Global challenges need smart solutions.

eBRIDGE
Power to urban fleets

Co-funded by the Intelligent Energy Europe Programme of the European Union

PROJECT GUIDELINES


eBRIDGE
Power to urban fleets

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1 THE eBRIDGE VISION

eBRIDGE has a clear vision and ambitious objectives: a zero-carbon urban mobility where technology by means of electric vehicles (EVs) and smart infrastructure supports people to make sustainable travel decisions.

We call it Urban e-Mobility 2020. In such a vision mobility performs instantaneously, mostly on-demand, by means of a multimodal, integrated transport system that includes a broad range of transport modes in an interoperable, seamless mobility chain. Information and communication technology, as well as smartphone technology enable smart travelling; useful tools like journey planners, or specific apps developed by mobility operators provide real-time information about the next trip options and allow on-line booking and billing, thus enabling efficient door-to-door trips.

To bring this forward, innovation and new technologies will be crucial in addressing our mobility needs and providing effective, efficient and affordable transport. Different research and application fields need to join efforts to redefine our mobility ecosystem and beliefs. Further R&D projects for the development of more efficient batteries, intelligent charging, vehicle and smart grid integration and cleaner energy production will contribute to cutting emissions from transport and make EVs cleaner, thus helping achieve the climate and energy 2020 goals. Moreover, innovative policy making and spatial planning will be key to ensure integrated urban development that leads to more sustainable cities. Most importantly, electric mobility will require a radical change of mindsets and beliefs about travel and the way we travel. Its success relies in a paradigm change and the role of traditional means of transport like the private car, and the need of car ownership. Some of these are already changing, and mobility trends like car sharing or active travel that favour cycling and walking instead of car trips, are visible already in many cities.

On this backdrop, eBRIDGE has explored the alternatives to our current fossil fuels based mobility and found out that EVs are not only a cleaner and more sustainable alternative, but also a technology that can contribute to higher quality of life standards, lower pollutant and noise levels and a better usage of urban space.

As with every project, we learned a great deal but also faced a number of challenges mostly related to the lack of knowledge on urban electric fleets and a young, developing technology, which did not help build confidence in the market. Distrust and lack of familiarity with EVs naturally leads to users' misperceptions, range anxiety, fear of the charging process or unfounded assumptions such as much lower battery autonomy. Also, financing barriers for the development of an adequate charging infrastructure as well as high purchase costs of EVs and market uncertainties still persist, slowing technology acceptance.

In this document, we summarise our findings, experience and know-how collected from the eBRIDGE pilots in the form of practical guidelines. The eBRIDGE Guidelines aim at providing a realistic and unbiased view on our understanding of the potential of electric mobility and electric fleets for daily travel. They are conceived to engage fleet managers of companies, local authorities, car sharing operators, transport operators, policy makers and car users with electric mobility, showing them the pros and cons of electric fleets and encouraging EV adoption.

The Guidelines are grouped in 3 sections: first, an overview of the electric mobility markets in the 6 eBRIDGE countries, second, the description of the 7 case studies with their specific achievements and third, a final section with key findings and recommendations, including a model case for commercial e-car sharing, a policy overview, scenarios for CO_2 emissions reduction, recommendations for better fleet performance and effective marketing and communication, and finally, the eBRIDGE messages. Additional information from a more hands-on perspective can be also found in the eBRIDGE Toolkit, available on www.ebridge-project.eu.

We hope our work serves as inspiration and support to other pioneers who also find that electric mobility is the way to go!

2 ELECTRIC MOBILITY IN THE eBRIDGE COUNTRIES

From the early 20th century, when electric vehicles[1] (EVs) were quite popular, to a temporary renaissance in the 1990s, we are now experiencing a slow but constant EV growth. In the second decade of the 21st century, the lithium-ion battery technology is becoming well-established and the vehicle fleet is gradually being electrified.[2]

Alternative propulsion types like BEVs, PHEVs and HEVs can reduce the dependence on fossil fuels as well as the emissions of air pollutants, contributing to the gradual decarbonisation of transport, the improvement of air quality as well as the reduction of noise levels, features that make them particularly suitable in the urban context. In addition, their lower fuel cost is a competitive advantage against conventionally-fuelled vehicles.[3]

The electric mobility market started expanding with HEVs (e.g. Prius) as the first alternative to conventional internal combustion engines (ICE), leading to an increasing market share within the last 2 decades. The debut of mass market fully electrified powertrains like the Nissan LEAF (BEV) and the Chevrolet Volt (PHEV) dates back to 2010. Today, several EV models are available on the global market and vehicle choice has diversified with electric vans, buses and two-wheelers. Industrial improvements in terms of higher battery intensity or lower purchasing prices are also encouraging EV sales.[4]

In terms of EV numbers, by the end of 2014 more than 665,000 BEVs and PHEVs were circulating worldwide, mostly in the USA, Japan and China. This reflects a 53 % growth compared to 2013. Still, these figures only represent 0.08 % of all passenger cars globally, and only 0.04 %in the EU-28.[5]

Despite their environmental and economic benefits, EVs face technological, commercial, and infrastructural barriers, but also user behavioural aspects for a greater diffusion in our mobility system and culture.

Table 1. EV Market Drivers and Barriers.

DRIVERS	BARRIERS
Environmental concerns: pollution reduction (noise, GHG), energy security, investments in renewable energy sources	Insufficient demand: little knowledge about EVs, lack of business models, range anxiety, distrust of EV reliability, higher purchase costs, lack of willingness to pay more for a non-established technology
Economic expectations: job creation and green growth, less dependence on imported fossil fuels	Infrastructural shortcomings: insufficient number of charging stations, non-interoperable connectors
Industrial factors: more available EVs, technological innovations, extended portfolio of powertrains	Industrial drawbacks: high cost, low energy density and heavy weight of batteries
Governmental initiatives: support for extension of public and private charging infrastructure, monetary and non-monetary incentives for EVs, integration of EVs into public fleets	

1 EV is used as a general term, including battery electric vehicles (BEVs), range-extended electric vehicles (REEVs), plug-in electric vehicles (PHEVs) and hybrid electric vehicles (HEVs).

2 Trigg, 2012, page 30.

3 EEA, 2015; ISI Fraunhofer, 2013, page 25.

4 Idem; IEA, 2015; Amsterdam Roundtable Foundation, Mc Kinsey, 2014, page 9, 13.

5 IEA, 2015.

In general, the European market for BEVs and PHEVs is currently in the early adoption phase with certain growth pockets like Norway or the Netherlands, reporting 2014 market sale shares of BEVs and PHEVs together of about 12.5 % and 4 %, respectively. Even on a global level, these figures are exceptional.[6]

The market share of EVs of all types, compared to the national car pool throughout the eBRIDGE countries remained well below 1 % with the UK having the highest share, 0.7 %, in 2014. Though starting from a rather low level, new registrations in the eBRIDGE countries show an upward trend: especially in the UK growth rates in 2014 were outstanding with 57.9 % more new EV registrations compared to 2013.

Still, by the end of the next decade, ICEs will dominate the European vehicle market. But towards 2030 sale numbers for EVs are expected to pick up globally. According to projections of the International Energy Agency (IEA), by 2030 EVs will account for 15 % of the worldwide vehicle fleet.[7]

To promote the uptake of alternative fuels and foster the development of interoperable charging infrastructure, the European Commission issued the Clean Power for Transport package in 2013. This requires the Member States to set up national regulatory frameworks including binding objectives for charging station build-up, common technical specifications, and comprehensive consumer information regarding environmental, financial and safety aspects as well as information about available charging stations.[8]

Such a policy initiative is one driving factor for the enhancement of the EV market. In order to foster EV demand, specially tailored policies have been developed, including tax incentives, purchasing grants or privileges like free parking in certain areas. Policy measures in the eBRIDGE countries reflect this trend. Exemptions from vehicle registration taxes apply in all eBRIDGE countries. Austria, Portugal, Spain and the UK subsidise EV acquisition costs. Spain distributes environmental badges to make EVs quickly identifiable to regulatory authorities. Governmental stimuli for EVs anticipate economic growth, job creation and new market opportunities. In this sense, Germany strives to become the main provider of electric mobility products and services. [9]

Nonetheless, environmental issues are usually the main reason for public authorities to push electric mobility and favouring policies. These environmental considerations concern especially the emission of greenhouse gases (GHG), mainly CO_2. Transport relies almost entirely on imported fossil fuel, making the transport sector the second biggest source of GHG emissions, following the energy sector, and responsible for a quarter of the total EU CO_2 emissions.[10]

The European Commission's White Paper on Transport aims at reducing emissions from transport by 20 % by 2030 with respect to 2008, and by at least 60 % by 2050 with respect to 1990. However, GHG emissions of road transport have soared by 20 % since 1990, which is an outstanding growth rate compared to other economic sectors. The chart below illustrates the great gap between the current GHG emissions levels of transport (incl. aviation) and the target reductions. If the reduction targets are to be met at all, higher energy efficiency of ICE powertrains will not suffice. Further (and stronger) electrification of the EU vehicle fleet is required.[11]

6 Amsterdam Roundtable Foundation/Mc Kinsey, 2014, page 9-10; IEA, 2015.

7 Trigg, 2012, page 30.

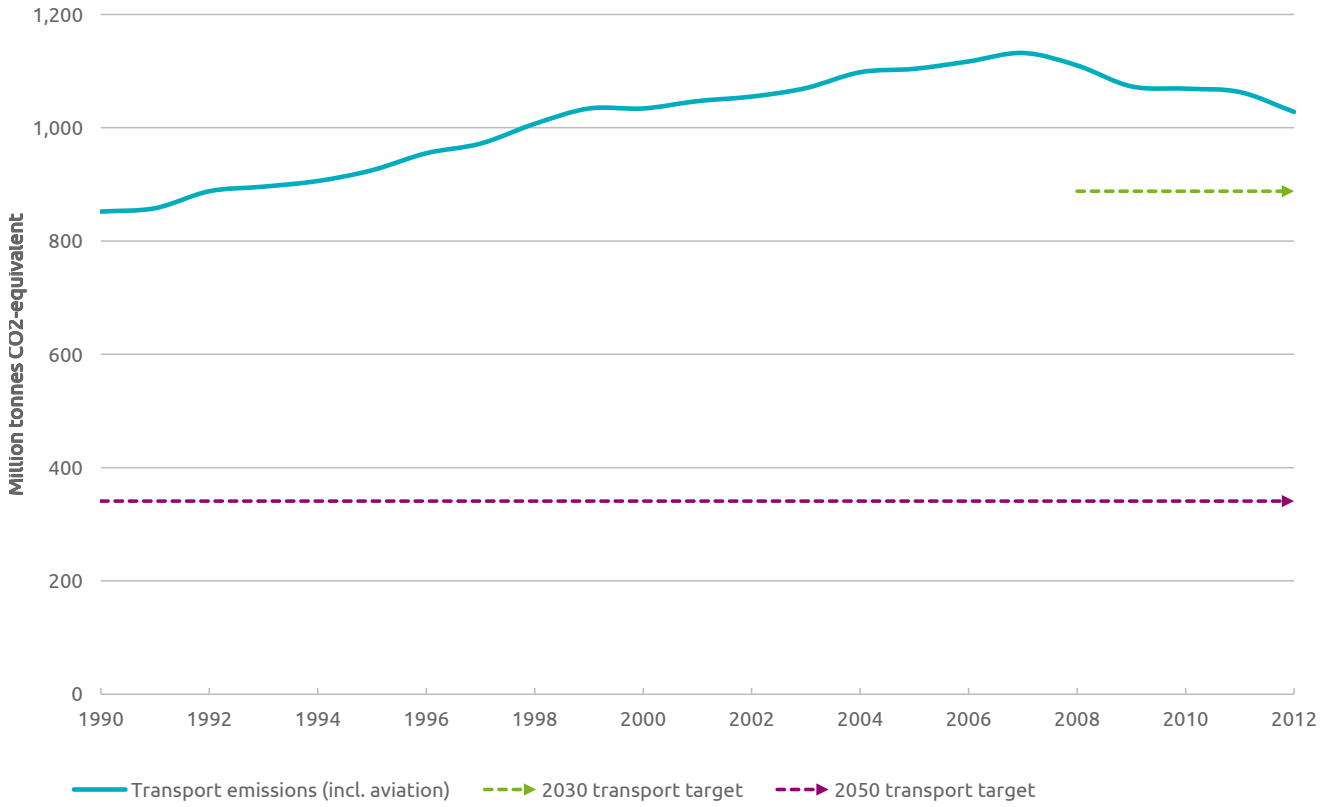
8 EC, 2014; EC, 2013, page 2, 9.

9 Amsterdam Roundtable Foundation/Mc Kinsey, 2014, page 14.

10 EEA, 2015; EC, 2014.

11 EEA, 2015.

Figure 1. Evolution and targets of transport emissions of GHG. *Source: Own work based on EEA*



To keep the overall lifecycle emissions of EVs low, the share of renewable energies on electricity production needs to be further increased. Within the eBRIDGE countries, particularly in Austria (68.1 %), Portugal (49.2 %) and Spain (36.4 %) a significant proportion of the electricity generated stems from renewable sources.

A larger share of EVs can also provide significant electricity storage if supported by smart grids.[12]

From the demand side, high purchasing price, range anxiety and lack of knowledge and awareness are the major barriers to EV adoption and a broader market uptake. EV sales are currently targeting specific customer segments, able to afford the higher purchase price. Among these so-called early adopters are commercial fleets, which show a significant market potential for broader diffusion. For fleet owners the vehicle's economic performance over its entire lifetime is of greater importance than its initial purchase price, which is contrary to the buying decisions of private customers. Due to favourable circumstances of fleet vehicle usage, e.g. predictable driving patterns and routes, and high vehicle mileage, EVs become particularly economic efficient.[13]

The eBRIDGE project aims to demonstrate how the introduction of EVs in fleets for business and private travel can efficiently contribute to improving the market conditions in the electric mobility sector. The project analysed the use of EVs in 3 types of fleets:

12 Eurostat, 2015; EC, 2013; Amsterdam Roundtable Foundation/Mc Kinsey, 2014, page 41; Xenias et al, 2015, pages 81, 89-102.

13 Amsterdam Roundtable Foundation/Mc Kinsey, 2014, page 12; ISI Fraunhofer, 2013, page 25-.

company and municipal fleets for business trips, and peer-to-peer and commercial car sharing fleets for all-purpose trips. Electric fleets are perceived as a highly relevant for a successful diffusion of EVs, as it increases their presence on the roads and provides access to a larger number of drivers (employees and customers). In addition, it can contribute to a broader diffusion of know-how about electric mobility.

The following section presents briefly the state of electric mobility in the eBRIDGE countries Austria, Germany, Italy, Portugal, Spain and the UK. It provides an overview of the current and the future market development for each country, as well as the status quo of the charging infrastructure. Furthermore, this section provides an insight into specific policies and strategies aimed at fostering EVs uptake.

