.

Showcase regions for electromobility

In the period from 2012 to 2015 the German government will financially support four selected model regions with funding of €180 million. Through the funding program "Showcase region for electromobility" in the German government is pursuing the goal to present innovative electromobility technology in Germany across sectors and combining the different sectors in a constructive way with the Federal States of the showcase regions. It is the aim of the funding program to make the electromobility system accessible for potential users and the public at large.

Successful and visible demonstration projects create a stimulus for increased demand. In addition, mobility concepts as well as regulatory framework conditions can be tested in the showcases. Moreover, the insights and experiences from the funding projects of the model regions electromobility will be shared and lessons learnt.

- **230 Projects**
- **700 Project partners**
- **600 Mio. EUR Project volume**

Over the next three years the commitment of industry, science, civil society and the public sector for the introduction and establishment of electromobility will be combined in the showcase regions Baden-Wurttemberg, district of Hannover, Bavaria, Saxony and Berlin chosen by the German government. Thereafter the interaction of the different aspects of the entire "electromobility" system i.e. energy system, electric vehicles and traffic system will be examined. The questions, such as customer expectations, infrastructure requirements and impact on environment and climate will be addressed and sustainable business and mobility models established as the basis for the entire market.

Exemption from motor vehicle tax for electric vehicles

The German government has exempted electric vehicles from motor vehicle tax for a 10 year period. There are subsidies for vehicles with a date of first registration between May 2011 and December 2015. From 2015, the exemption from motor vehicle tax will be reduced to five years. In addition, these subsidies are not limited to only pure electric cars but apply to hybrid electric vehicles. With these incentives, the German government seeks to achieve its goal of incentivizing the purchase of electric vehicles.

Other measures

Besides the measures mentioned above, a number of other European countries, including Germany, offer other incentives. These variations have been discussed in the EVUE network meetings. The introduction of a purchase subsidy is often considered to be an effective measure to incentivize electromobility as it mitigates the higher associated purchase costs.

During the site visit in Oslo there was a description of Norwegian policies such as allowing EVs to use bus lanes and exemptions the vehicles from road tolls. In the London EVUE meeting there was a discussion of how the UK also provides tax exemptions which are especially beneficial for company use vehicles.

A number of other policies and actions also reinforce support for electromobility such as conferences or eco-rallys to demonstrate the benefits.

IAA tour: Federal Chancellor Angela Merkel (in Ampera), Hesse Prime Minister Volker Bouffier (right), Mayor Petra Roth a.D. (right), Opel CEO Karl-Friedrich Stracke (left)

City EV actions

In spring 2009 the city of Frankfurt am Main adopted a resolution to "Make Frankfurt a pioneer for electromobility". Following this, a number of measures and activities were initiated to advertise the topic electromobility and to provide information in order to counteract the many existing prejudices.

The model region electromobility Frankfurt Rhein-Main

As a result of the funding by the German government in the model Frankfurt Rhein-Main (Hesse) region, 15 exemplar projects were launched between 2009 and 2011. A total of 490 electric vehicles were put into operation and approximately 260 charging stations were installed. Other projects for commercial and delivery vehicles in urban use including pedelecs (for corporate mobility), buses in the public transport system (hybrid and electric drive), e-scooter, a hybrid rail vehicle as well as electric vehicles for company transport fleet and sharing systems. The establishment of an infrastructure (normal current, rotary current, DC fast charging stations, charging Pedelecs, induction) and securing the connecting mobility to the regional and long distance traffic were in the focus of interest. A large part of the exemplary projects took part in the urban area of Frankfurt am Main.

Strategic paper "Electromobility in 2005 in Frankfurt am Main - Vision and strategy"

The strategic paper "Electromobility in 2005 in Frankfurt am Main - Vision and strategy" was adopted by the municipal authorities of Frankfurt am Main in June 2011 for the implementation and promotion of electromobility in the Main metropolis. The strategy developed by elected representatives, officers and the private sectors contains 26 projects covering infrastructure, marketing, framework conditions and measures which are meant to support the introduction of electromobility. The projects will start over the next few years and are intended to give people in Frankfurt an understanding of electromobility in everyday life.

Besides demonstrating e-mobility the paper provides for a change of the mobility behavior of the people in the Main metropolis. For this reason the projects also contain car and bike sharing schemes as well as a mobility card for intermodal transport services. By 2025 seven goals are to be achieved, from an area-covering network of public and privately-held charging stations right up to the reduction of the traffic load in the municipal area by vehicles with a combustion engine. The implementation of the projects is accompanied by a uniform communication platform under the label "FrankfurtEmobil".

EV Readiness Index

As part of the Expert Exchange process within the EVUE project, Ole Henkrik Hannesdahl of Green Car and Hans Kvisle of Norstart (members of the Oslo ULSG) developed an EV Readiness Index. Originally produced for the Suceava seminar, the index seeks to identify the views of local stakeholders with regard to e-mobility. Through identifying areas of consensus or diverging opinion, actions can be undertaken to address deficiencies in knowledge or awareness and ensure a common view is taken when promoting e-mobility.

Marketing activities of the city Frankfurt am Main

By supporting the projects with targeted marketing activities the city of Frankfurt am Main aims to increase general understanding of the public and reduce the barriers to this technology. An example for the targeted implementation is the marketing concept "FrankfurtEmobil". Since September 2010 the city of Frankfurt am Main has incorporated all activities in the field of e-mobility under this action label. Furthermore, since December 2011 the action label "FrankfurtEmobil" has the websites www.frankfurtemobil.de and www.frankfurtemobil.com at its disposal for visualization and awareness-raising. In addition to the activities and projects of the partners, the website contains a city map with all publicly available charging stations in the municipal area and other information about e mobility related events. A video showing the user the functionality of the Frankfurt charging stations.

Infrastructure activities of the city Frankfurt am Main

Mayor Petra Roth a.D. (left) when activating a charging station and the "Frankfurt Model" (right)

Frankfurt Model

The municipal charging infrastructure system called "Frankfurt Model" enabled the city to develop an innovative charging infrastructure in Frankfurt am Main from the outset. Together with partners the "Frankfurt Model" was implemented as a customer-friendly, affordable and open accessible charging infrastructure which differs from other concepts in so far as it is a combination of parking and charging. The unique feature in this concept is the fact that the electric vehicle can be charged in public streets or in parking garages without the prior registration by the respective operator of the charging station. The model also uses existing parking ticket machines and paying machines in parking garages to invoice the electricity consumption. Since December 2010 the first charging stations of Mainova in Frankfurt am Main were taken into operation. As of August 2012, there are 17 charging stations with 23 charging point which have been equipped with this cost-efficient concept. New charging stations will be established in accordance with the future needs.

Awareness raising activity by the city

The city of Frankfurt am Main intensively supports e-mobility. Both on an organizational level, professionally and among the community, e-mobility is frequently and regularly advertised. The different measures cover exhibitions of EVs and information in pedestrian areas and shopping malls at the weekends, participating in trade fairs, executing press conferences with politicians, the regular coming-together of working groups up to presentations and talks on international symposia. It is an important focus of the city to explain that electromobility is not something that will be a topic in 20 years or later, but now. It can be used by everybody in everyday life.

Therefore the different facets of electromobility are presented many times. Because electromobility is more than just the mere electric vehicle, it can supplement a number of urban carriers of traffic like Pedelecs, E-Scooter, and cars from small cars to luxury cars, courier vehicles, buses and even aircraft tractors. All these vehicles are part of the municipal communication strategy.