2.1 AUSTRIA

Table 2. Key facts Austria. *Sources: ACEA (2014); AustriaTech (2015); BMVIT/Herry Consult (2011); Statistik Austria (2015a, b); WKO (2015a)*

Share of motorised private transport modes of total journeys (1995)	51 %
Passenger car density per 1,000 inhabitants (2014)	547 units
Share of vehicles in European passenger car pool (2012)	1.9 % (4.6 million vehicles)
Market share of EVs in national passenger car pool (30.06.2015)	0.4 % (18,691 units)
Market share of EVs in new registrations of passenger cars (2014)	1.2 % (3,641 units)
Top automotive brand for new EV registrations (2014)	BEV: Renault (389 units)

2.1 OVERVIEW & MARKET DEVELOPMENT

The Austrian Federal Government has put electric mobility at the heart of its transport policy to ensure a sustainable, clean and efficient transport system. The implementation plan "Electromobility in and from Austria. The common path" launched in June 2012 goes beyond the mere substitution of conventional cars. It is a global vision where electric mobility is integrated into an intermodal transport system, and supplied with renewable energy sources.

Deemed to be a big opportunity for economic and technological development, but also for a climate and environmental-friendly economy, electric mobility is at the centre of the research activities. R&D projects funded by the federal government and managed by the Climate and Energy Fund are bringing the technology forward. Since 2008, 7 model regions are testing approaches for cleaner logistics and integrated mobility solutions for urban transport, including e-car sharing and other shared systems, commuter's mobility, charging infrastructure and billing solutions, etc.

There is a remarkable setup of 171 charging stations (4 of them fast charging) in the first model region for electric mobility in the province of Vorarlberg. Within the framework of the VLOTTE project a "mobility card" was developed, which includes, among other features, fully operational EV leasing, free charging at all public charging stations and a pass for the regional public transport system.[14]

14 VLOTTE, 2015, page 3, 10, 16.

Picture 1. Electric Car Sharing with Caruso. *Source: Caruso Carsharing, Benedikt Krauß*

Within the project "E-Mobility Post", the Austrian Post is leading the introduction of EVs for mail delivery in Vienna. Started in 2012, the project aims to acquire a total of 1,157 EVs, including cars, scooters and bikes, as well as to install the necessary charging infrastructure. By the end of 2014 almost a third of the targeted number of EVs had been acquired. The electricity supplied is provided by rooftop photovoltaic systems installed on 2 logistics centres.[15]

Passenger cars, commercial vehicles, busses and trains, as well as two-wheelers like motorbikes, scooters and bicycles powered partly or fully with electricity are under the scope of the Austrian strategy, strongly supported by the Austrian Climate and Energy Fund under the programme klima:aktiv mobil. With an initial target of 250,000 EVs, and although electric mobility is progressively gaining relevance, the ambitious target is unlikely to be met. The implementation plan: "Electromobility in and from Austria", published in 2012, does not specify any further target.

The challenge thus remains, making mobility accessible to all and reducing the impacts of transport. Part of the solution is to promote the introduction of clean, efficient vehicles in road traffic. The car market has a good number of international models available and it is expected that the palette of alternative powertrain vehicles will grow in the coming year[16].

As of 31.01.2015, the number of BEVs was 3,486 of a total passenger carpool of 4.7 million vehicles. HEVs amounted to 13,069 units (both petrol and diesel hybrid and plug-ins). This represents an EV share of 0.4 % with respect to the total Austrian passenger car pool.

New registrations are developing positively with growing numbers for EVs. In the first half of 2015, new registrations accounted for 2,635 EVs (1.6 % of all new registrations). Considering the most recent annual registration data, in 2014 BEVs accounted for 1,281 units (+ 95.9 % on 2013). Of them, Renault held the largest share (30.4 %) with 389 BEVs new registrations, followed by BMW with 296 BEVs. HEVs new registrations in 2014 amounted to 2,360 units, of which 2,167 petrol-hybrids (- 10.2 %) and 193 diesel-hybrids (+ 20.6 %).

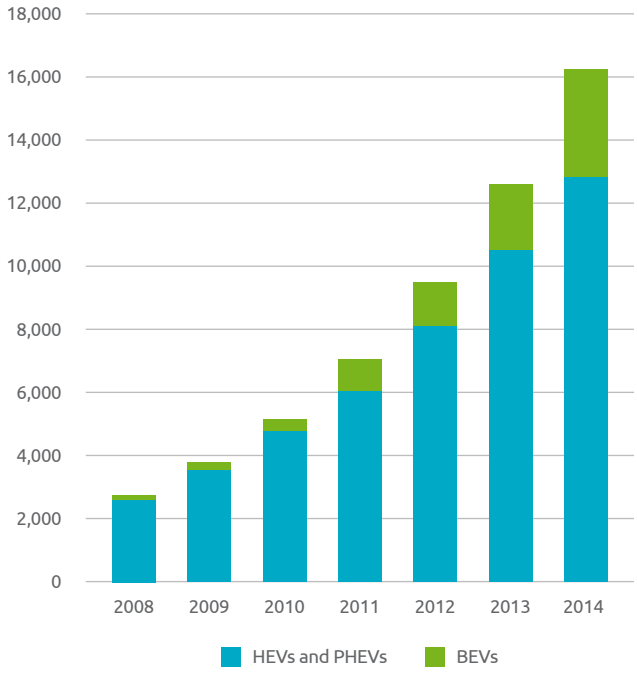
In the last years, companies were responsible for more

15 E-Mobility Post, 2014, page 4, 7, 8.

16 An overview of the EVs and PHEVs (incl. range-extenders) models available as of October 2014 can be found at http://www.e-connected.at.

than half of all EVs new registrations, specifically for over 60 % in 2013.[17]

Figure 2. Number of EVs registered in Austria 2008-2014. *Source: Own work based on Statistik Austria*



2.1.2 CHARGING INFRASTRUCTURE

The actual state of the Austrian charging infrastructure is challenging to assess as there is no central point responsible for the elaboration of a unified listing of the evolution of the charging network. This appears to be a common issue in other countries as well and an overview of integrated, reliable data is missing. There are, however, several initiatives mapping charging stations through collaborative digital platforms[18]. The Climate and Energy Fund operates the website e-connected.at, which gathers information on electric mobility in Austria and suggests several search engines.
By July 2015, according to the online database provided by the electric utility KELAG, there are 1,877 charging stations available in Austria, compared to 1,759 in 2014. Main operators are private companies ranging from electric utility companies to the national automobile club.

2.1.3 POLICY FRAMEWORK

Despite the positive evolution of the electric mobility market in Austria, additional measures to increase the presence of EVs are needed. The taxation framework is crucial to improve private users' acceptance. The following list provides an insight into the diverse incentive measures offered, sometimes only at regional or municipal level. Often, EV subsidies vary according to the electricity sources used to charge them[19]:

- Exemption from the car registration tax (NoVA – Normverbrauchsabgabe) for BEVs. Until the end of 2015 there is a bonus of 600 EUR for low-emission vehicles.
- Exemption of the motor-related insurance tax for EVs up to 3.5 tonnes.
- Deduction of input tax (VSt – Vorsteuer) of 20 % on EVs and on related running costs (e.g. maintenance) from 2016 onwards. Reduced insurance rates (self regulation by some insurance companies).
- National Government provides grants (up to 4,000 EUR) to local authorities and companies for the purchase of up to 10 alternative-fuelled vehicles.
- The Lower Austrian Government offers grants up to 5,000 EUR for EV purchase to companies, municipalities, associations and private persons.
- Free parking and charging for EVs in some cities (e.g. free parking for 3 hours in the city of Klagenfurt).

AustriaTech, commissioned by the Austrian Ministry

17 Statistik Austria 2015a, b; AustriaTech, 2015, page 9.

18 AustriaTech, 2015, pages 6,12.

19 Klima- und Energiefonds (2015); WKO, 2015b; Kommunalkredit Public Consulting, 2015, page 1; Ecoplus, 2015.

of Transport, Innovation and Technology, developed a policy brief with a series of recommendations for the further promotion of EVs at a national and regional level[20]:

- Taxation of company cars based on vehicle CO_2 emissions: considering the higher share of new passenger cars registered by companies, usually overmotorised, this measure suggests tax reductions for lowest-emission vehicles (60 - 100 g CO_2/km).[21]
- New set of exemptions for private EVs on NoVA and the motor-related insurance tax based on the vehicle's CO_2 emissions.
- Promotion of the acquisition of low-emission vehicles in public fleets.

As a basis for this set of measures, AustriaTech suggested the identification of EVs via the existing vignette "§57a-Pickerl", according to the CO_2 emission criteria.

2.1.4 FUTURE DEVELOPMENTS

The higher purchasing price compared to conventionally-fuelled cars is a common barrier to a broader expansion of EVs. As price is gradually declining while public funding and the available vehicle assortment is expanding, the number of EV on the road is expected to rise. From 2017 onwards experts predict an increasing market share of EVs, especially of PHEVs ahead of BEVs across the end-user, public and private sector segments.
As indicated above, there is no unified listing of the Austrian charging network available. As a result of the implementation of the directive 2014/94/EU on the deployment of alternative fuels infrastructure, EU state members were called to set national targets for charging stations and to develop standardised databases of charging stations. Such a requirement can contribute to fostering the market penetration of EVs, as searching for charging possibilities becomes easier. Charging stations are not only growing in number but also in interoperability, which will lower customers' usage barriers.[22]

20 AustriaTech, 2014, page 2.

21 For the tax reform in 2016, employee benefits on EVs were earmarked (e.g. tax exemptions for privately used company cars) but the draft law was changed shortly before the resolution.

2.2 GERMANY

Table 3. Key facts Germany. *Sources: ACEA 2014; KBA 2014, 2015a; MOP 2015*

Share of motorised private transport modes of total journeys (2013)	52.4 %
Passenger car density per 1,000 inhabitants (2012)	539 units
Share of vehicles in European passenger car pool (2012)	17.7 % (42.9 million vehicles)
Market share of EVs in national passenger car pool (01.01.2015)	0.2 % (126,702 units)
Market share of EVs in new registrations of passenger cars (2014)	1.2 % (35,957 units)
Top automotive brand for new EV registrations (2014)	BEV: Smart fortwo (1,589 units) HEV: Toyota Auris (8,921 units)

2.2.1 OVERVIEW & MARKET DEVELOPMENT

Since the foundation of the National Platform for Electric Mobility (NPE - Nationale Plattform Elektromobilität) in 2010, the Federal Government has set ambi-

22 AustriaTech, 2015, page 6, 23,37, 41.

tious goals to make Germany market leader and main provider of electric mobility products and services. By 2020, one million EVs should be on the German roads. The industry sector is doing its part and in autumn 2013 the German automobile manufacturers presented the first models at the International Motor Show (IAA - Internationale Automobil-Ausstellung) in Frankfurt.

Since then, and with more than 17 EV models of German manufacturers available on the market (and 12 new models foreseen for 2015)[23], the number of new registrations has grown dynamically.

In 2014, new registrations of EVs amounted to a total of 35,957 units, of which 8,522 were BEVs and 4,527 PHEVs. Company registrations accounted for 77.4 % (6,592 units) of newly registered BEVs and 83 % (3,757 units) of PHEVs. The first half of the year 2015 showed a growing trend of new registrations with 20,676 EVs registered until June, which is almost three quarters of the 2014 total registrations. In that year, the most registered BEV models were Smart fortwo (1,589 registrations), Renault Zoe (1,489) and BMW i3 (1,242). Most registered HEVs models were Toyota Auris (8,921 vehicles) and Toyota Yaris (7,333).[24]

As of 1.1.2015 the German car pool had a total of 126,702 passenger EVs, a significant growth (+ 76 %)[25] compared to the previous year (72,109 EVs). Although HEVs had the largest shares, BEVs performed exceptionally well during 2014, accounting for 18,948 units (+ 166 %).[26]

The Federal Government supports the further development of electric mobility through the funding programme Showcase Electric Mobility, launched in 2012 and running until 2016. With a funding of about 300 million EUR, over 90 large-scale regional projects including more than 300 sub-projects, are exploring and testing crucial issues such as renewable energy supply and EVs integration in the transport and mobility systems.[27]

23 NPE, 2014.

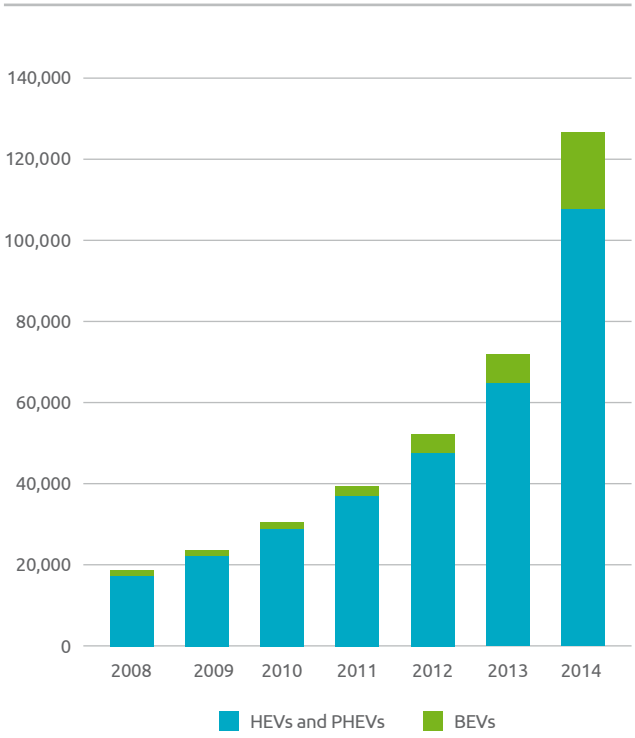
24 KBA, 2015b; KBA, 2014, pages 41, 42.

25 KBA, 2015a.

26 The total number of EVs includes BEVs, PHEVs and HEVs.

27 Deutsches Dialog Institut, 2014.

Figure 3. Number of EVs registered in Germany 2008-2014. *Source: Own work based on KBA*



Results so far show that EVs meet people's daily transport needs for most of the journeys and perform satisfactory and that electric mobility has the potential to reduce the environmental impacts of transport and increase the quality of life. Additional knowledge on user behaviour, customer's needs and expectations, smart grid integration and standards for charging infrastructure are some of the aspects researched within the programme.

2.2.2 CHARGING INFRASTRUCTURE

The majority of charging stations (85 %) are located on private grounds. The development of public charging infrastructure was initiated via nationally funded R&D projects, thus mainly concentrated in bigger cities like Berlin, Hamburg or Stuttgart.[28]

28 With 500 BEVs car2go offers in Stuttgart Germany's largest e-car sharing fleet.

Picture 2. e-Flinkster customer at charging station. *Source: DB Rent GmbH*

Contrary to the growing number of EVs, the further development of public charging stations has slowed down. Influencing factors are high costs, lack of economically-efficient business and financing models, and complex permit procedures.[29]

Up to date Germany has installed around 5,500 publically accessible charging points of which only 100 are fast chargers, while the aim is to install 70,000 normal and 7,100 fast charging points by 2020. Plans for the development of a rapid charging network along the German motorways, mainly required for longer trips, are underway. According to the Ministry of Transport, 400 additional fast charging points are due to be installed by 2017.[30]

The German Association of Energy and Water Industries (BDEW - Bundesverband der Energie- und Wasserwirtschaft) estimates this would provide sufficient fast charging coverage by 2017. As a dense charging infrastructure network is perceived by EV users as an important factor to reduce range anxiety, this might contribute to a broader market penetration of EVs. However, to ensure an adequate amount of available normal charging points, the BDEW suggests setting up a general national development programme for 20,000 additional public charging points until 2017. This programme should also include standardisation measures for service access and billing.[31]

2.2.3 POLICY FRAMEWORK

The policy framework needed to support the successful implementation of electric mobility is constantly under review. Electric mobility is instrumental to achieve the German climate and energy goals: increase the share of renewable sources in the energy mix while reducing the contribution of nuclear power sources (Energiewende – *energy transition*), achieve a cleaner and energy-efficient transport system, and lessen the dependence on foreign fossil fuels imports.

Measures to promote the purchase of EVs are diverse[32]:

- Vehicle tax exemption (Kfz-Steuer – Kraftfahrzeugs-

29 NPE, 2014, page 22,-; BuroHappold, 2014, page 8.

30 NPE, 2014, page 43; Thomas Reuters, 2014.

31 BDEW, 2015, page 2.

32 BMWI, 2015.

teuer): The exemption for BEVs licensed before the end of 2015 has been extended from 5 to 10 years. It covers all BEV types. Vehicles licensed between 2016 and 2020 will be granted 5 years of tax exemption.

- Taxation of company cars: Compensation measures to offset the higher list price of EVs compared to conventional cars.

- Public Procurement of low-emission vehicles target: 10 % of all new vehicles purchased or leased by the German ministries should emit less than 50 g/km.

- The Electric Mobility Act (EmoG – Elektromobilitätsgesetz) enables local authorities to grant EVs parking privileges, the use of bus lanes and access to environmental zones.

- Special-AfA (Sonder-AfA – Absetzung für Abnutzung) that should regulate the depreciation of fixed assets like company EVs, is approval pending.

Today, purchasing an EV pays off mostly only for companies. Incentives are focused on them, as they account for around 63.7 % of new EV registrations[33]. Effective monetary incentives for private consumers are not expected. In contrast to other countries like USA, the Netherlands, Norway, Spain or the UK, Germany does not offer EV purchase subsidies. There is still no consensus on the benefits of such an incentive.

2.2.4 FUTURE DEVELOPMENTS

The announced plans for the expansion of the charging infrastructure at a national and local level can positively affect range anxiety and lack of confidence, and also encourage energy utilities to develop appropriate business models for charging and billing.
The experience in the e-car sharing sector shows that car sharing users do not prefer EVs only because of their environmental concerns. There is no especial inclination to pay more for driving an EV despite all ecological benefits, and the operational costs of such a system are higher than those of conventional car sharing.
In this light, policy-makers should consider new incentives and promotion measures that reach the wide public, e.g. further tax reductions or purchase subsidies, and more targeted actions to engage the business sector.
At the time of writing, it is too early to make a stand about how the EV market will develop in 2015. However, new registrations of BEVs and PHEVs were on the rise in 2014 compared to 2013 (see figure 3). As of June 2015, 145,986 EVs (BEVs, PHEVs, HEVs) were on Germany's roads, representing 0.3 % of the total German carpool. This amounts to 14.6 % of the national target of 1 million EVs by 2020.
Nevertheless there are projections for market penetration by 2020. The scenarios developed by ISI Fraunhofer in its study "Market Evolution Scenarios for Electric Vehicles" present very interesting conclusions[34]:

- In general EVs are economical at high annual mileages (over 15,000 km) and high electric driving range (over 80 %). This benefits especially drivers who have uniform daily driving cycles and cover sufficiently long distances.

- External factors such as future developments of battery prices, crude oil and electricity greatly contribute to spreading uncertainty about the EVs market evolution. Additionally, the willingness to switch to EVs, on the basis of higher purchasing price and limited vehicle choice, is difficult to predict.

- If the above mentioned aspects evolve in favour of electric mobility, e.g. lower battery prices, greater range of available EVs, low-price charging possibilities and dense charging network, the 1 million goal can be met even without monetary incentives. The market shares of REEVs and PHEVs are expected to be bigger than BEVs (around 75 %).

33 KBA, 2014, page 14.

34 ISI Fraunhofer, 2013, page 25,-.

- Even under less favourable conditions, the number of EVs by 2020 can reach 150,000 to 200,000 units.

- Full-time employees from rural areas, suburbs of larger cities and small to medium-sized towns, who account for a third of the total private car owners, show a significant potential to switch to EVs. Furthermore, a significant market growth can be expected in commercial fleets.

2.3 ITALY

Table 4. Key facts Italy. *Sources: ACEA (2014); MIT (2014); UNRAE (2014); ANFIA (2015)*

Share of motorised private transport modes of total journeys (2014)	75.4 %
Passenger car density per 1,000 inhabitants (2012)	621 units
Share of vehicles in European passenger car pool (2012)	15.1 % (36.6 million cars)
Market share of EVs in national passenger car pool (01.01.2015)	0.2 % (65,840 units)
Market share of EVs in new registrations of passenger cars (2014)	1.6 % (22,488 units)
Top EV models based on new registrations (2014)	BEV: Nissan LEAF (336 units) HEV: Toyota Yaris (9,781 units)

2.3.1 OVERVIEW & MARKET DEVELOPMENT

From 1997 until 2010 Italy has been among the European pioneers supporting electric mobility, especially through purchasing subsidies. With a budget of 150 million EUR several initiatives have been put into practise and by the end of 2010 the number of EVs in Italy amounted to over 50,000 including electric cars, buses, quadricycles and motorbikes, as well as 200,000 e-bikes.

In 2012, after a 2-year consultation phase, the Italian Government approved the law no. 134/2012 (Disposizioni per favorire lo sviluppo della mobilità mediante veicoli a basse emissioni complessive) aimed at supporting more sustainable mobility solutions. Originally dedicated to the development of electric mobility, the amended law finally covers not only EV but a wider range of vehicle powetrains. Policy measures include financial support for the installation of charging stations, the integration of low-emission vehicles in public and private fleets as well as EV purchasing subsidies. [35]

In 2012, Italy had one of the largest passenger car fleets in the EU, ranking second after Germany. The Italian passenger car pool comprised 37.1 million vehicles by the end of 2014, of which 65,840 EVs (+31 %), representing 0.2 % of the total passenger car pool. In 2013, EVs represented approx. 0.15% of the passenger car pool, or (45,404 units).[36]

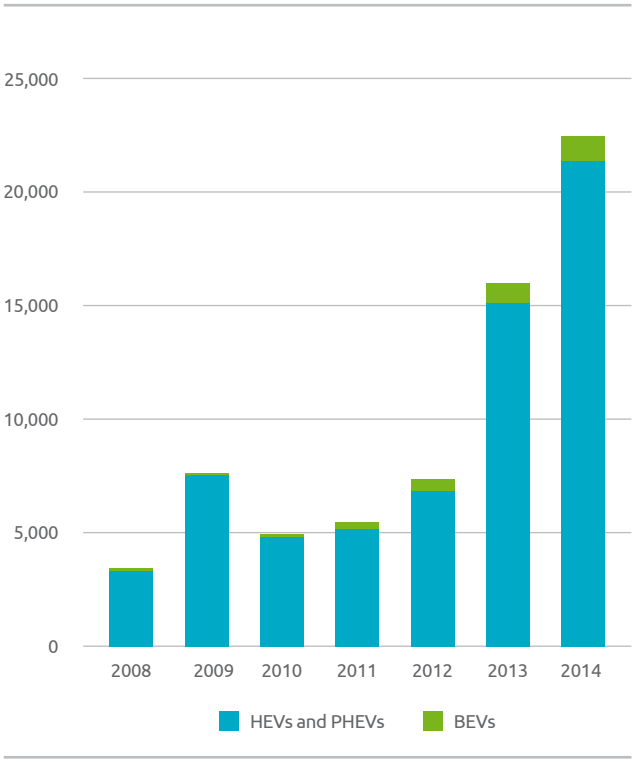
Recent data on new registrations show that HEVs demand was higher than BEVs demand. However, the growth of EVs new registrations was small in contrast to other eBRIDGE countries like the UK or Austria. In 2014, a total of 21,387 HEVs and PHEVs (+ 41.1 %) as well as 1,101 BEVs (+ 27.4 %) were registered, representing a market share of 1.6 % of all newly registered vehicles. New registrations for the first half of 2015 showed a similar development: by the end of June, EVs share in new registrations was 1.6 % (936 BEVs, 13,404 HEVs and PHEVs).[37]

35 CIVES, 2015.

36 ACEA, 2014; ANFIA, 2014a, 2015.

37 UNRAE, 2014, 2015a.

Figure 4. EV new registrations in Italy 2008-2014.
Source: Own work based on UNRAE



With 3,500 enterprises and about 1.2 million direct and indirect employees, the automotive industry is of high importance for the Italian economy. One of the main actors in this sector is the Fiat Group, which retrofitted the Fiat 500 with a fully electric powertrain and launched it onto the US market in 2013. Sales in Europe are so far not foreseen. Nevertheless, the e-Fiat 500 is available in Turin as part of the car sharing fleet of "Io Guido Turino".[38]

The Italian EV market is thus dominated by foreign manufacturers. In the category of HEV Toyota was the most popular brand with the models Yaris, Auris and Prius, ranking among the top 5 brands. In 2014, 9,781 Toyota Yaris were registered. New registrations of the Nissan LEAF accounted for 336 units, followed by the Smart fortwo and the Renault Zoe.[39]

38 IA-HEV, a; Germany Trade & Invest, 2014.

39 UNRAE, 2015b.

2.3.2 CHARGING INFRASTRUCTURE

The law no. 314/2012 initiated the national plan for charging stations (PNIRE – Piano Nazionale Infrastrutture di Ricarica Elettrica) defining the framework and the guiding principles for the implementation of the charging network for the period 2013-2015. Electric mobility should be pushed forward in urban agglomerations first, in order to improve air quality and reduce noise. Motorways and rural areas will follow. Besides public charging stations, the plan encourages the installation of private charging stations in parking garages, and it foresees tax deductions for private owners who install charging points.[40]

At the moment, there are about 2,300 charging points available across the country, most of them located in Northern Italy. The Italian energy utility Enel is the main operator of charging stations.[41]

In 2014, the first fast charging station was set up along the motorway A7 Milano- Serravalle, allowing EV drivers to charge their vehicle within 20 to 30 minutes. In cooperation with the petrol company ENI, Enel has plans to extend the public charging infrastructure with fast charging stations and that allow 3 EVs to charge simultaneously and preferably located at petrol stations.[42]

40 Iacovini, 2012; Germany Trade & Invest, 2014.

41 CIVES, 2015; Enel Spa, 2015; Germany Trade & Invest, 2014.

42 Electromobility.it, 2014; ANFIA, 2014b, page 33; BEM, 2012.

Picture 3. GuidaMi customer at charging station in Milan. *Source: ATM, GuidaMi*

2.3.3 POLICY FRAMEWORK

The law no. 134/2012 allocated 50 million EUR for 2013 and 45 million EUR for 2014 and 2015, respectively for financial incentives. Subsidies for the acquisition of low-emission vehicles were granted as part of a scrapping scheme. The amount of the subsidy differed according to the vehicle CO_2 emissions and the year of registration.[43] Still, the Stability Law 2015 (law 190/2014) derogated all financial incentives as of 1st January 2015. Despite this, there are policy measures to promote EV uptake[44]:

- Exemption from the ownership tax (tassa di possesso): since 1953, BEVs have been eligible to this exemption for the first 5 years after registration. Varying according to regional laws, BEVs benefit from a 75 % reduction of the tax rate after this period or the exemptions haven been even extended to the entire vehicle's lifetime. In some regions the tax exemption also applies to HEVs.

- Financial support for the installation of charging stations: the Ministry of Transport co-finances the installation of public charging stations up to 50 % of the implementation costs.

- Municipal incentives: for example the participating communities of the electric mobility pilot project *I e-travel* (mi muovo elettrico) in the Emilia-Romagna Region offer free parking and unrestricted access to the limited traffic zones in city centres.

At a local level, Milan, capital of the Lombardy region, is an inspiring example. Because of its air pollution problems and a high car ownership rate, Milan was the first Italian city to introduce a congestion charging system in the city centre, so-called Area C, in 2012. This is part of a Sustainable Urban Mobility Plan (SUMP). On working days, vehicles have to pay a congestion charge of 5 EUR, while EVs are eligible to enter the zone free of charge until 2017. The revenues of about 23 million EUR are reinvested in public transport and sustainable mobility. In 2014, the environmental effects of Area C were remarkable: traffic reduced by a third, the number of polluting vehicles almost halved, whereas the amount of non-pol-

43 Law no. 134/2012;.

44 ACEA, 2015d; CIVES, 2015; Emilia-Romagna Region, 2013, page 9.

luting vehicles increased by 6.1 %.[45]

Picture 4. Milan Congestion Charge Zone "Area C".
Source: ATM, GuidaMi

2.3.4 FUTURE DEVELOPMENTS

In order to significantly reduce CO_2 emissions and to meet EU reduction targets, the Italian Commission for Electric Road Vehicles (CIVES – Commissione Italiana Veicoli Elettrici Stradali a Batteria, Ibridi e a Celle a combustibili) estimates that until 2020, 150,000 - 200,000 EVs (not including HEVs) should be sold. However, recent sales figures show that this goal is far within reach.
In its progress report of electric mobility in Italy, CIVES doubts whether the remaining financial support for the installation of charging points will suffice to increase EV market share.
CIVES opts for an adequate substitution of the cancelled subsidies through the combination of various monetary and non-monetary measures to promote EV uptake and support its market development. These policy measures shall be integrated and applicable nationwide. In April 2015, CIVES presented a plan to the Italian Parliament suggesting for example, reductions of the Value Added Tax (IVA – Imposta sul Valore Aggiunto) for EVs. CIVES also proposed low emission zones and building regulations, making the installation of charging stations in garages or courtyards of housing complexes mandatory.