In the last few years the activities of all companies and institutions a total number of 29 public and semi-public charging stations was established in Frankfurt am Main.

Examples from Frankfurt

Presentation of the initiative "FrankfurtEmobil", Frankfurt Motor Show IAA (Internationale Automobil-Ausstellung), Frankfurt am Main, September 2011

Presentation of the initiative „FrankfurtEmobil" in a pavilion at the „European mobility Week 2010, Frankfurt am Main, November 2010

The City Councillor Makrus Frank (right) and the managing director Peter Kania of the Frankfurt Ecomomic Development GmbH (left) , Frankfurt am Main, October 2010

Deputy mayor Jutta Ebeling at the European mobility Week managed by traffiQ, Frankfurt am Main, September 2011

Presentation Evue at the Conference - International Forum Electromobility, Frankfurt Airport, September 2011

Pedelec test drive at the European mobility Week 2011, green belt Frankfurt am Main, September 2011

Showcase Proposal, display to promote Frankfurts E-mobility Actions with Stromos the 1st E- Service Car of Frankfurt, Berlin, November 2011

Press time with the UPS electric delivery vehicle, the city councillor Markus Frank accompanied a delivery tour, Frankfurt am Main, July 2010

Press time, the Lord Mayor Petra Roth A.D. at the start of the first car park charging station, Frankfurt am Main, February 2010

The EVUE-Group make a Test drive with the Opel Ampera, Frankfurt am Main, September 2011

Press time, local politicans and entrepreneur present some EV's at the Römer (Central place), Frankfurt am Main, September 2009

Showcase Proposal, the city councillor Markus Frank (right) promote Frankfurts

MARKETING LESSONS FROM BUSINESS

The iPhone 4S is a phenomenon.

(Own Graphic: iPhone 4S)

This does not relate to the device itself but rather to the acceptance of consumers to pay more for the product than comparable smartphones. This is despite the fact that the iPhone is only available in two colors and its applications are also available on competing smartphones. But everybody would like to have an iPhone because it is modern and trendy. An iPhone is a status symbol combining trendiness and the fun using the device. Also other mobile phone manufacturers try to copy the iPhone in order to transfer the phenomenon to their own products.

What can the marketing of e-mobility learn from this?

Apple tries to sell the iPhone directly to mainstream consumers and thus conquer the profitable market directly without taking detours via innovators and early adopters. In doing so the marketing strategy of Apple is fundamentally different from its competitors. Besides considerable advertising expenditure through traditional mass media e.g., television and print, it invests comparably little in social media marketing. The reason is that the latter still primarily addresses early adopters. With Steve Jobs as the face of the brand, the products also got a face. Such personalized marketing is especially effective on the mass market.

As a further marketing measures Apples tries to highlight the clear distinguishing features of its products. The customers do not only want the latest technical features, Apple rather emphasizes the innovative and elegant design and a superior user-friendliness. Apple also puts a particular value on mass market sales channels. The Apple Stores in cities' top retail areas attract people not interested in new technologies but who now have the possibility to test and experience the products themselves.

By means of the apps Apple furthermore ties service providers and companies to their products and at the same time offers customers the possibility to communicate via the internet even in the remotest places.

Lessons learned: How can electromobility benefit from the phenomenon iPhone?

- **Reshape the marketing strategy towards Majority Customers in order to directly conquer the mass market**
- **Create clear distinguishing features in the design of electric vehicles to show the people that electric cars are a new technology and thus a new product**
- **Establish mass compatible sales channels in order to enable people to test and to experience the technology**

LEARNING POINTS

The iPhone was able to become a fashion accessory and status symbol thanks to a comprehensive marketing strategy. By adapting the marketing strategy to the respective company and to electromobility the acceptance and the desire of the people to buy and to possess an electric vehicle would be increased. Through a new marketing strategy for cars which may differ from the traditional approach a change of popular norms could result in EVs replacing ICE cars. In this case a particularly sporty car for a younger demographic or a luxury car for a successful person who achieved a lot would not be a distinguishing feature. Electric vehicles could rather be a symbol for responsible decisions and sustainability, whereas the significance of these characteristics should be more important to the company than the social standing of a person.

Conversely, a review of current EV marketing shows that their environmental benefits are often illustrated. However, without the wider support and communication techniques applied by Apple, we need to ensure that the methods used identify with the consumer. With EVs being able to provide exceptional performance due to their design eg, maximum torque from initiation, they can also provide an unparalleled level of responsiveness – why isn't that highlighted in campaigns?

Innovative approaches to marketing electric mobility

To see the different approaches, it is useful to review the sales strategies of different manufacturers. Each of cases about the four manufacturers described below takes a different and novel approach to their marketing. All of them differ considerably from currently prevailing standards of car advertisements. In order to introduce new and innovative marketing concepts for electric vehicles a comprehensive strategy is required on how the end customer can be lead to the topic electromobility.

With respect to the sales strategies it is particularly noticeable that often also so-called sales cooperations are created. For example car manufacturers and electricity suppliers along the value chain cooperate in order to advertise the use and purchase of an electric vehicle. Key stakeholders which are important include:

- Original Equipment Manufacturers
- Cities
- Associations
- Governments
- Electricity suppliers
- Mobility suppliers
- Consumers

For an efficient marketing campaign which also reduces costs the cooperation of several stakeholder is recommended. With a joint, newly designed marketing campaign covering new media, TV, social networks and print media the electric car could quickly be introduced to the mass market.

(Own Graphic: Innovative new marketing concept)

Marketing for electric vehicles-lessons from business

- **Characterised EV is as trendy, emotional, fascinating, modern, fun**
- **Explain the advantages of electromobility**
- **Bundle capacities and resources for activities**
- **Enable people to test drive an electric car**
- **Try to integrate celebrities and well-known politicians into your marketing campaign**

CASE STUDIES

Opel: focus on PR related activity, not just the car

With the aim of further improving environmental sustainability of cars, Opel launched the Ampera and thus introduced - as the first European manufacturer – the first range extended electric car suitable for everyday life. The strategy "e-mobility unlimited" specifically designed for Opel is intended to make Opel the industry leader. The Opel Ampera can manage 60 kilometers completely electrically or 500 kilometers with the aid of a range extender. Retailing for approximately €40,000 the model will only repay its premium price if oil prices increase in future. Despite these circumstances the car is step-change for Opel. The launch of the Ampera, accompanied by different marketing strategies which are meant to show the manufacturer in a 'green light' illustrates that the company has understood that is time to rethink its approach.

(Own Graphic, screenshot website: http://www.opel.com/microsite/project-earth/#/expedition)

"Project Earth" describes a new marketing strategy for the automotive industry. The focus is on the conservation of habitats in the Arctic Sea, in Brazil, in the Pacific Ocean and in Tanzania. Under the guidance of the Apollo 11 astronaut and NASA scientist Dr. Edwin "Buzz" Aldrin and other 'moon-walkers', Opel tries identify its actions with the protection of threatened eco systems and cooperates with renowned organizations like the WWF. The former astronauts are supported by selected students of scientific disciplines to combine the brand with young, eco-conscious people. The project is a good example for how a car manufacturer supported by trend setters, allied to environmental protection attempts to engender in the consumer a sense of responsibility that everybody can/should make a contribution under environmental aspects.