45 Riazzola, 2014, page 17-25; European Union, 2015.

2.4 PORTUGAL

Table 5. Key facts Portugal. *Sources: ACEA (2014); IMT (2011); INE (2012); ACAP (2012)*

Share of motorised private transport modes of total journeys (2011)	65 %
Passenger car density per 1,000 inhabitants (2012)	429 units
Share of vehicles in European passenger car pool (2012)	1.9 % (4.6 million units)
Market share of EVs in national passenger car pool (31.12.2011)	0.2 % (9.693 units)
Market share of EVs in new registrations of passenger cars (2014)	–
Top EV models based on new registrations (2012)	PHEV: Peugeot 508 Hybrid 4 (160 units)

2.4.1 OVERVIEW & MARKET DEVELOPMENT

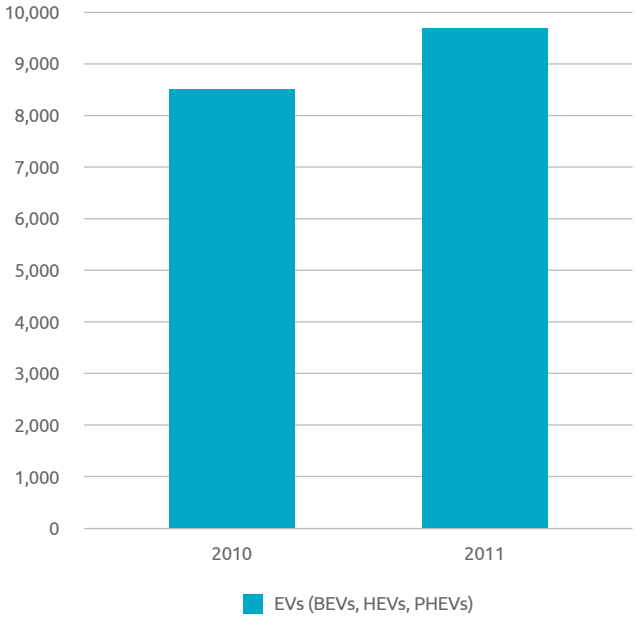
Electric mobility represents a unique opportunity for the Portuguese government to reduce the environmental impacts of transport and improve energy efficiency. Portugal's vast potential for renewable energy generation plays a decisive role in the decarbonisation of transport and the reduction of dependence from fossil fuels. In 2013, 49.2 % of Portugal's electricity stemmed from renewable sources, largely wind and hydro. As set in the National Energy Strategy 2020, by 2020, 60 % of electricity generation shall be provided from renewable sources, and the consumption of energy shall be reduced by 20 %. [46]
The MOBI.E (Mobilidade Eléctrica) programme was

46 Eurostat, 2015 ; Portugal 2020, 2011, page 18.

launched by the national government in 2009. MOBI.E is the integrated plan for the promotion of electric mobility in Portugal. With an estimated investment sum of 3 billion EUR (and a state share of 51 %), the plan is aimed at deploying a nation-wide interoperable electric mobility system. Today more than 35 cities offer charging options. MOBI.E is a holistic policy approach with the goal of covering all implementation aspects: from retailers and operators of electric mobility to the charging network and the end-user.[47]

Portugal's goal is to electrify the entire national transport system, putting 200,000 EVs on the roads by 2020. The last available data about the number of EVs of the total passenger car fleet dates back to 2010 and 2011. In this period the amount of EVs increased from 8,510 to 9,693 units (+ 13.9 %) as shown in the figure below.[48]

Figure 5. Number of EVs registered in Portugal 2010-2011. *Source: Own work based on INE*



47 MOBI.Europe, 2015; Portugal 2020, 2011, page 53.

48 INE, 2012. ; IA-HEV, b.

In 2014 new registrations of EVs amounted to 189 BEVs (+ 13.9 %) and 100 PHEVs (+ 81.8 %).[49] New registrations in the first quarter of 2015 amounted to 155 units[50] (0.3 % of all new passenger car registrations). Although very low, the figures show a positive trend in the development of EVs new registrations in the last years. High purchasing costs, limited range, lack of adequate charging infrastructure and long charging times are perceived as the main barriers for a greater diffusion of EVs. Moreover, the financial crisis of the recent years just added complexity to the challenging EVs market situation.[51]

Against all odds the capital of Portugal, Lisbon, is working with local and European stakeholders towards a broader implementation and promotion of electric mobility. In cooperation with the Municipal Transport and Parking Operator (EMEL - Empresa Municipal de Mobilidade e Estacionamento de Lisboa), Lisbon City Council developed the Local Action Plan for Electric Mobility, oriented to favour EVs as the preferred mode of transport in urban areas with incentives such as free parking. Also, within the framework of the EU funded project Freight Electric Vehicles in Urban Europe (FREVUE), the city council cooperates with EMEL and the Postal Services of Portugal (CTT - Correios de Portugal) to trial logistic solutions with EVs oriented to optimise the efficiency of urban logistics and improve traffic flows, thus reducing congestion and the related impacts.

2.4.2 CHARGING INFRASTRUCTURE

The Portuguese charging network started being developed within the MOBI.E project. The developed charging technology includes a payment system, and allows users to find and select charging locations, plan routes and know the battery level of their vehicles.

The MOBI.E network planned the installation of 1,300 normal charging points in public roads and 50 fast chargers in the main motorways by 2011. However,

49 ACEA, 2015b.

50 This number includes BEVs and PHEVs but also Fuel Cell Electric Vehicles (FCEVs), which are not covered by the term EV as used in the eBRIDGE project.

51 ACEA, 2015a, c; Rolim et al., 2014, page 231.

by 2015 only 1,211 charging points were operative, of which only 8 fast charging points.[52]
The main network operators are the energy utility Energias de Portugal and the petroleum companies Galp Energia and Prio Energy.[53]

The Green Taxation Reform (Lei Fiscalidade Verde n°82-D/2014) that came in force in January 2015 is contributing towardsthese targets. The law introduced attractive fiscal advantages for the purchase of EVs aimed at the invigoration of the electric sales market.

Picture 5. Private EV charging at the MOBI.E station. *Source: choice GmbH, Janett Kalina*

2.4.3 POLICY FRAMEWORK

In 2014 the Ministry of Environment, Spatial Planning and Energy launched the Commitment to Green Growth strategy (CVV – Compromisso para o Crescimento Verde) defining targets for the period 2020-2030. Among other sectors, this strategy covers several measures for the transport sector. The objectives encompass cost reduction for BEVs and PHEVs, promotion of competition in the public mobility network and encouragement of charging at home and at the workplace.

It covers the following financial incentives relevant for electric mobility[54]:

- Exemption of Vehicle Tax (ISV - Imposto Sobre Veículos) and Single Circulation Tax (IUC - Imposto Único de Circulação) for BEVs. PHEVs are eligible to a 40 % reduction on the ISV and deduction of 25 % of IUC.
- Discount on Value Added Tax (IVA – Imposto sobre o Valor Acrescentado) on passenger EVs.
- Corporate Income taxes (IRC – Imposto sobre o Rendimento das Pessoas Colectivas): exemption

52 MOBI.Europe, 2015; INTELI, 2014; Ministry of Environment, Spatial Planning and Energy, 2015, page 28.

53 Ministry of Environment, Spatial Planning and Energy, 2015, page 28.

54 INTELI, 2010; ACEA, 2015d; Veículos Electricos, 2015, page 15.

for BEVs and deduction of 5 % for PHEVs priced up to 25,000 EUR, 10 % for PHEVs from 25,000 - 30,000 EUR and 17.5 % for PHEVs over 35,000 EUR.

- Subsidies for the renovation of end-of-life passenger vehicles: private persons can deduct 4,500 EUR when replacing an ICE (vehicle age 10 years or more) with a BEV, and 3,250 EUR when replacing it with a PHEV. A deduction of 1,000 EUR is foreseen for electric quadricycles such as Renault Twizy.

- Purchase grants: according to the Decree Law 39/2010 (Decreto-Lei nº 39/2010) and until the end of 2015, private buyers of the first 5,000 EVs are entitled to an incentive of 5,000 EUR. An extension until the end of 2016 as suggested by the Portuguese Environmental Agency is under revision.

Furthermore, public administrations are encouraged to lead by example switching to EVs instead. By 2020, 1,200 coventionally-fuelled vehicles of the public administration fleet shall be replaced with BEVs and PHEVs. For this purpose 100 million EUR from the European Cohesion Fund are budgeted.[55]
In some municipalities, like Lisbon, EVs are entitled to free parking in public parking areas for a limited period or have preferential parking spaces.[56]

2.4.4 FUTURE DEVELOPMENTS

A study conducted by the University of Lisbon on the adoption of EV technology among BEV drivers revealed that half of the interviewed private drivers and a third of the fleet drivers perceive EVs as the car of the future, and suggest more governmental incentives to buy BEVs in order to further support their market uptake.[57]
Encouraging activities promoting electric mobility are taking place at municipal level. Lisbon City Council is pursuing its own strategy and progressively increasing the number of alternatively-fuelled vehicles in the municipal fleet. Cooperation with local entities and European partners is active and public information events promoting the use of EVs are planned. New measures and incentives are being implemented.
Yet, despite these positive experiences, the future development of the national electric mobility policy is hardly predictable. The MOBI.E programme is partially on stand-by. New legislation for charging infrastructure and concessions is still pending approval. The MOBI.E charging network has currently no operator in charge and a number of the charging points are out of order, which can affect EV user adoption as well as the successful EV uptake aspirations pursued by the city council. The financial crisis faced by the country in the last years has slowed the pace of the MOBI.E programme. The results of the 2015 general elections will be decisive for the future development of electric mobility.

55 Ministry of Environment, Spatial Planning and Energy, 2014, page 51, 77.

56 Rolim et al., 2014, page 241.

57 Idem., page 236, 241.

2.5 SPAIN

Table 6. Key facts Spain. *Sources: IDEAUTO (2014)*

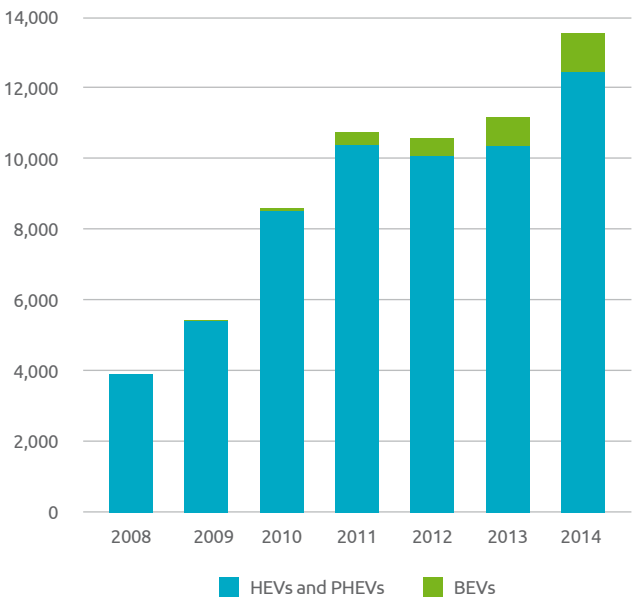
Share of motorised private transport modes of total journeys (2006)	42.3 % (working days) 46.4 % (weekend)
Passenger car density per 1,000 inhabitants (2012)	476 units
Share of vehicles in the European passenger car fleet (2012)	9.1 % (22 million vehicles)
Market share of EVs in national passenger car pool (01.01.2015)	–
Market share of EVs in new registrations of passenger cars (2014)	1.6 % (13,445 vehicles)
Top EV models based on new registrations (2014)	BEV: Nissan LEAF (465 units)

2.5.1 OVERVIEW & MARKET DEVELOPMENT

The Comprehensive Strategy to Promote the Electric Vehicle 2010-2014 (Estrategia Integral para el Impulso del Vehículo Eléctrico en España 2010-2014) developed by the Spanish Government underlined the relevance of electric mobility to achieve higher energy efficiency and the reduction of fossil fuel dependence by increasing the use of renewable energy. The strategy aimed at increasing EVs demand, promoting R&D in the technology sector and developing the charging infrastructure, and set the goal of achieving 250,000 BEVs and PHEVs on Spanish roads by 2014. This goal, as shown in the previous table, could not be achieved and up to date there is no official communication on the release of a new national strategy or a revision of targets.

The yearly subsidies for EVs purchase accessible through MOVELE (MOVilidad ELEctrica) the funding programme created within the national strategy continue nevertheless, and new editions of purchase incentive programmes for conventional cars have been launched.

Figure 6. EV new registrations in Spain 2008-2014.
Source: Own work based on IDEAUTO, ANFAC and IDAE



New registrations of EVs in 2014 amounted to 13,445 EVs: 1,076 BEVs (+ 32 %), 290 PHEVs and 12,079 HEVs. In total, EVs accounted for 1.6 % of the total Spanish new vehicle registrations for 2014 (855,265 vehicles).[58]

Concerning the regional distribution of new EV registrations 2014, Madrid held the lion's share with 325 units, followed by Catalonia with 281 units, and Andalusia with 109 units. With exception of Madrid, where the share of BEVs decreased by 7.7 %, the regional figures showed a general increase of about 90 % compared to 2013. The regional distribution of HEVs was similar: Madrid 3,124 units (+ 14.0 %), Catalonia 2,636 (+ 3.1 %), and Andalusia 2,220 (+ 37.3 %).[59]

The favourite BEV models 2014 were Nissan LEAF and Renault Zoe, with 465 and 289 units sold respectively (both models increased their respective sales compared to 2013 by 202 and 107 units). In total, Renault sold 674 vehicles including Twizy and Kangoo ZE. Other top brands were Mitsubishi (Outlander PHEV) and BMW (BMW i3).[60]

Light commercial electric vans also experienced a positive growth. Nissan e-NV 200 and Renault Kangoo ZE each sold 180 units. Citroën Berlingo EV and Peugeot Partner EV still have difficulties to enter the market, as shown by the low registration rates.

2.5.2 CHARGING INFRASTRUCTURE

According to the Institute for Diversification and Saving of Energy (IDAE – Instituto para la Diversificación y Ahorro de la Energía) responsible for the MOVELE programme, the Spanish charging infrastructure has, up to date, 761 public charging points, of which 4 fast chargers. Plans for the expansion of the public infrastructure are supported by national funding in some regions. MOVELE Balearics is the collaboration between the Balearic Ministry of Economy and Competitiveness and IDAE for the development of charging infrastructure in the Balearic Islands. With an allocated budget

58 ANFAC, IDAE, IDEAUTO, 2014.

59 IDEAUTO, 2014.

60 Ramos, 2015; ANFAC, 2015.

of 2,374,000 EUR the plan foresees the installation of 2,000 charging points, both public and private, published via tender by the regional ministry. The current regional legislation does not regulate the technical conditions to provide private points connected to the domestic electricity network. For this reason, the regional government is working on the required legislative modifications.
Madrid plans to install 35 new fast charging points and Barcelona aims to expand the current fast charging network to supply its increasing fleet of electric taxis (currently 18 BEVs of the models BYD E6, Nissan LEAF, and Nissan e-Nv 200 that is manufactured in Barcelona since April 2014).

Picture 6. Charging situation in Vigo. *Source: CEAGA*

The development of the private charging network is slower because of the delay in the approval of the Complementary Technical Instruction regulation (ITC – Instrucción Técnica Complementaria BT52), the national guidelines for the technical installation of private charging points. The regulation was finally approved in December 2014[61].

2.5.3 POLICY FRAMEWORK

Apart from the national subsidies, which are quite inconsistent (the subsidy sums are approved yearly, but have remarkably short lifetimes), EV incentives differ from region to region. Some of the most common are:

- Parking privileges, use of bus lanes and access to environmental zones.
- Registration tax exemption (Impuesto de Matriculación): The actual amount depends on regional regulations.
- Road tax exemption (Impuesto sobre Vehículos de Tracción Mecánica): BEVs and PHEVs are eligible to an exemption of the annual road tax.

At the time of writing, the Spanish government supports EVs purchase through three grant programmes.
Published in April 2015, MOVELE 2015 has a budget of 7 million EUR for direct support of purchase (incl. leasing and renting) for EVs priced up to 40,000 EUR, for SMEs, freelancers and individuals on a first come, first served basis. The grant applications are managed through the car selling point, which has to be associated with the MOVELE programme. Moreover, participating car dealers must contribute up to 1,000 EUR for the installation of a charging point for the beneficiary of EV grants.
The Efficient Vehicle Incentives Programme (PIVE - Programa de Incentivos al Vehículo Eficiente) is contributing to the recovery of the automotive sector, with increasing new registration numbers since 2013.

61 BOE, 2014.

PIVE8 was published in May 2015 with a budget of 225 million EUR for the renewal of the passenger car pool, and provides grants up to 1,500 EUR for the purchase of new EVs. The grants are available for all clean vehicle types and are accessible to SMEs, freelancers and individuals.

Specially tailored for the commercial sector, the 4th Plan for the Impulse of Air Quality (PIMA Aire4 - Plan de Impulso al Medio Ambiente) was launched in November 2014 with the aim of reducing CO_2, NO_x emissions and particulate matter through the renewal of the commercial vehicle fleets. PIMA Aire4 allocates 8 million EUR for the purchase of commercial EVs (as well as natural gas fuelled vehicles and electric bikes).

From April 2015 and in the frame of the PIMA Aire, the General Directorate of Traffic (DGT - Dirección General de Tráfico) distributes the environmental badge "0 Emisiones" to the owners of BEVs, PHEVs and REEVs (and fuel cell vehicles). The aim of the badge is to facilitate city councils the implementation of positive discrimination measures for EVs, e.g. parking and driving privileges, and tax reductions in their municipalities. The badge identifies the vehicle as eligible for the specific local privileges and sets a standard for the vehicle identification at a national level. By doing so, municipalities will not need to issue an own label that might not be acknowledged by other municipalities. The label is provided at the time of vehicle registration.[62]

2.5.4 FUTURE DEVELOPMENTS

Spain is Europe's market leader in the fabrication of EVs with 5 electric models produced for world-wide export: Renault Twizy, Citroën Berlingo Electric, Peugeot Electric, Mercedes Vito Electric and Nissan e-NV 200. In 2013 the Spanish electric fleet (including passenger, bus, truck EVs) accounted 56,200 vehicles, representing the 0.2 % of the national fleet.[63]

According to a recently published study by DBK, the number of electric passenger, commercial, and quadricycle vehicles in Spain is estimated to reach 18,000 units by 2017 (HEVs not included). Especially PHEVs are predicted to lead the market share.[64]

Recent tendencies of economic recovery can foster the growth of the electric car market in the short and the medium term. Supporting government initiatives, the charging infrastructure coverage, the acquisition price of EVs as well as the battery technology improvements are relevant factors that can boost sales.

2.6 UNITED KINGDOM

Table 7. Key facts United Kingdom.
Sources: ACEA (2014); DFT (2014, 2015a); ONS (2012)

Share of motorised private modes of transport of total journeys (2011)	64 %[65]
Passenger car density per 1,000 inhabitants (2012)	464 units
Share of vehicles in the European passenger car pool (2012)	12.1 % (29.3 million vehicles)
Market share of EVs in national passenger car pool (01.01.2015)	0.7 % (204,345 units)
Market share of EVs in new registrations of passenger cars (2014)	2.1 % (50,889 units)
Top EV models based on new registrations (2014)	BEV: Nissan LEAF (4,042 units)

2.6.1 OVERVIEW & MARKET DEVELOPMENT

The Climate Change Act, issued in 2008, set the legally binding target to reduce GHG emissions by at least 80 %

62 DGT, 2015.

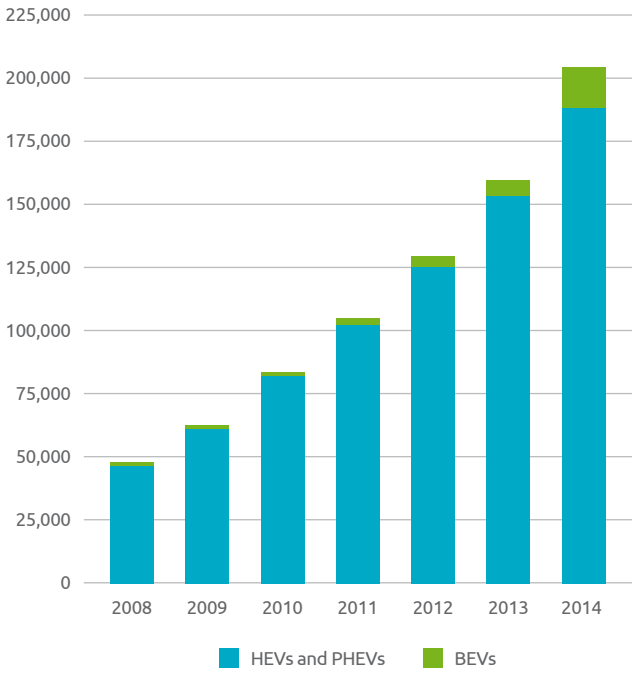
63 ANFAC, 2014.

64 REVE, 2015.

65 This figure covers England and Wales only, because the comparable Scottish and Northern Irish statistics could not be identified.

by 2050 with respect to 1990 levels. In order to reach this, the UK pushes both the decarbonisation of electricity generation and the decarbonisation of transport. To reduce air pollution and cut GHG emissions from passenger transport the use of ultra low emission vehicles (ULEVs) is actively encouraged by the UK government. ULEVs either emit less than 75 g CO_2/km or are electrically charged; their recent sales numbers underline that their market shares are expanding significantly.[66] The passenger car pool amounts to 29.6 million vehicles by the end of 2014, of which 8.6 % were company registered. EVs market share reached 0.7 % (204,345 units) in 2014, compared to 0.6 % (159,808 units) in the year before. With 188,137 units, HEVs and PHEVs accounted for more than 90 % of the total stock of electric cars in 2014.

Figure 7. Number of EVs registered in the UK 2008-2014. *Source: Own work based on DFT*



With an annual growth rate of more than 9 % the number of newly registered vehicles is expanding quickly compared to other key European markets. The UK was the second largest new car market in 2014, after Germany, returning to the levels before the 2008-9 recession. Although the fuel price plunged in the same year this did not have a negative impact on the sales of EVs. Quite the contrary; EVs were experiencing rapid growth rates. Compared to 2013, the number of BEV quadrupled and accounted for 10,772 units in 2014. In 2014 HEV and PHEV new registrations reached a total of 40,117 vehicles (+ 135.6 %).[67] According to a study on family motoring in Norway and the UK commissioned by Nissan, EVs are no longer perceived as the second car as families are favouring them over standard combustion alternatives. The average European family spends around 230 hours per year in the car and travels less than 75 km a week. For those short-distance trips the EV has proven to be a viable alternative at low running costs.[68] The EV market is driven by a range of factors like financial incentives, low car taxes and competitive pricing. Furthermore, the expanding assortment of available models pushes further EV uptake. In 2015, 25 EV models cover various segments ranging from super-minis to hatchbacks and medium vans. According to the UK Department for Transport, the Nissan LEAF was the most popular BEV, with 4,042 new registrations in 2014. This model was the first mass produced EV, introduced in 2010. Since 2013 it is manufactured in Sunderland (UK) for the European market with an annual capacity of about 50,000 units.[69]

2.6.2 CHARGING INFRASTRUCTURE

Thanks to private and public investment, charging infrastructure has been constantly expanding in the last couple of years. In 2011 the UK Government set up the National Charge Point Registry (NCR), which records the publicly-funded charging points (5,668 by

66 Department of Energy & Climate Change, 2015, page 38; HM Government 2011, page 3-4

67 Department for Transport, 2015c, page 2.

68 Nissan Newsroom Europe, 2015.

69 Lane, 2015b; Department for Transport, 2014; Nissan Motor Corporation, 2010.

June 2015). According to Zap-Map, a website providing data from private and public sources, there were more than 8,400 charging points at 3,262 charging stations accessible to the public by June 2015. The proportion of fast charging units which account for almost three quarters of all charging points is also remarkable.[70]

- Plug-in car and van grants: Introduced in 2011 and 2012 respectively, these grants subsidise 35 % (up to 5,000 GBP) of the acquisition costs of a car or 20 % (up to 8,000 GBP) of the acquisition costs of a van.

- Exemption from Vehicle Excise Duty (VED) for owners of EVs.

Picture 7. EV charging at Parc Myrddin. *Source: Cardiff University, Dimitrios Xenias*

2.6.3 POLICY FRAMEWORK

The UK Government founded the Office for Low Emission Vehicles (OLEV), is tasked with supporting the uptake of ULEVs as well as their manufacture and development. From 2015 to 2020, 500 million GBP governmental funding supports the uptake of ULEVs. In this context, the following financial benefits for owners of EVs were implemented nation-wide[71]:

Governmental policy encompasses the funding of related R&D projects, the development of a framework for charging infrastructure, various measures to support the setup of public and private charging points as well as the formulation of ambitious performance standards for new vehicles. In this way, more people shall be motivated to prefer ULEVs over standard combustion engines, thus helping the implementation of national carbon emission reduction targets. Additionally, this strategy aims at strengthening both the UK's automotive sector and the domestic market in the de-

70 Lane, 2015a; Department for Transport, 2015b.

71 Office for Low Emission Vehicles, 2014; TNA, 2015a, b.

sign, production and use of ULEVs.[72]
In addition, there are financial incentives offered by municipalities. For example the City of London offers a 100 % discount on the Congestion Charge for EVs and in some boroughs EVs enjoy free parking.[73]

2.6.4 FUTURE DEVELOPMENTS

As stated above, the market for EVs is developing positively and is showing a clear upward trend. Especially the number of sold BEVs soared in the course of 2014. However, HEV and PHEV still hold a greater share on all new registered EVs. In 2011 the UK Government announced the aim to have 1.7 million EVs on the road by 2020, in order to meet the emissions reduction target of 50 % by 2025. Based on this, 250,000 new EVs should be registered annually. Despite the significant growth rates this goal is unattainable. In recent policy papers there are no concrete numbers available but the envisioned target is that almost every passenger car shall be a zero-emission vehicle by 2050[74].
As the UK Government strongly supports a mass market shift to EVs by 2020, the question of energy provision for this sector is substantial. However, especially when charging during the off-peak period, e.g. at night, EVs help balance demand for electricity. This will be further supported by means of intelligent power supply networks and smarter grids.[75]

72 Department for Transport et al., 2015.

73 Transport for London, 2015.

74 Department for Transport et al., 2015.

75 OLEV, 2013, 12-13.

3 THE eBRIDGE DRIVERS OF CHANGE

Electric mobility keeps developing as it promises to bring together sustainable transport and energy generation. EU state members are progressively increasing renewable energy sources shares in the energy mix, following an overall strategy of decarbonisation of the energy and transport sectors. Major investments have been made to test the suitability of EVs for day-to-day urban travel with encouraging results. Charging networks are being expanded, charging and billing standardisation is progressing and battery technology development now provides higher intensities at lower weight and price. At the demand side, end-users start being familiar with EVs, and the number of models available in the market has increased in the last two years, many of them from major automobile brands. Yet, electric mobility is still in its infancy.

With the aim of giving electric mobility more impulse, the eBRIDGE Drivers of Change have implemented innovative measures for the successful operation and promotion of electric fleets in 7 case studies: Austrian towns and regions, Berlin (Germany), Carmarthen (Wales, United Kingdom), Lisbon (Portugal), Milan (Italy), and Valencia and Vigo (Spain).

3.1 AUSTRIAN TOWNS AND REGIONS: FACILITATING PEER TO PEER E-CAR SHARING IN RURAL AREAS

Commercial car sharing in Austria is mostly concentrated in urban agglomerations, as the low demand in rural areas makes it hardly viable financially. Likewise, public transport in less populated regions is often unable to meet the local mobility needs of the residents, who are forced to rely on private cars.

To tackle this challenge, the Austrian pilot project partners Mobility Institute Vorarlberg (MIV – Mobilitätsinstitut Vorarlberg) and Austrian Mobility Research (FGM-AMOR – Forschungsgesellschaft Mobilität) designed a tailored-made concept for rural areas: Caruso peer-to-peer e-car sharing.

In cooperation with municipalities, small enterprises and non-profit organisations, the project partners, supported by the Caruso Carsharing technology, developed an alternative to commercial car sharing. The scheme is based on the peer-to-peer e-car sharing (P2P e-CS) concept. This means that car owners rent their private car for a short period of time to others. The renting process is similar to traditional car sharing schemes such as Flinkster (Berlin case study), or GuidaMi (Milan case study), but the fleet is a virtual one comprising of cars from participating owners. People can rent a car which is close by and pay only for the time they are using it.

Caruso Carsharing supports small local e-car sharing initiatives with technical equipment and professional consulting services. Part of this equipment are the Caruso boxes, on-board units that enable car sharing functionalities for practically every vehicle. A user-friendly online reservation system allows booking management and the possibility of offering rides to other users, thus favouring travel efficiency through carpooling. Caruso Carsharing also provides user support and advice to the P2P pilot projects and the website facilitates the establishment of groups of private people who would like to share a car.

Picture 8. Caruso Carsharing online booking.
Source: Caruso Carsharing

In this way, the residents of the participating communities can benefit from a cost-efficient, affordable and comfortable offer that complements existing public transport. At the same time, users have the opportunity to use EVs without having to buy one.

3.1.1 PROJECT ACTIVITIES

The Caruso concept was tested in various demonstration sites spreading all over Austria. Some of the participating municipalities are: Gaubtisch, Krumbach, Baden, Auersthal, Waidhofen/Thaya, Thüringerberg, Zwettl, Bad Aussee, Gröbming, Weißenbach, Eferding, Korneuburg, Ernstbrunn, Langenegg, Lienz, Sarleinsbach, Amstetten, Hard, St. Leonhard, St. Veit an der Glan, Thal (Sulzberg), Werfenweng and Bad Zell.
Starting with 4 BEVs by the end of 2012, a total of 29 P2P e-CS initiatives with 38 BEVs were launched during eBRIDGE. The EV shared at the project sites was usually purchased either by the municipality or an organisation especially created for this reason. The vehicle would serve two purposes: being used as municipal car by the municipality employees and also as a shared car for the residents who joined the initiative.
As people in smaller municipalities generally know each other, personal contacts and the establishment of mutual trust are key to establishing a car sharing scheme. Setting up a P2P e-CS as in the eBRIDGE Austrian sites needs the support of an enthusiastic local community and especially committed individuals (e.g. local opinion leaders) who are willing to initiate local car sharing and to motivate others to support and join the initiative.

Picture 9. Welcome event for the municipal EV in Baden "bea" (Lower Austria). *Source: Municipality of Baden*

Part of the design of each P2P e-CS initiative is the development of a suitable tariff scheme. A membership fee is set in accordance with the fixed costs of the scheme, which reflects the commitment of users to the service. In combination with comparable low tariffs

for daily usage, this pricing system usually leads to the efficient use of the service and high number of bookings. This is facilitated by means of modern technology equipment, which includes online booking, automated drivers' logbook and smartcard access, ensuring the smooth performance of the system as well as high security.