In another project called 'Together for renewable energies' Opel co-advertises with existing German energy suppliers. The stated aim of Opel is to use sustainably generated electricity as a source of energy for EVs in order to decrease CO_2-emission and to actively promote this fact. The customer is shown that the eco-balance is more favorable with energy produced in a clean way. Electromobility is put in direct connection with climate protection. With the aid of a search box on the website cooperation partners (energy suppliers) can be searched.

Together with the Cinema for Peace Institution Opel has sponsored the Green Film Awards. Opel used the gala to publicly present "Project Earth" and the Opel Ampera with well-known faces. Besides many other prestigious celebrities also animal activist Jane Goodall was present. For the first time Opel acted as the main sponsor and provided an eco-friendly driving service for the famous guests with its electric car Ampera and about 20 Insignia ecoFlex.

The strategic aim of Opel is to energise the brand and position it in the middle of the society with the help of these measures and projects. With a focus on young, talented people and commitments in the field of music and entertainment play an important role in this concept. The projects in particular display innovative strength and an emotional design. Opel's marketing will present to the general public a company which has a sense of environmental consciousness and social responsibility.

BMW i: Times are changing BMW - a classical car brand challenges its tradition

BMW is known worldwide as a manufacturer of sporty, premium vehicles. With the slogan "Freude am Fahren" (Pleasure in Driving) the marketing campaigns of the German premium car manufacturer repeatedly shown successful and dynamic people who enjoy driving and can afford their premium product. The company is now positioning itself as a visionary vehicle and mobility services provided with the concept of the BMW i. The marketing strategy both encompasses the innovative design of the vehicles and also on the responsibility of everybody individually for an environment worth living in. This is different to the strong performance and fast car approach normally taken promoting an inspiring design as well as a new understanding of premium, which in particular can be combined with the concept of sustainability. Both the concept of the BMW i3 as well as the BMW i8 shall be equipped with the so-called "LifeDrive-Architecture".

The LifeDrive-Architecture differs from the current procedure of the so-called "Conversion-Approach" in the production of electric vehicles. The electric components are to be designed in accordance with the technical requirements of electric engines and not - as is currently the case - be designed for cars with combustion engines. With a redesign of vehicle architecture, BMW hopes to create more room for electric engines and batteries and save weight by using an intelligent lightweight construction with carbon and other innovative material.

With the new design BMW intends to visualize the new technology. Brand values like lightness, security and efficiency are to be transferred on this concept.
The new BMW i is sold via so-called BMW i Stores, via selected sales partner, on the internet and via a mobile sales service, Customer Interaction Center, (CIC) to ensure that potential customers have the possibility to experience the cars. The CIC will enable customers to directly receive information about mobility services and sustainability. Furthermore the interaction of the different sales channels enables the customers to decide which sales channel they prefer. An additional change in the sales concept includes the concept of the sales agreements being between BMW and the purchaser directly, rather than with the dealership. It will also be possible to purchase the BMW i Pedelec to match the car which can be folded and put in the trunk of the BMW i3.

(Own Graphic: screenshot website: http://twitter.com/BMWi/)

A new approach has also been taken with regard to the BMW I brand communication and marketing strategy. In advance of vehicles even being on the market, the company has tried to actively advertise electromobility and its products. Besides the established social media portals Facebook and Twitter the company follows new paths of marketing with its innovative online strategy. The communication concept intends to make use of the three digital channels: iAd, foursquare and Mashable.

The mobile advertising platform iAd enables users to target owners across the suite of iPhone, iPod touch and iPad products to provide a three-dimensional picture of the BMW i3 and i8. The vehicles can be made a real experience thanks to the 3D functionalities available. In cooperation with this key social media communication service provider, which is used by 15 million people worldwide, users are shown interesting locations in a total number of 30 cities relating to the topics sustainability, electromobility, design and art. Furthermore weekly updates on the topic mobility and technology are published via the news platform Mashable.

Youtube has already been tested by BMW i as advertising channel. The advertisement of the e-brand was online at the first page of the platform to reach the relevant target group. The new core target group is above the so-called "Generation X", the "Digital Natives" or the "Generation iPhone". These short advertising campaigns are aimed at the core target group and will supplement the digital communication strategy in future.

It is remarkable that the traditional brand follows completely new paths with all BMW i marketing activities with respect to customer acquisition. This may be related to the fact that BMWi combines e-mobility with innovative technology, as well as defines new target group relevance for its e-mobility products. In particular, the position of the car as a status symbol has weakened in the younger demographic groups and is now seen as a mobility solution[12]. The interconnection of the car with multimedia applications and the availability of a share-function via smartphone are highly attractive, especially for the young generation. BMWi would like to have this potential in order to achieve a sustainable commercial success for electromobility. The fact that an electric car is furthermore considered to be particularly eco-friendly will also attract a younger audience.

(Tail Design of the new BMW i 3)

Tesla: Not a car manufacturer but a popular producer

Over the last few years, Tesla has become synonymous with EVs. Since 2004, Tesla was the first mass producer of EVs with a cruising range of more than 300 kilometers. With energy consumption which is an equivalent of less than <1l/100km and an acceleration of 0 to 100 km/h in 3.9 seconds the Tesla is a market leader. As the first high performance, mass produced pure EV the Tesla Roadster kills the complaint about the performance and efficiency of electric vehicles.

The technical performance which Tesla Motors implemented with the Tesla Roadster is visionary. When considering the business model it became clear that the Californian company is really a visionary that just happens to produce EV. At present, approximately 2,000 Tesla cars have been sold and there will also be an annual amount of 20,000 of the new model S.

This gives rise to the question how Tesla intends to cover on a long-term basis the overhead costs for research and development, engineering, marketing and distribution.

It is generally known that the automobile industry requires economy of scale and that for the purpose of covering the above-mentioned costs some hundred thousand of vehicles need to be produced. In addition Tesla plans to produce about 70% of the parts for the entirely newly developed model S in its own factories. Other manufacturers try to outsource the production of the parts to save cots and they invest much more than Tesla in the development of new models. Tesla tries to compensate for deficiencies in the business model through innovation and a comprehensive change of the vehicle architecture. Tesla should not distinguish itself as an exclusive sports car brand but should rather be an e-mobility service provider in the broadest sense which hastens the development of the EV and makes them suitable for the mass market.

The sales concept of Tesla provides for an increased investment in showrooms. The stores are not operated by car dealers but by Tesla itself. All current and future stores need to have a customer footfall of about 4,000-5,000 people per week whereas it has to be assumed that this number can only be reached in very prominent city centre locations.

Tesla is aiming at direct inner-city locations and preferably near an Apple Store when opening its showrooms. The overriding objective is to reach as large a number of people as possible, to give them an understanding of the topic electromobility and of the brand Tesla, rather than the traditional need for car showroom or servicing space.

The high quality and much frequented stores are completed by a Digital-Signage-Concept. The visitors are provided with information on the brand by means of large screens. Furthermore, 3D models of the cars be presented to the customer via these screens. The so-called design-studios enable the visitors to see their imagiing of the Tesla range through an interactive touch-screen display. Just as is the case for BMW i electromobility is connected with playful and multimedia applications, hence also Tesla and its sales strategy aims at a young clientele interested in interactive technology.

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[12] There are cultural differences with this however, as in many eastern European countries cars are still seen as a social status in younger generations.

Tesla does not expect that the stores will sell a lot of vehicles. The stores rather serve the purpose of providing an interactive experience in a high-quality atmosphere where customers can be introduced to the company and products. The actual sale shall rather be made on the online portal, just as is the case for Apple.