The promotion of the Caruso concept was intensively carried out by MIV with support of FGM-AMOR. Personal communication measures and face-to-face contacts were complemented by various promotion activities (e.g. information brochure, video[76]) to approach the local stakeholders directly, foster their engagement and spread the idea of P2P e-CS. Workshops and information events were organised to engage stakeholders, reassure users, and foster experience exchange among the P2P e-CS initiatives.

The validation of the pilot scheme was based on EV usage data collected via a remote monitoring system using GPS. The data provided information about the distance travelled, average speed, the stage of battery charge, etc. In addition, several interviews with car sharing members provided useful information about users' perception of usage barriers, mobility needs, recommendation, etc.

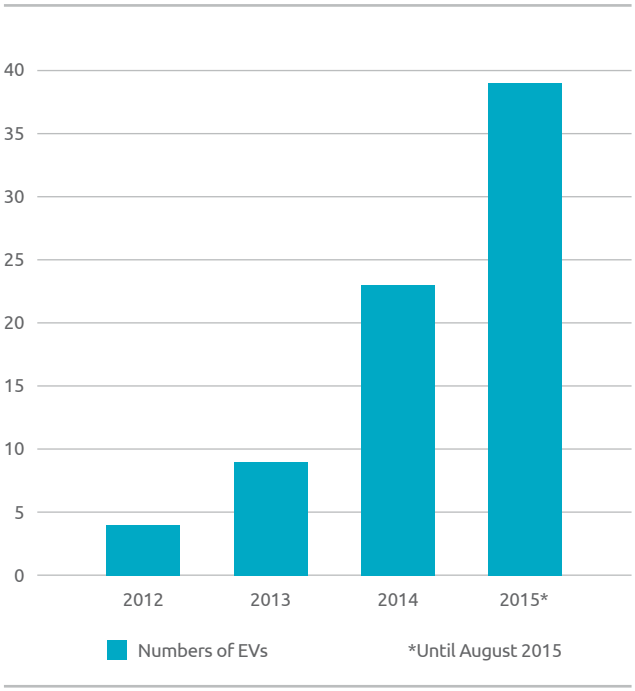
3.1.2 KEY FINDINGS

Rural areas have special mobility needs that can be fulfilled with tailored-made solutions. The Austrian pilot brought together the local mobility needs with the potential of electric mobility and proved that P2P e-CS is an excellent way to enhance mobility in small communities.

With 38 BEVs in use, the pilot sites combined amount for the largest e-car sharing fleet in Austria. The most popular EV models introduced in the pilot sites are Renault Zoe (20 vehicles), Mitsubishi iMiEV (5 vehicles) and Renault Kangoo ZE (3 vehicles).

76 Information material available at the eBRIDGE website: http://www.ebridge-project.eu/en/downloads

Figure 8. Evolution of the Austrian P2P e CS fleet during eBRIDGE. *Source: Own work*



Usage profiles

The efficient use of the EVs, translating to at least one booking a day, was one of the project targets. The monitoring data show that the goal was successfully reached with an average of 34 bookings per vehicle and month, with a booking record of 75 bookings for the Mitsubishi iMiEV in Hard (Vorarlberg).

The cost-effective operation of the P2P e-CS was one of the main concerns of the initiators of the schemes in the beginning. The schemes proved to be economically feasible with approx. 30 members per car, half of them using the car regularly. This ratio ensures fair car availability even considering the charging times.

Driving Experience

The majority of the users had no experience with EVs before joining the car sharing scheme, which required intensive information provision activities. The initial concerns about driving autonomy and charging

time decreased significantly during the course of the project as users got familiarised with EV use (battery range, charging process) and the specific driving features (efficient driving styles). The car sharing users of the Maronihof complex (Vorarlberg) indicated a preference for EV for shorter trips in the surrounding area, while the shared ICE vehicles were chosen for longer distances. The users appreciated the comfortable electric driving experience, especially the silent driving.

Mobility Behaviour

Traditional mindsets and mobility behaviours require certain adaptation to get used to the new P2P e-CS model introduced at the pilot sites. People are used to the availability of the private car, sometimes even of a second household car, and thus the possibility of making spontaneous trips.
Users perceived the need for adaptation as a positive development that led to a more conscious trip planning and raised awareness on the real costs of car ownership and car travel. Users also indicated feeling proud of being pioneers of a new mobility, and motivate others to join the initiative.
The carpooling booking possibility was widely used by the users of the Thüringerberg (Vorarlberg) scheme.
Sharing a car in a small community has many advantages. As people know each other, there is a common interest in making the system work. Small tasks such as cleaning are taken over by the members themselves in a cooperative way, easing the management of the system. The municipality of Gaubitsch (Lower Austria) offers incentives like free kilometres for cleaning the car.
Generally speaking, the systems are self regulating.
Users' main reasons for joining the e-car sharing initiative were curiosity, cost reduction and environmental awareness. In some cases, users wanted to have access to a car without having to own one, or to replace one household car.

Picture 10. Application form for municipal EV. *Source: Caruso Carsharing*

3.1.3 LESSONS LEARNED

P2P e-CS, as it is enabled by Caruso Carsharing and tested in the pilot sites, works on a small-scale, non-profit base in rural areas apart from urban agglomerations where commercial car sharing systems are more common place. It depends primarily on the local community which needs to be strongly involved in the implementation process. If the local residents foster the idea of e-car sharing themselves, than P2P e-CS can work successfully. In most cases, national or regional financial funding supported the implementation of the initiative.

User

Familiarising with electric mobility by means of car sharing can induce a change in the users' mobility behaviour and generate spillover from business to private EV use, for instance. A number of users of the pilot site in Baden (Lower Austria) sold their private car after having joined the "bea" scheme (P2P e-CS initiative developed within eBRIDGE, picture 9).
The regular use of EVs helps overcome misperceptions as the drivers become familiar with the vehicle, how to drive efficiently, and the charging procedures. In this regard, the current Austrian charging network should be further developed and information on charging possibilities should be unified in a reliable charging network map.

Funding

For the municipalities, the funding initiators of the initiatives, the implementation of a P2P e-CS scheme represents an official commitment to environmental-friendly mobility and sustainability, but also an opportunity to foster citizens' familiarisation with EVs and provide best alternatives for local transport.

Fleet Operation

The successful implementation of a P2P e-CS scheme requires a careful operation and smooth functioning from the beginning in order to engage municipalities, organisations and private users to start their own scheme.
In this sense, there is no one-size-fits-all solution. Each initiative must be carefully planned taking into account the local conditions, the specific usage needs and the users' mobility patterns. The right choice of the EV model also plays a role for the success of the P2P scheme.
The EV station should be located at a central, well accessible point, preferably within a walking distance. In regions with long winter periods a garage or carport is indispensable.

Picture 11. EV parking bay in Auersthal (Lower Austria).
Source: Caruso Carsharing

Currently there are no cars with standardised interface for car sharing, and every pilot scheme requires a close supervision especially in the initial stage. Following the success of the Austrian pilot sites, automobile manufacturers have indicated interest to work in this direction. Plans for cooperation with the Verkehrsverbund (local transport operator) for the integration of e-car sharing with train stations are under development.
Overall, the Austrian case study has successfully demonstrated that P2P e-CS in rural areas is a viable additional mobility option that also contributes to a change in the users' mobility behaviour. The participating municipalities can furthermore show their support for new forms of mobility, and inspire other communities to implement P2P e-CS schemes.

3.2 BERLIN: INTEGRATING E-CAR SHARING INTO THE BUSINESS MOBILITY PORTFOLIO

Berlin, the vibrant and multicultural capital of Germany, is rapidly developing into an innovation hot-spot of sustainable mobility and clean transport. On this backdrop, car sharing has become an important trend with a wide choice of operators and services. The eBRIDGE partner DB FuhrparkService is one of the pioneers introducing EVs in its fleet.

Picture 12. e-Flinkster on EUREF Campus in Berlin. *Source: Deutsche Bahn AG*

The eBRIDGE Berlin pilot focused on the e-Flinkster fleet located on the EUREF Campus, a research and business cluster. The campus, supplied primarily with renewable energy and conceived as a driver for sustainable urban development, has several companies related to electric mobility and has given rise to numerous research and implementation projects, serving as a living laboratory to test new mobility concepts. The campus has good connections to the public transport networks, and is accessible from the main peripheral motorways. The e-Flinkster car sharing station adds e-car sharing to the mobility choice of the campus and is also a testing ground, where different types of EV models and charging column technologies are tested. As part of the multimodal travel options, the station provides access to the Call a Bike sharing bicycles operated by DB FuhrparkGroup.

The Berlin pilot aimed at finding innovative ways to integrate e-car sharing into business mobility. The project partners DB FuhrparkService and Choice explored the potential of e-car sharing for business travel and how such an option can contribute to increasing overall mobility of business travellers while helping reduce its

negative economic and environmental impacts.

3.2.1 PROJECT ACTIVITIES

The Berlin pilot assessed the suitability of e-car sharing for business travel among the companies of the EUREF campus. The pilot activities focused on a comprehensive analysis of the core aspects of the operation of car sharing: a) fleet performance, b) user-centred analysis and c) company-centred approach.

The e-Flinkster EUREF fleet was launched in 2013 with 8 EVs (various models). During 2013 and 2014, some models were replaced and the fleet went through a consolidation process. Currently the e-Flinkster EUREF fleet has 10 EVs (6 BEVs and 4 PHEVs). The models provided are Citroën C-Zero, Smart ed and Opel Ampera. The vehicles are equipped with a RFID-capable on-board unit and can be accessed via a customer card. Bookings can be made online, by telephone or using the Flinkster App.

The monitoring activities collected car trip and booking data, e.g. number of bookings, booked vehicles, trip length, trip duration, etc. which were the basis for the analysis and optimisation of fleet performance. This analysis provided better understanding of the costs and structure of the fleet, as well as the suitability of the EV models for their use in car sharing fleets. Apart from optimising fleet performance, activities oriented to raise awareness of the e-car sharing offer and EVs in general were carried out.

The user-centred analysis was conducted by means of a user survey. The EUREF Campus Business Mobility Survey was carried out in autumn 2013 among the campus employees. A total of 259 employees from 35 companies responded to the online survey. The results revealed the potentials and barriers of e-car sharing for business trips and provided useful insights into employees' behaviour and mindsets with regard to e-car sharing.

The company-centred approach consisted of the analysis of interviews with managing staff of the EUREF companies, carried out in a local cooperation project. This contributed to a better understanding of the companies' mobility and travel requirements and how these relate to the opportunities for the use of e-car sharing (and car sharing in general) options.

As a result, consolidation of the key findings constituted the base for the development of a new marketing and communication approach that on top of selling mobility products as e-car sharing, offers companies targeted advice for the design of tailored-made travel plans according to the company mobility needs, cost restrictions and travel policy.

3.2.2 KEY FINDINGS

Fleet Monitoring

After the fleet renewal phase, the e-Flinkster fleet grew from 8 to 10 EVs in 2014, which caused an increase in the number of bookings (+11 %) and km (+26 %). With 162 customers the number of users (with at least one booking) remained stable while the number of bookings per customer increased to 3.98 (+18 %). Overall vehicle performance remained almost stable, with 65 bookings per vehicle on average (+1.5 %).

Employees' Business Mobility Patterns and Mindsets

The EUREF survey revealed that business trips were mainly done by car (53 %), including car sharing (15 %), and local public transport (40 %). The 43 % of the employees travelled at least once a month with a typical trip length of less than 50 km and a journey time of less than 4 h.

Forty per cent of the driving licence holders were car sharing customers and 27 % indicated having used the campus e-Flinkster offer. The main reason for not using the offer was lack of individual demand.

When asked about the possibility of including e-car sharing or EVs in the company fleet, 42 % of the business travellers (who completed one or more trips per month) would appreciate the provision of e-car sharing for business trips and a third would appreciate the introduction of EVs in the company fleet.

Figure 9. Business Trip Distance (km).
Source: EUREF Business Mobility Survey

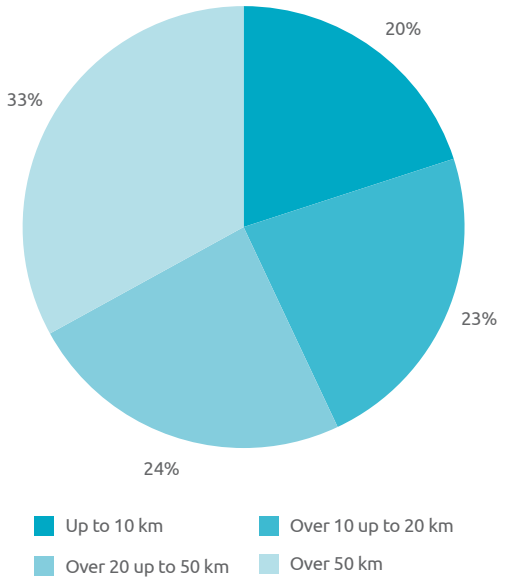
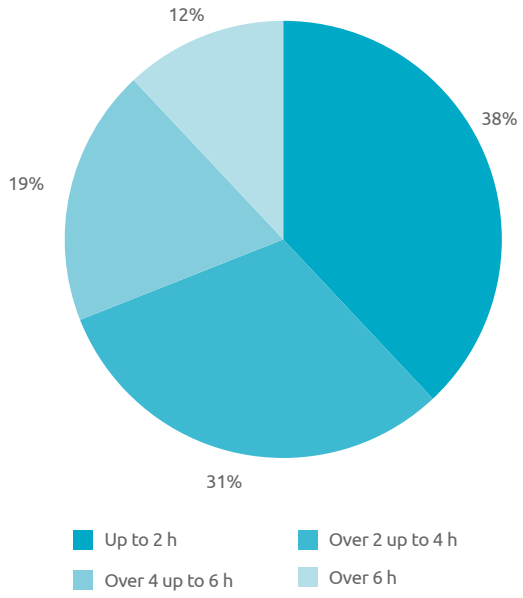


Figure 10. Business Trip Duration (h).
Source: EUREF Business Mobility Survey



Employees' Barriers for Electric Mobility

Charging network, limited range of EVs and long charging times were perceived as very important barriers for electric mobility. By contrast, environmental benefits were confirmed as the most important potential by the vast majority of employees, followed by lower operation costs and noise reduction.
Although EV purchasing intention among driving licence holders was very low (6 %), it is worth noting that 40 % had no intention to buy a car at all, whereas more than half did not want to buy (specifically) an EV.

Company-centred approach

The company-centered approach revealed that the transport offer available on campus (car sharing, bike sharing, public transport) is one important factor increasing its attractiveness as a business location together with the mix of service companies and research institutions, as well as the sustainable approach for energy production and consumption of the campus, which has piloting installations for wind and photovoltaic energy generation.

Mobility Management

Based on our previous findings, DB FuhrparkService and Choice envisioned a responsive marketing and communication approach, expected to contribute to making companies aware of the benefits of e-car sharing and assist them in the definition of optimised travel plans.
For this purpose, on-site vehicle demonstrations were conducted in order to familiarise potential users and company mobility managers with the technology.
In addition, DB FuhrparkService developed a concept for the technology-based assessment of employees' daily mobility behaviour supported by a smartphone app. The results of this demand analysis constituted the basis for the subsequent assessment of company mobility plan.
The results gained within eBRIDGE fed into a holistic sales approach that included mobility management consulting for companies. As a consequence

the DB Rent[77] website for business customers was re-launched, showing all mobility products and services in an integrated way. Additional software for the design of tailored mobility portfolios based on demand analysis, company preferences, and budget limitations, is currently under development.

Picture 13. Screenshot of the DB Rent website for business mobility. *Source: DB Rent GmbH*

3.2.3 LESSONS LEARNED

The results of the Berlin pilot indicate that e-car sharing has the potential to complement business travel and help reduce its negative impacts. Both employees and managing staff of the EUREF companies have a positive attitude towards electric mobility and e-car sharing, and perceive it as added value to the company's travel plan.
At the operational side, the comprehensive monitoring of the fleet performance indicators helped gain better insights into fleet performance and identify potential for improvement. As a result, a fleet consolidation was carried out from 2013 to 2014, leading to major improvements: optimised fleet size, up-to-date EV models, the redistribution of stations and reduced costs while increasing and/or maintaining the key performance indicators.

77 DB Rent is the sales branch of DB FuhrparkGroup.

User

Almost half of the employees of the EUREF campus were familiar with car sharing and EVs. A large share of business trips is suitable for e-car sharing due to short/medium distances and durations. An introduction of e-car sharing therefore seems promising.
Even though the employees indicated largely positive attitudes towards electric mobility, private purchasing intention is very low. This suggests that e-car sharing can be an option to help build confidence on the new technology, lower misperceptions about EVs performance and tackle barriers to EV use and adoption. The use of e-car sharing neutralises the price barrier, and makes spillover from business to private trips more likely.

Companies

At present, the need for dedicated employee company cars is strongly questioned. In most cities the improvement of public transport services and the introduction of cycle lanes and bike sharing offer a clear alternative to the use of company cars. In this sense, car sharing can contribute to a reduction in the number of cars, helping tackle congestion and lowering parking pressure. Moreover, e-car sharing can help cut GHG and improve local air quality, thus reducing the negative impacts of business travel.
Downsizing a company fleet or completely replacing it by joining a car sharing system still provides access to cars whenever needed, helping reduce travel costs, emissions and pressure on parking spaces and roads. If needed, companies can arrange an on-site car sharing station to increase availability and proximity to the service.

Fleet Operation

So far, the operation of e-car sharing proved to be practical in terms of fleet operation but is (still) not cost-effective.
"Electric" is not a unique selling point as car sharing itself is deemed as environmental-friendly. There is no

additional willingness to pay for e-car sharing, which, added to a predominant lack of individual demand makes e-car sharing operation a challenging business. In addition, the long charging times of EVs and the lack of fast chargers reduce their availability compared to ICEs. Operational activities such as towing depleted cars or vehicle redistribution (in the case of free-floating systems) drastically increase operational costs.

transport, walking or cycling, being a core element of a well-functioning urban transport system. This can be favoured by placing e-car sharing stations close to intermodal transport hubs. Moreover, expanding the station network into business hot spots like technology parks, or major commuting destinations in the neighbouring cities can be crucial to consolidate the success of car sharing.

Picture 14. e-Flinkster intermodal mobility. *Source: DB Rent GmbH*

Still, EVs present specific advantages for car sharing. Lower fuel costs and vehicle maintenance (assuming that charging infrastructure is available), financial savings through tax reductions, and an improved image as an environmental-friendly mobility provider are positive aspects. In many cities additional driving and parking privileges, e.g. access to environmental zones, the use of bus lanes and dedicated free-parking places, can favour e-car sharing choice over conventional private car. These advantages can significantly reduce travel time and parking pressure, making EVs competitive against ICEs.

As part of a multimodal transport system, e-car sharing develops its full potential when combined with public

3.3 MILAN: PROMOTING E-CAR SHARING THROUGH WEB 2.0 COMMUNICATION

Milan, the capital of Lombardy and engine of the Italian economy suffers from severe traffic congestion and air pollution. With a population of 1.4 million inhabitants and a high number of commuters from the surrounding regions, the city has one of the highest car ownership rates in Europe.

To tackle this, and as part of the Sustainable Urban Mobility Plan, Milan was the first Italian city introducing a congestion zone in the city centre in 2012 called "Area C". Access to Area C with car is only possible upon payment or with EVs. The Milan Expo 2015 attracted a con-

siderable amount of investment and transformed the city into an ideal testing ground for electric mobility.
Milan is an important transport hub with an outstanding public transport system operated by the Milanese Transport Company (ATM - Azienda Trasporti Milanesi). ATM operates the local metro, tram and bus system, as well as the car sharing scheme GuidaMi and the bike sharing scheme BikeMi which are integrated into the public transport network.

3.3.1 PROJECT ACTIVITIES

GuidaMi was established in 2001 as the first Milanese car sharing offer. The fleet comprises 140 cars, including 9 EVs. It operates station-based with 10 parking stations in the Area C zone equipped with charging stations.
The local eBRIDGE partners Fondazione Legambiente Innovazione (FLI) and ATM explored how the use of digital technologies with a social and gaming approach can help gain insights into the customers' experience and improve knowledge on EVs and their use. The objectives are to raise awareness about EVs among the citizens and the employees in the Area C, to foster the development and optimisation of the e-car sharing offer through the feedback of the users.

Picture 15. ATM's GuidaMi car sharing scheme.
Source: ATM, GuidaMi

The Milan pilot focused on the congestion charge zone where potential early-adopters live and work. EVs provide users with a cost-saving-opportunity as no congestion charge applies. From an environmental point of view, the use of EVs is a valuable opportunity to alleviate air pollution and congestion in Milan. In addition, e-car sharing stations in the city centre guarantee a high visibility for marketing and communication activities.
Lately, Milan has become one of the national hot spots for car sharing. The city is facing a rapid development especially of free-floating car sharing schemes with 6 operators currently active.
GuidaMi joined eBRIDGE in 2013 with 10 EVs (6 BEVs and 4 PHEVs). The market changing conditions and fierce competition caused a reduction in the number of BEVs and today, the GuidaMi electric fleet comprises 4 BEVs Citroen C-Zero and 5 PHEVs Toyota Prius. The GuidaMi smartcards are compatible with public transport and the BikeMi bike sharing system. Bookings can be made either online or through a 24/7accessible call centre.
The Milan pilot developed marketing and promotional activities oriented to understand the GuidaMi customer and the barriers to a wider acceptance of e-car sharing. The project partners carried out a series of user surveys that collected customers' feedback on the quality and usage barriers of the GuidaMi system, as well as suggestions for improvement.
A first survey was developed with a group of 12 testers who should also share their experiences in real-time. Additionally qualitative interviews with private and business users were conducted. A second survey was developed in cooperation with IKEA, an essential step to raising awareness of electric mobility and promoting EV use.

Picture 16. Cooperation of IKEA and GuidaMi.
Source: ATM, GuidaMi

Over 1,000 GuidaMi and IKEA customers provided useful feedback regarding their EV driving experience and knowledge about EVs.
A trial test was developed in cooperation with the City of Milan. The Milan municipal fleet has 50 conventional vehicles for employee travel. Encouraged by ATM the city decided to take part in a testing pilot to better understand if EVs can meet their travel needs. As they were using the standard GuidaMi fleet to top up their own fleet, EVs represented a new opportunity in the frame of that strategy. From January to March 2015, 12 employees of the municipal Logistic and Mobility Department tested 2 Citroën C-Zero. A survey among the employees on EVs knowledge and interviews on the quality of the GuidaMi service provided useful feedback to improve the service.
In addition to this, car and trip data, e.g. trip duration and distance, charging status, were continuously monitored. The evaluation of fleet performance was crucial to assess the potential for optimisation in terms of EVs usage, equipment and charging infrastructure requirements.
The marketing and promotional activities carried out during the pilot helped better understand the user and align the GuidaMi offer to the customers' expectations. The focus was on digital communication means, encompassing a Web 2.0 campaign to promote the next steps. Users should be continuously informed about vehicle availability, the booking system, relevant usage information, etc. through the GuidaMi e-car sharing app.

3.3.2 KEY FINDINGS

The use of digital technologies and social media is an effective tool to collect feedback on user experience and perception of e-car sharing, as well as to raise awareness of the GuidaMi service and electric mobility in general.

Driving Experience

The GuidaMi testers survey revealed an overall positive experience with EVs.
The majority of testers (92 %) booked EVs for commuting trips, and 33 % stated that uncomplicated charging is decisive for EV choice. A full battery at the time of booking increased the confidence of the driver.
The employees of the Logistic and Mobility Department of the City of Milan took part in a second survey on driving experience and EV knowledge. Employees identified battery autonomy (43 % of the respondents) and the small number of charging points (33 %) as strong barriers to EV use. By contrast, only the 17 % considered the lack of knowledge about EVs as a strong barrier. The long charging time was considered as a minor barrier by 71 % of the respondents.
The EV manageability and low noise were generally stated as positive aspects of EVs. Moreover, 29 % perceived EVs as a way to differentiate themselves from the crowd.
Additionally, the interviews on the quality of the e-GuidaMi service revealed that despite initial mistrust, employees quickly acknowledged the positive aspects of the EVs they drove: the silent engine gives a general good feeling; the charging system is easy to use (and improves with regular use); the vehicle store capacity was enough for daily needs; the car design was appreciated.
The monitoring data of the city employees' trips showed average trip distance of 17 km and average duration of 5 hours, with 21 bookings per car and month. It is worth noting that the total km covered during the last month of trial significantly increased compared to the first two months (+200 %).

Mindsets towards e-Car Sharing and EV Use

The online survey in cooperation with IKEA targeted both GuidaMi and IKEA customers. It revealed that 88 % of the respondents have never used an EV before. Accordingly, familiarity with EV was low: almost 75 % rated their knowledge about EVs as poor or limited.
Among the barriers to EV use, 55 % customers considered the lack of familiarity with EVs as a bearable barrier. Battery autonomy and charging time were perceived as bearable barriers by 44 % of the respondents, but a strong barrier for 40 % (16 % indifferent).

The limited public charging possibilities were deemed a strong barrier by 57 %.
Among the reasons for EV use, 90 % of respondents indicated EVs' contribution to reducing urban air pollution; lower noise levels was a strong reason for 69 %; and 55 % considered EVs easy to drive and park.
Respondents considered e-car sharing useful for trips to the city centre (79 %) and short trips in general (44 %). The following facilities were indicated as most useful when driving an EV: navigator with indicator of battery autonomy until destination; phone application providing advice on EV charging and use; dedicated info-line service; application recording driving style and CO_2 emissions.
Digital and social media attitudes, however, were lower than expected: only 23 % would share the EV driving experience on social networks.

EV Promotion

The cooperation with IKEA added visibility to the GuidaMi e-car sharing scheme and promoted EV use. IKEA customers could book the GuidaMi EV that was located at the Milan store. IKEA Family card holders and employees were granted 50 % discount on the annual GuidaMi membership fee. In addition, those who decided to sign up as EV drivers were granted one EV booking at no cost.

Picture 17. Screenshot IKEA website: Advantages for IKEA Family card holders. *Source: IKEA Italy*

Additional promotional measures through social networks were implemented. Participants of a picture contest could post photos made with a cardboard cut out of an electric car located at the IKEA stores. Prizes such as free tickets to the EXPO Milan 2015 were given to the person with the most shared pictures showing that they went shopping to IKEA with the GuidaMi EV.

3.3.3 LESSONS LEARNED

The Milan pilot encompasses a participative approach by using social media and gaming techniques aimed at collaborating closely with the users for the development and optimisation of the GuidaMi e-car sharing scheme. Several methods were applied to gain a deeper understanding of the barriers to EV use and driving experiences. Concerning the interactive survey, this approach proved difficult to pursue in terms of finding a representative sample. Although the feedback from the GuidaMi testers was positive and gave useful insights into the users' needs and requirements, the number of participants was too limited to draw reliable conclusions.

Project Level

The Milan pilot shows how external conditions, in this case the emergence of new car sharing operators, outside the realm of the project partners strongly influence the pilot development. Still, committed to the participatory approach and in reaction to these changing framework conditions, the project partners ATM and FLI adapted and enlarged the target group as well as the spatial focus. The interviews and surveys provided a starting point with helpful suggestions from the users' point of view for the future development of the GuidaMi e-car sharing scheme.
The interviews with the GuidaMi testers and additional 50 private and corporate customers showed that using digital tools (preferable via smartphone) is an important aspect to consider for the development of an effective survey. In this way, customer experiences can be collected for instance through Facebook or Foursquare, where users can insert geo-tagged information. A software framework using Web 2.0 technology is under development to manage customer experience interactively and in real-time.

Picture 18. Social media framework for customer experience management. *Source: GuidaMi*

User

Both private and business users identified the battery range as a strong barrier to EV use. The limited number of charging points available was a strong barrier especially for private users, who indicated more concerns than the business users. Lack of knowledge on EVs was for both user segments a bearable barrier, which could be tackled with information provision and driver training.

Both business and private users value EVs' manageability and ease of use as a strong driver for e-car sharing use, although this seemed to be more appreciated by the business users.

A wider acceptance of the GuidaMi e-car sharing scheme may be fostered with the implementation of innovative driver facilities in fleet vehicles, such as a navigator with battery range indicator and EV use tips application.

3.4 LISBON: GREENING A LOCAL ADMINISTRATION FLEET

Lisbon City Council (CML – Câmara Municipal de Lisboa) is fully committed to electric mobility and aims to set an example for sustainable transport and green procurement.

Starting in 2008, the municipality took part in the National Program for Electric Mobility (MOBI.E - Mobilidade Electrica) which deployed an interoperable electric mobility system nationwide. In 2010 CML developed together with the Municipal Transport and Parking Operator (EMEL - Empresa Municipal de Mobilidade e Estacionamento de Lisboa) a "Local Action Plan for Electric Mobility" to foster further EV uptake, with incentives such as free parking. In addition, the introduction of a Reduced Emissions Zone (ZER – Zona de Emissões Reduzidas) was implemented in order to improve air quality in the city centre.

In line with an overall strategy to mitigate the environmental impacts of the transport sector, CML committed to the introduction of EVs in the municipal fleet by at least 20 % of all newly procured vehicles. The municipality has progressively invested in the acquisition of EVs, substituting older vehicles. Today CML has the largest EV fleet in Portugal, making it a pioneer at national level.

The Lisbon pilot explored the potential of EVs to perform municipal services and how this can contribute to promoting EVs beyond the municipality, facilitating EVs market penetration and supporting decision-making towards electric mobility.

3.4.1 PROJECT ACTIVITIES

The municipal fleet has a total of 834 vehicles. It includes 57 passenger EVs but also light-duty vehicles for municipal cleaning, and quadricycles and e-scooters used by the municipal police.

The EV share in the municipal fleet is 13 %. The EV models are Peugeot iOn, Renault Fluence, Mitsubishi iMiEV, and Fiat Seicento Elettra. The vehicles are either allocated to a single user or used in a carpool among approximately 200 employees of several municipal departments (e.g. the Municipal Environment Division, the Municipal Division of Work and Construction), the Department Directors as well as the CML Presidency. Charging takes place either at the municipality premises, where 105 charging points are available on a 24 hour basis, or at one of the 500 MOBI.E charging points in Lisbon.