With this strategy Tesla primarily aims to sensationalise the brand Tesla and it create a positive image (Tesla Trend) when the new, more profitable models are launched on the market.

Fisker: The vision of a new car design combined with electro-mobility

Fisker Automotive is a joint-venture company that was formed in 2007.

The company successfully entered the market in the segment of electric high-performance luxury cars with its Fisker Karma model. The special thing about this hybrid vehicle is the solar roof design which reduces the energy consumption of air conditioning and heating. Thanks to the integrated 20 kW Lithium-Ion batteries, 408 HP is produced and a maximum speed of 200 km/h can be reached. With an all electric cruising range of 80 kilometers before the combustion engine starts extending the range to up to 400 kilometers. The Karma is positioned by Fisker in the segment of ecofriendly sports cars. The marketing strategy of Fisker tries to combine visual and emotional aspects and the image of a four-seater coupé which protects the environment. The company clearly does not want the same appearance as a Toyota Prius or similar models. Fisker intends to create an image for its vehicles which is a combination of sporty limousine and eco-car. Hence the approach of Fisker is: ecofriendly but premium.

The marketing strategy of Fisker in particular tries to convey to potential buyers that green can be sexy. The company intends to convince the target market that people who want to help improve the environmental conditions do not necessarily have to drive small, unattractive cars. In relation to convenience and luxury, the Fisker is comparable to other sports cars already available on the market. Therefore Fisker is one of the few electric car manufacturers advertising with the slogan "It is fast, it is sexy and it looks good". The environment-luxury-approach of Fisker seems to work. The orders already received show that the chosen concept is successful.

When having a look at Fisker's customers there are many buyers who are employed or involved in the renewable energy or advanced technology sectors such as solar energy or aircraft technology. Fisker offers the possibility to drive a luxury car which at the same time stands for a responsible handling of energy resources, just as their own companies – blending status, environmental ethics and performance.
The exhibition of a Fisker Karma at FrankfurtEmobil events clearly showed that such vehicles can trigger interest and enthusiasm in electromobility. Many people cannot imagine that such vehicle is electrically driven. After an explanatory discussion the visitors often confirm that they now have a completely new picture of electromobility.

Visitors of the Hesse days in Wetzlar examine the Fisker Karma, Wetzlar, June 2012

CONCLUSIONS

"Lets change our old fashion car cult to a new mobility culture"

(Horst Köhler in 2010, Former Federal President of Germany)

Electromobility is not a fast-selling item. While there are some current constraints, for instance driving range, EVs have a difficult position in popular opinion. An important and vital building block when introducing electromobility is the clear definition of the target group. Not all ICE vehicles can be directly replaced with an EV and this needs to be accounted for. But electric vehicles can be deployed in many areas as the cruising range and stand-by times are completely sufficient for everyday business. These areas of deployment need to be defined and to be made public.

Electromobility will be much more important in urban regions than in rural areas due to both urban air quality issues and the negating of range issues. E-mobility will also not enable all vehicles to be replaced as they will not address other mobility issues such as congestion. It is however, a building block upon which new forms of mobility can be provided.

Unfortunately, this is exactly the understanding and the expectation of many people with respect to electromobility. That is exactly where the awareness-creation has to start.

Therefore educational work is necessary. This has to be led by local authorities, politicians as as well as the private sector. In this context the following differentiations have to be made:

- While industry will always act with a target market to sell products, the public sector should put their emphasis on informing the general public about the topic electromobility and about the suitability in everyday life of this technology.
- The general aim is to convince people to use this new technology about which the majority of the population still have reservations. This can only be reached via marketing like press releases, internet, roadshows and trade fairs for the general public. Therefore, besides challenging erroneous perception of EVs, future conditions associated with limited energy resources and increasing oil prices have to be explained. The responsible and sustainable acting of every single citizen has to be appealed to
- A further important aspect is the imminent changes of the car's social role. Whereas the car has traditionally been seen as a status symbol, in modern urban environments it shifting to more of method of mobility. The younger generation does not put the main emphasis on the possession of a car itself, but rather on the requirement to ensure their mobility needs can be adequately met at all times.
- Furthermore nowadays you do not necessarily need your own vehicle thanks to the numerous mobility services like car and bike sharing or car rental services. Due to parking pressures and the considerable environmental pollution in the cities the possession of a car is often considered to be a burden by young people. This attitude, which is growing, signifies a great opportunity for electromobility.

The role of the necessary infrastructure like charging stations in the cities has changed in the course of the EVUE-project. While at the beginning of the project most municipal representatives assumed that an efficient network of charging stations is the fundamental prerequisite for the successful introduction of electromobility, the opinion on that topic changed in the second half of 2011.

The charging stations already installed in the cities do not result in increased sales figures of electric vehicles. It was rather demonstrated that hardly anybody would buy an electric vehicle if it cannot permanently be ensured that the vehicle can be recharged after every drive. This can only be ensured by means of a charging station at home or at the place of work on a permanently rented parking lot.

Also in future people will not rely on free charging station in public areas; that is an exception. An e-vehicle manufacturer had an interesting view on this topic at an EVUE workshop conducted as part of the project. He explained that the cities and municipalities should better invest their money in marketing to strengthen the awareness of electromobility, as the problematic charging station situation would be solved by the users themselves and that the charging station in the municipal areas were only a supplementary.

A further aspect besides rational considerations which is not to be neglected is the emotional significance of electromobility. It needs to be understood that driving an electric vehicle does not imply reduced performance or a lesser driving experience. To drive an electric vehicle is just as much fun as driving a sports vehicle with combustion engine. This kind of educational work can be made achieved through providing driving

experiences. For this reason the roadshows discussed earlier which are undertaken by car manufacturers as well as by municipal authorities and institutions make a crucial contribution there.

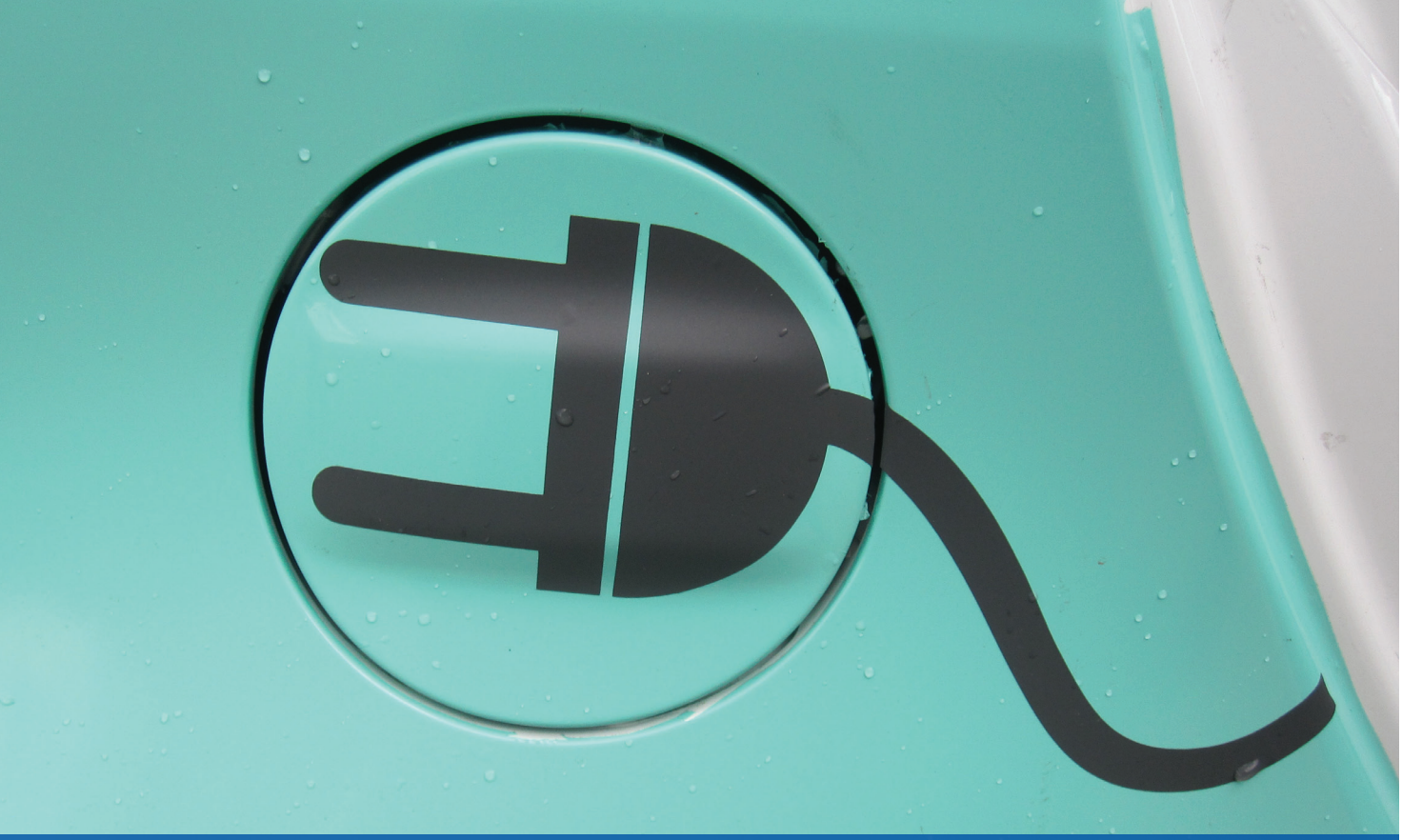
(Own picture)

(Own picture)

In this context the younger generation (generation smartphone) the connection of the new technology electromobility with their status symbol (mobile phone) plays an important role. By using and interconnecting highly modern cell phone technology features a great potential of electromobility to challenge the use of fossil driven vehicles. One option would be to offer electric vehicle sharing. Such solutions could also increase the willingness to pay a higher price for a vehicle or for mobility services.
In order to have a deep market impact with the above-mentioned aspects it is a prerequisite that the main stakeholders like politicians, municipal authorities, car manufacturers, energy suppliers, institutions and mobility service providers cooperate.

The task for cities is to strengthen the awareness for electromobility among the population includes the provision of educational work which is time and cost intensive.

The car has an important role in the society as it symbolizes independent mobility and a social position. The discussions about environmental pollution in the last decades have not considerably damaged the image of the car. Similarly, growing total cost of car ownership has not really affected the sales of cars. Therefore to make the transition to e-mobility, we need to redefine vehicle ownership and its meaning with a greater focus on sustainability and innovative mobility. This cannot be managed by the individual car manufacturers or other stakeholders, but requires integrated and consistent messages from all parties to create the respective awareness and to finally create a success story for electromobility comparable to the one of combustion engines.



CONCLUSION FROM EVUE

CONCLUSIONS FROM EVUE

The environmental problems associated with traditional fossil fuelled urban mobility are widely recognised and understood. While encouraging walking, cycling and the greater usage of public transport is at the heart of sustainable transport policies, we cannot forget the very real benefits that personal motorised transportation brings.

Whether that is to meet the needs of those with physical impairments for whom there is no alternative, through to the travelling salespeople whose journeys cannot be met in any other way, the car is essential. The challenge facing our elected representatives and policy makers is how to ensure these needs are met without compromising the environment or our quality of life.

Electro-mobility provides a solution that maintains personal freedom and autonomy while addressing the many public (environmental and health) challenges posed by the internal combustion engine.
Realising this change however requires new ways of looking at the problem to identify the economic opportunities and, given the challenges of the financial crisis, implement these solutions.

Our focus has been on the four key areas that local authorities can affect when seeking to enhance the uptake of EVs. While national policy and vehicle types are discussed, these are not areas that the cities can readily influence. However, in encouraging the uptake of vehicles, consideration to the business models being applied is an essential factor. Similarly, the availability (or otherwise) of charging infrastructure along with general public awareness are within the remit of local authorities. As organisations with substantial responsibilities and budgets, the ability of the public sector to influence the supply of EVs in the market through procurement is also substantial.

Our work on business models however has shown that although no clear winner has emerged in this field, there are a number of different approaches that can be applied.

The most important requirement is to look at all the stakeholders from the manufacturer through to the end user. While the involvement of the public sector in this area has traditionally been limited, due to the additional costs with this nascent industry and the public benefits that arise from zero emission mobility, finding new ways of working together is a necessity. As there is no 'one-size fits all' business model, the local conditions, geography and national policy framework must be taken into consideration. While not guaranteeing success, the development of a local EV roadmap will help identify and capitalise on the opportunities available.

The common challenges have provided a number of areas where we can learn from our European neighbours. Norway for instance introduced incentives to encourage electromobility, even when the availability of vehicles was very low. This provided a good message to their citizens, while costing very little from a public revenue perspective.

Conversely, while Romania has incentives for EVs in their legislation, it has not been fully enabled, partly due to the financial crisis. It is only through fully implementing these rules however can the Romanian government show it truly supports the move to electro-mobility. While the reality may be that there will be little or no uptake of these incentives (and therefore no cost) in the immediate future, it is the message to the people that counts. The need for coherent and consistent policy is clear, especially given Romania's significant green energy potential and their commitment to the Europe 2020 Strategy.

As demonstrated by the variety of examples discussed, the key aspect is the need to look at the entire value chain, both horizontally and vertically. It is through these linkages that new opportunities can be identified and revenue streams secured. The URBACT local action planning process has supported cities in identifying new collaborations and potential new funding streams, including through future European funds.

Public sector actions through supportive policy can give the private sector the confidence to invest and contribute the much needed funding to develop the market.

Alternatively, implementing joint ventures where the risks are mitigated or transferred to third parties can also be beneficial. The Portuguese Mobi.E scheme is one of the best for integration and risk management however smaller scale operations such as Source London may be more appropriate in other areas.

With responsibility for e-mobility often resting with the transport functions of local authorities, there is often a lack of funding within these departments to procure EVs either as either communication or practical demonstration examples. However, within the wider organisation, numerous departments are likely to regularly procure vehicles for their daily activities and/or manage delivery contracts with external suppliers. Through working with colleagues and introducing EVs into these areas, funding for e-mobility activities can be secured.

The scale of procurement activities within the public sector also provides opportunities for joint procurement. With careful consideration, joint procurement activities can help raise awareness of EVs, strengthen competitive bargaining power and reduce vehicle or infrastructure costs.

One of the most immediate challenges facing local authorities is the 'chicken and egg' scenario of infrastructure and vehicles. Should the charging infrastructure be installed to encourage EVs or only once there is sufficient vehicles to demonstrate the need?

The physical provision of the infrastructure can also be quite complicated. The lack of European or industry wide standards regarding the connectors does not help the situation, regardless of the debate whether it should be standard, fast or rapid charging and how usage can be paid for.

A number of different approaches have been demonstrated from the simple approach as seen in Oslo, the pay as you go model of Frankfurt or the fully integrated Mobi.E and Source schemes in Portugal and London respectively.

While the final approach must lie with the local communities, cities do have an important role to play. Vehicle manufacturers in general expect people to charge in off-street locations at home. With dedicated off-street parking being severely limited in most urban areas, city authorities must find a way to reconcile the competing needs until such a time as 'electric service stations' are commonplace.

The area where cities can have the biggest impact is ensuring their residents are informed about electro-mobility and are able to make educated choices. While EVs are more expensive than comparable ICE vehicles, their lack of tailpipe emissions provide health and environmental benefits that promise to make a substantial impact on the quality of life in our cities. While we understand the effects of poor air quality, to fully grasp its impact we only need to look at mortality rates.

As cities struggle not just with transport related environmental problems but also congestion and wider public health issues such as obesity, a new approach needs to be taken in raising community awareness. While manufacturers seek to sell EVs, the role of the city needs to be in broadening the awareness levels and understanding of the whole community so EV ownership can move from the early adoptors to the majority. When considered within the wider remit of sustainable urban mobility plans, the task of local authorities becomes even clearer – redefining vehicle ownership within the wider scope of sustainability and innovative mobility.

This series of reports has not attempted to answer every question about electro-mobility nor tell the reader how it can be achieved. The aim has been to provide the reader with an understanding of the different approaches and methods that cities have employed in this developing area. The co-funding from URBACT has allowed this knowledge to be generated. Fundamental however, will be the engagement and collaboration between residents, consumers, businesses, manufacturers and the public sector that supports cities to capitalise on the opportunities provided by electric vehicles and ensure the wider economic and environmental benefits are realised.

APPENDIX: SOME FREQUENTLY ASKED QUESTIONS

General Questions

What Electric Vehicles (EVs) are available?

The term 'EV' refers to any vehicle that is powered, in part or in full, by a battery that can be directly plugged into the mains. This document concentrates on cars for individual use.

EVs encompass the following technologies:

- **Pure-Electric Vehicles** (Pure-EVs) - wholly electric vehicles operated by a battery. Currently most manufacturers offer pure-electric cars with a range up to 100 miles.
- **Plug-In Hybrid Vehicles** (PHVs) - battery range in excess of ten miles, after the battery range is utilised, the vehicle reverts to the benefits of full hybrid capability (utilising both battery power and ICE) without range compromise.
- **Extended-Range Electric Vehicles** (E-REVs) - similar to pure-EVs but with a shorter battery range of around 40 miles, range is extended by an ICE on-board generator providing many additional miles of mobility. With an E-REV, the propulsion technology is always electric, unlike a PHV where the propulsion technology can be electric or full hybrid.

What are EVs like to drive?

EVs handle similar to traditional vehicle with the exception that electric motors are very quiet. Similar to automatic cars, there is no gearbox in a pure-EV, which is particularly useful in built-up areas or heavy traffic. Electric cars require the same driving licence as traditional cars and pure-electric cars can be driven on an automatic-only driving licence, where there is no clutch or gearbox.

What are the benefits of EVs?

Electric motors are very good for the environment, when they operate solely on battery power their benefits include:

- no tailpipe emissions
- a quiet driving experience
- easy to use infrastructure
- practical and easy to drive, particularly in urban stop-start traffic

Electricity is also a great alternative to oil for motive power. It can be produced from sustainable sources, it can be readily supplied, and be emission free. This means EVs can offer significant environmental benefits when used as urban commuter transport.

What is the top speed and acceleration of an EV?
Electric vehicle specifications differ by manufacturer and vehicle and are generally able to achieve similar speeds to their ICE counterparts during everyday driving . In general however, there are no constraints to normal driving conditions with all cars able to achieve the maximum posted speed limits (<120km/h). Some high performance pure-electric cars can reach speeds in excess of 200km/h. Power is delivered by the electric motor as soon as the vehicle begins to move which gives smooth and swift acceleration.

This one goes fast.

Does an EV have adequate range for all my needs?
Like speed, range is dependent on the type of EV. Most pure-electric cars offer a range up to 160 kilometres and are ideal for short to medium length journeys. If you are likely to be regularly driving short to medium range journeys and over 100 miles then an E-REV or PHV may be more suitable.

In Europe, more than 80% of daily journeys are less than 100kms which shows that EVs are suitable for most driving needs.

But I often do more than 150kms?
EVs will not be suitable for all drivers, similarly, not all vehicles are suitable for all drivers. When considering your vehicle requirements, you need to consider vehicle range, performance and capacity (seating, luggage space), but current EVs can match most of the needs for a great proportion of the population very well. The intended use will determine what type of EV is most suitable. Manufacturers are introducing more car models, which will satisfy the demand for vehicles of different size and capacity. Until recently, pure-electric cars have been used mainly in commercial and urban environments.

When will EVs be a mass market proposition?
Many manufacturers already have EVs as part of their range and it is only a matter of time as increasing sales see EVs common on the road.

Why will EVs take off now? Haven't we heard this before?
EVs offer a number of benefits besides reducing CO_2 emissions and have very low running costs.

Because of this there are a number of changes that have happened to make EVs a viable proposition:

- EU and national government policies have set ambitious targets for reducing carbon emissions and oil independence. As such there are numerous EV incentives available in support of this.
- Growing public awareness of the need to protect the environment and improve air quality has led to increasing environmental standards and low emissions zones which support the introduction of EVs.
- Technological improvements have seen the introduction of newer vehicles, at lower cost which provide comparative levels of services in relation to ICE vehicles.

Charging

How much does it cost to charge an EV?
The cost of charging an EV depends on the size of the battery and how much charge is left in the battery before charging. As a guide, if you are charging an electric car from flat to full will cost from as little as €3. This is for a typical pure-electric car with a 24kWh hour battery which will offer around 160 kilometre range.

If you charge overnight you can take advantage of the cheapest electricity rates when there is surplus energy. The cost of charging from public infrastructure will vary, many offer free electricity in the short term.

How long does it take to charge an EV?
How long it takes to charge an EV depends on the type of vehicle, how depleted the battery is and the type of charge point used.

Typically, pure-electric cars using standard charging will take between six and eight hours to charge fully and can be 'opportunity charged' whenever possible to keep the battery topped up. Pure-EVs capable of using rapid charge points could be fully charged in around 30 minutes and can be 'topped up'in around 20 minutes, depending on the type of charge point and available power.

PHVs take approximately one and a half hours to charge from a standard electricity supply and E-REVs take approximately three hours. PHVs and E-REVs require less time to charge as their batteries are smaller and provide a smaller range.

Why does standard charging take this long?
Charging a battery is not the same process as replacing fuel in a tank. Current battery technology means that it takes longer to charge an EV than it would to refuel a conventional car with petrol or diesel. There are different charging options which can However, if you have access to off-street parking at home, the process of charging is potentially very simple. You just plug in your EV when you get home and leave it to charge.
What happens if my pure-electric car runs out of juice?
Manufacturers take every precaution to inform the driver of the available charge remaining in the battery.

As with ICEs, a 'fuel' gauge will indicate how much charge is left in the battery. If the driver continues without recharging the consequence will be similar to running out of fuel and recovery services can assist motorists to reach their destinations and charge their battery.

Where can people charge EVs?

Charge points will be available at homes, at some workplaces, on-street and in a number of public places such as car parks and supermarkets.
Home charging is relatively easy to arrange - this can be done by installing dedicated weatherproof external sockets or in a garage. It is advisable that owners ensure that their charging socket and wiring have been approved by a qualified electrician before they commence home charging.

For those without access to off-street parking at home, charging infrastructure will be required in public locations and, where possible, at work.

Information on national infrastructure can be found at a variety of locations on the internet. However, please note that as the installation of charging points is gathering pace, this information should be seen as a guide to what is available rather than a definitive list.

Will I need to install special equipment to charge an EV at home?

EVs can be charged by plugging into a standard socket. If you are charging outdoors, an external weatherproof socket can also be installed.

It is recommended to install a home charging unit on a dedicated EV circuit, similar to those required for other appliances such as electric ovens. This will ensure the circuit can manage the electricity demand from the vehicle and that the circuit is activated only when the charger communicates with the vehicle.

Owners are advised to check with their vehicle manufacturer to see if there are any vehicle specific requirements. A safety check by a suitably qualified professional is advisable before charging an electric vehicle at home.

For rapid charging special equipment would be required and is therefore unlikely to be installed at home, where most consumers will charge overnight.

Will there be cables trailing across the pavement?
For safety reasons, there should be no cables trailing across public access ways. Please contact your local authority for more information.

Is there a 'chicken and egg' scenario for the vehicles and charging infrastructure?

Yes. While many users of electric cars with access to off-street parking at home or at work will not need to make use of public charging infrastructure on a regular basis to increase consumer confidence, it is important that there is a network of public charging infrastructure in place. Local authorities and key stakeholders e.g., supermarkets, are therefore working to ensure that charging points are publicly available.

How do I pay for charging?

If you charge your vehicle at home, the cost of the electricity you use to charge your car will simply be reflected in your electricity bill. Electric companies are also interested in consumers installing smart chargers so that you can choose when to charge your vehicle and so take advantage of lower rates (eg overnight). At present, different areas will have different arrangements for paying for electricity from public infrastructure.

How can I charge my EV from low carbon energy?

If charging from your home supply, you may request a green electricity tariff from your supplier. By signing up to a green electricity tariff your electricity supplier has to provide evidence to demonstrate that its tariff results in a reduction of a minimum threshold of carbon dioxide emissions. Electricity suppliers must show that the activity associated with the green tariff is in addition to what they already have to do to meet existing government targets for sourcing more renewable electricity and reducing household carbon emissions.

Do all EVs and charging points have a standard plug and socket? Will my EV charge in other countries?

The EU is currently working on developing EU-wide standards for EV-specific plugs and sockets but there are no standards yet. It is best to check with the vehicle manufacturer about charging equipment, such as the cable, which may be provided with the vehicle and the countries in which it can be used.

Can anyone unplug my car when it's charging?

For those charging at home, this is unlikely to occur and the majority of public charge points are lockable, meaning passers-by cannot unplug the cable.
Some charge points can send a text message to the car owner if the vehicle is unexpectedly unplugged, or tell you when the vehicle is fully charged.

Is it safe to charge in wet weather?

Yes, it is safe to charge in wet weather. Weatherproof charging equipment can be installed and if you are installing a charging facility at home, your supplier will be able to provide further advice about charging safely.

What rate of charging will be available?

Different areas will be installing a range of charging technologies. Charging times and rates depend on both the vehicles' capability and the charging equipment available.

Initially, most will be standard or fast charge. You can find further information about the sort of charging infrastructure available near you by contacting your information point.

Batteries

What battery technology is being used?

Modern EVs use Lithion ion batteries which are similar to those used in laptops etc. In the first generation of EVs (mid – 90s onwards) most vehicles used lead acid batteries due to the availability and lower cost. However, as they had a low energy density, significantly more were needed to provide acceptable ranges and their weight added considerably to the vehicles.

Are there enough Lithium and other materials to produce the batteries or we exchanging oil dependency for lithium dependency?

Yes. There are proven Lithium resources in Asia, South America, Australia and the United States that should provide sufficient supplies to meet demand. In addition, as Lithium batteries can be recycled, as old batteries are replaced, they can be recycled into new batteries

How long will the battery last in my EV?

Battery manufacturers usually consider the end of life for a battery to be when its capacity drops to 80% of its rated capacity. However, batteries can still deliver usable power below 80% charge capacity, although this will produce shorter range. This means that if your original battery has a range of 160 kilometres on a full charge, after eight to ten years (depending on how much the vehicle has been driven) this may have reduced to 100 kilometres. However, the battery will still be usable. Whether you want to exchange it at that stage for a newer battery will partly depend on your driving habits. A number of vehicle manufacturers have designed the battery to last the lifetime of the car.

Does using the radio and lights etc, flatten the battery?

Yes, this will impact on the range to some extent, particularly pure-electric vehicles. As with conventional ICE vehicles, if you run air-conditioning excessively then the fuel consumption of the vehicle will be affected. Many vehicle manufacturers are using innovative solutions, such as LED exterior lights, to reduce energy consumption and control systems can be used in EVs to minimise the amount of energy used by additional items, such as air-conditioning and heating.

What is the cost of a replacement battery?

That depends on the size and type of the battery, which are determined partly by the vehicle.
Batteries are relatively expensive at the moment but prices will come down, as technology improves and volumes increase. Customers are advised to speak to manufacturers for more information.

Can the batteries be recycled?

Yes.

Service, repair and breakdown

Where will I be able to get an EV repaired or serviced? Manufacturers will ensure that service technicians are provided with detailed service instructions and training, just as they do for other vehicles. In addition, industry training programmes are being developed to ensure dealers, technicians, manufacturing staff, emergency services and breakdown recovery staff can become qualified to handle EVs.

What will it cost to service an EV?

In a pure-EV, there are few moving parts which should reduce servicing costs and downtime. When it does require servicing it will be similar to an ICE service because although the powertrain is different, many of the service actions for Pure-EVs are similar to ICEs. For hybrid vehicles, they will have their normal service procedures as well.

Can EVs be towed like regular cars?

In most cases, yes. Always check with the manufacturers instructions first, but it is likely the restrictions that apply are similar to those for automatic vehicles (eg limited speed and/or distance for towing).

Do EVs work in cold weather?

Yes. As with any newly developed vehicle, manufacturers have carried out extensive testing in extreme weather conditions. In addition, the country with the highest rate of EV ownership per capita is Norway where the climate is substantially colder than most places throughout Europe. The range of EVs may be affected by cold weather; the use of heating and other items is likely to increase the load on the vehicle system and reduce the range, particularly of pure-EVs, in cold weather.

Emissions, electricity, grid

Will an increase in EVs lead to more emissions (from coal-fired power stations)?

No. The energy industry in Europe is constrained by legally binding limits on the total amount of CO_2 emitted each year, up to 2020. This limit reduces annual emissions to achieve an overall reduction in CO_2 emissions. If overall energy demand increases as a result of electric vehicles (or for any other reason) then the increase in demand must be met with electricity from renewable or zero carbon generation sources. In addition, measures such as the EU's Renewable Energy Directive, which requires 20% of renewable energy by 2020, are positive strategies to achieve

CO_2 reductions while the European Emissions Trading Scheme requires electricity suppliers to reduce their overall CO_2 emissions.

Will the grid be able to cope with increased demand?

There has been some concern that the electricity distribution grid will not be able to cope with the demand for EVs. However, research undertaken by the network operators has shown that most charging is likely to take place in off-peak periods and the grid will be able to cope with new demand from EVs. Off-peak charging will enable surplus energy to be used, resulting in more efficient use of the electricity generated. Electricity companies are working with EV manufacturers to prepare for the future using smart metering systems which can automatically select charging times, as well as tariffs which incentivise off peak charging.

What will happen if everyone charges their EV at the same time?

It is expected that EVs could be programmed to charge during off-peak times and therefore balance the demand on the grid. Being able to pre-programme EVs to charge during these hours will allow drivers to take advantage of cheaper electricity prices, whilst using any surplus electricity. It is also likely that drivers will charge at different times, depending on their vehicle and driving patterns.

In addition, the development of smart metering systems which can automatically select charging times and tariffs can also help to manage demand on the grid.

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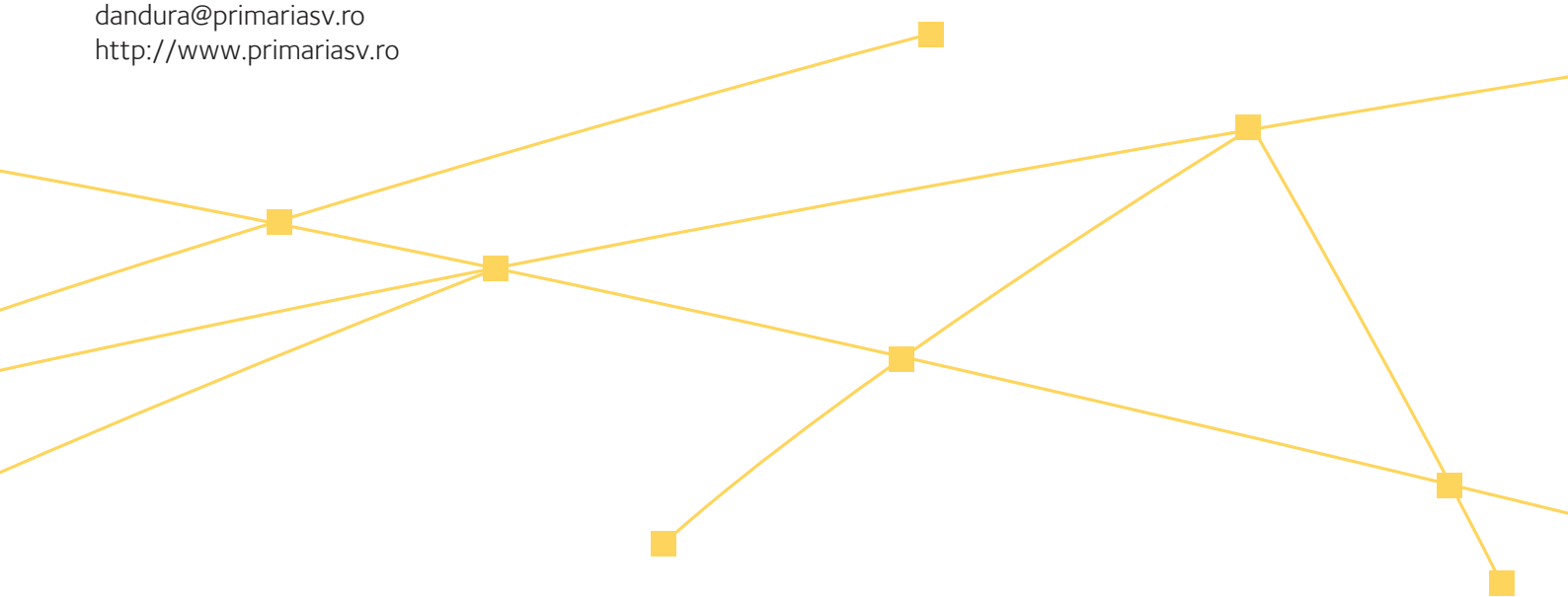
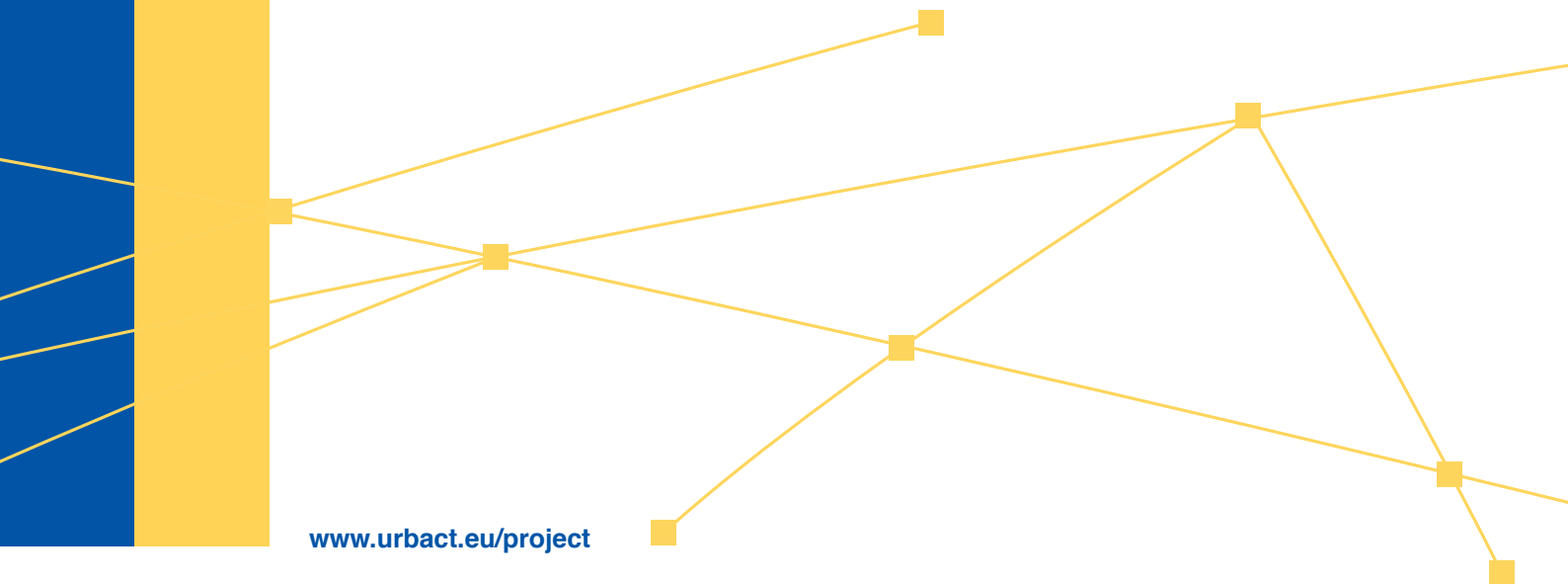


URBACT is a European exchange and learning programme promoting sustainable urban development. It enables cities to work together to develop solutions to major urban challenges, reaffirming the key role they play in facing increasingly complex societal challenges. It helps them to develop pragmatic solutions that are new and sustainable, and that integrate economic, social and environmental dimensions. It enables cities to share good practices and lessons learned with all professionals involved in urban policy throughout Europe. URBACT is 181 cities, 29 countries, and 5,000 active participants



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