Picture 19. Lisbon municipal electric fleet. *Source: CML, Department of Marketing and Communication*

The activities developed to test the suitability and the optimal function of the EVs implied different tasks that led to increased overall energy efficiency and reduced CO_2 emissions of the fleet. Financial savings arose from the lower fuel costs of EVs and the optimised driving style adopted by the employees.

The fleet activity benchmarking assessed the mobility needs, fleet composition and vehicle allocation of the municipal fleet. A comparison between EVs and ICEs in terms of operational, financial and environmental performance served as a basis for the development of fleet renewal plan and different fleet configurations, e.g. pool of vehicles versus vehicle allocation to a single user, in order to minimise emissions, optimise energy consumption and ensure effective integration of the EVs.

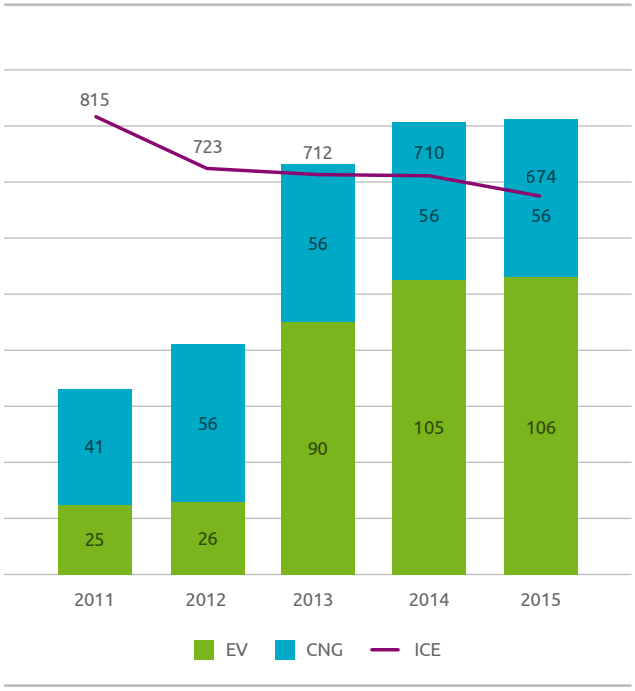
The monitoring activities allowed the comprehensive evaluation of the EVs integration. Operational data such as trip distance and energy consumption provided by the fleet management software was collected and evaluated. Additionally, user surveys and interviews were conducted among the municipality employees and fleet managers to gain a better insight into driving experience and user attitudes.

Finally, several promotional and communication activities helped raise awareness of electric mobility among the general public. Furthermore, CML is partner of several European projects including IEE-Pro-E-Bike (www.pro-e-bike.org) and FREVUE (www.frevue.es), which help increase electric mobility visibility further.

3.4.2 KEY FINDINGS

The evolution of the municipal carpool shows an increasing trend towards alternatively fuelled vehicles. From 2011 onwards CML has progressively increased the number of EVs (also CNG vehicles) replacing conventional cars, of which total number has dropped by 17 %.

Figure 11. Evolution of the CML vehicle fleet.
Source: CML, Fleet Management Division



The municipality plans the acquisition of several additional EVs, ranging from quadricycles, light-duty and passenger vehicles to electric buses. The future potential of smart charging through a new management model is currently being analysed.

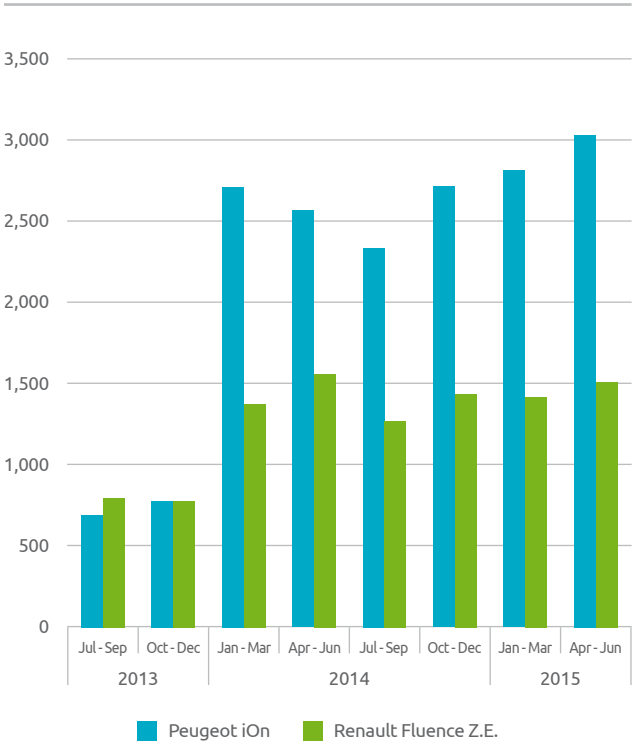
Configuration Schemes

The analysis of configuration schemes showed that pooled vehicles had higher usage, performing more than double daily trips compared to vehicles allocated to a single driver, which had shorter trips in terms of length and duration. A higher annual mileage of the pooled vehicles is expected due to optimised car usage. The pooled cars showed higher energy consumption per vehicle. This might correspond to the driving requirements in urban context, with more braking and acceleration events, but also to the higher average distance per vehicle and the higher number of trips per vehicle.
The best configuration scheme must meet the requirements of the activities intended for the vehicles. Due to the operational needs of the municipality, where employees attend meetings, travel between the different departments in the city and supervise the construction and maintenance of the infrastructures, EVs are mainly used in a pool.

Fleet Monitoring

The 45 pooled EVs covered more than 860,000 km from November 2013 to June 2015, with an average monthly distance of 800 km per vehicle (some of the vehicles over 1,000 km), and approx. 39 tonnes CO_2 resulting from vehicle charging. The average trip distance per vehicle of pooled and assigned vehicles increased along the project time. The pooled vehicles presented higher average distances, which might respond to the increasing confidence of the drivers in respect of battery autonomy and the higher use of the vehicles. Average EV energy consumption equalled 0.4 MJ/km compared to 2.6 MJ/km of diesel cars, implying savings of approx. 53,000 litres of diesel with the equivalent EV fleet.

Figure 12. Average distance (km) per EV.
Source: CML, Fleet Management Division



Each EV contributed to saving 2.6 tonnes CO_{2eq} yearly (based on approx. 3 tonnes CO_{2eq} per diesel vehicle and year and 0.4 tonnes CO_{2eq} per EV and year).
Costs were calculated on the basis of fixed (renting and leasing quotes) and variable costs (maintenance, fuel, etc.) per vehicle and year. On average, each EV incurred in a cost of 0.55-0.71 EUR/km while the diesel vehicles had a cost of 0.13 EUR/km. [78]

Driver Experience

The employees' surveys showed positive opinions about EVs for the majority of respondents. The driving experience was rated as positive and very positive by 65 % and 94 % would use an EV again.
Eighty five percent of respondents considered EVs

78 The lower cost per diesel car responds to the fact that the diesel cars are owned by the municipality and not imply fixed costs, since they have been amortized years ago.

more environmentally friendly than ICEs; however, lack of knowledge and uncertainties about costs and safety of EVs are still prevalent. Purchase willingness increased to 57 %, compared to 27 % in 2012.[79]
Interestingly, range anxiety was not identified as a major concern by more than 60 % of respondents. However, initial misperceptions about the battery range led users early on to charge the vehicle whenever possible. Drivers showed improved driving styles, reflected in lower average speeds in general, and in lower maximum speeds. Likewise, the routes and business trips became more rationalised, probably as a result of a better understanding of vehicle particularities and the awareness of range limitations. This might respond to the training and information sessions carried out and also to some residual concern regarding battery range. The interviews with the fleet managers showed that environmental benefits were regarded as the most positive aspects of EVs, battery range and charging times being the least positive. User adaptation to the new vehicles was very smooth. However, the use of ancillaries (e.g. heavy use of heating or air conditioning) proved to have a huge influence on battery range.

EV Promotion

The use of EVs by the CML Presidency as well as various Department directors is a clear sign of the municipality's commitment to electric mobility, both to the employees and to the general public. This commitment was communicated through press releases and social media networks. The municipality extended its leading by example approach of EV promotion and use. In line with CML's fleet renewal, in 2014 the municipal parking operator EMEL acquired 5 Renault Kangoo Z.E for their daily service operations such as maintenance of spaces and equipment and parking meters revenue collection. In cooperation with 2 taxi associations, CML also incentivised in the gradual renovation of Lisbon's taxi fleet.
Furthermore, CML organised an open test-driving day for the general public during the Mobility Week on 21st of September 2015, thus contributing to a greater awareness of electric mobility.

Picture 20. Lisbon European Mobility Week 2015.
Source: CML, Fleet Management Division

3.4.3 LESSONS LEARNED

The introduction of EV in the municipal fleet led to environmental and financial savings in terms of emissions and energy consumption. The positive results contributed to promoting electric mobility among local businesses, citizens, and other public companies.
The use of EVs for the daily municipal services and the example given by CML's management board contributed to improved attitudes towards EVs and building trust in this technology among employees and the general public. The municipality keeps working to expand this approach and contribute to raising awareness of electric mobility in Lisbon.
The municipality pursues a long term strategy which goes beyond the acquisition of EVs for municipal tasks, including also various supportive policy measures.

79 APVE, 2012, page 35

User Attitudes

Attitudes towards EVs were generally very positive. Employees' confidence improved during the pilot and typical usage barriers such as range anxiety were effectively overcome. A considerable share of employees would consider buying an EV.
User adaptation to the new vehicles was very smooth. Driving style proved to have a huge influence in battery autonomy. For this reason, comprehensive information and/or training in driving techniques is highly recommended.
Still, the employees' surveys revealed lack of knowledge and uncertainty in terms of vehicle maintenance, operational costs and safety. The municipality organised several workshops in order to specifically address these uncertainties directly with the employees. Based on this, an information flyer providing targeted information about EVs and optimal driving behaviour will be developed.

Managing the usage of an EV is similar to a smartphone: the more features you use, the more battery you consume.

You can plug-in as much as you wish: partial charges do not harm battery life.

Applicable to Peugeot iOn:

- The engine is like a generator in deceleration: it charges the battery by transforming kinetic energy in electricity. This is known as regenerative braking.
- The battery range of 150 km is theoretical: depending on your driving style, you can perform larger or smaller distances.

In Lisbon, the municipal parking operator EMEL sells a green label allowing EVs free parking.

The Portuguese Environmental Agency offers scrapping incentives of up to 5,000 EUR for EV purchasing, when replacing 10-or more-year old cars.

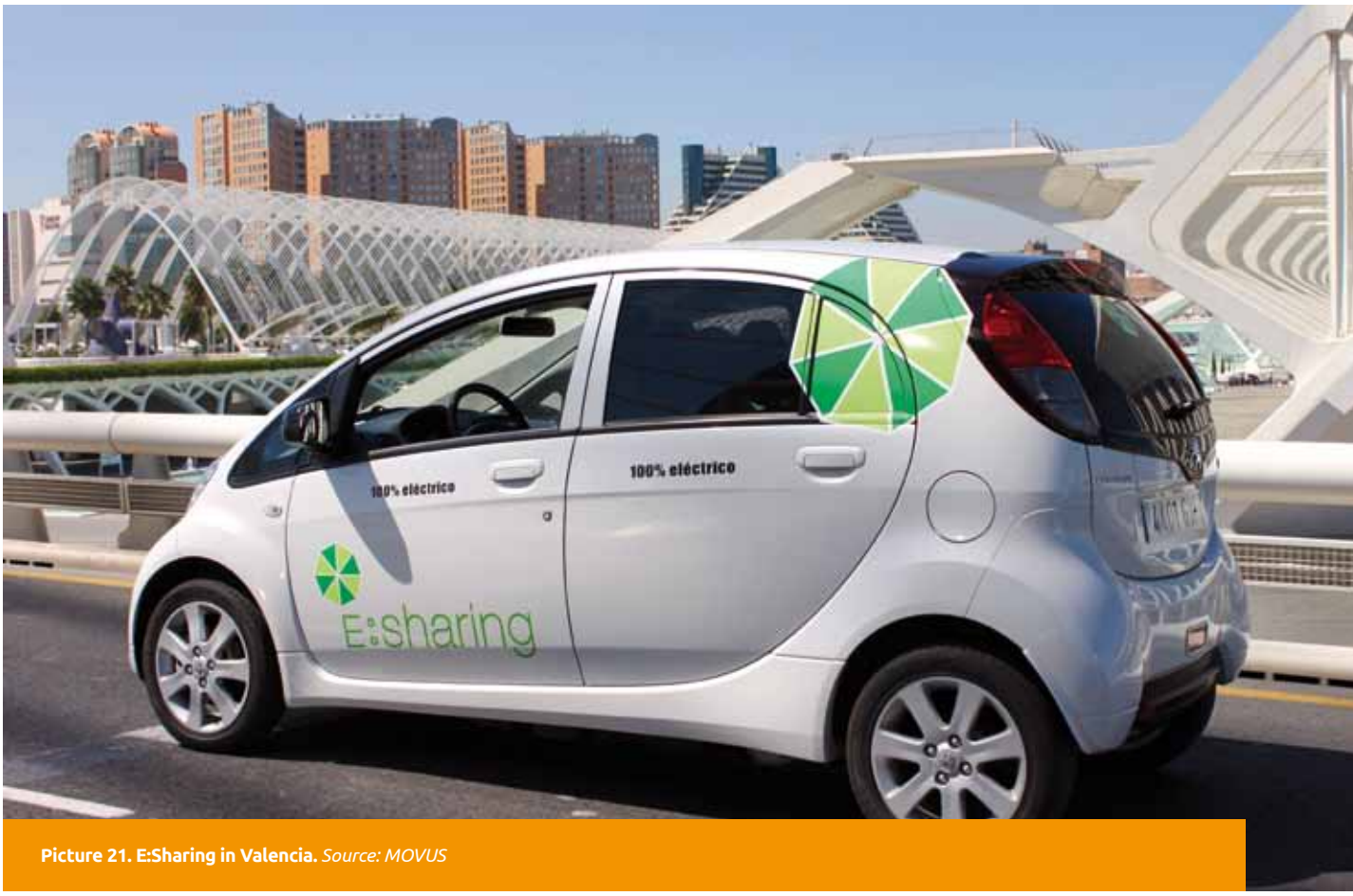
Fleet Operation

The experience of the Lisbon eBRIDGE pilot shows that the evaluated municipal duties demands can effectively be fulfilled with EVs, since they present adequate operational capacity. Battery range and long charging times only posed a challenge for the 24 hour services. To address this, the municipality installed a fast charging point at its premises and purchased 3 PHEVs that were allocated to these particular services.
However, charging procedures can be challenging as the lack of standardisation of charging devices requires an additional adapter to charge EVs in the municipal premises. The maintenance of the MOBI.E charging network is currently not sufficient.
Still, the EVs performed well without major problems and the introduction of EVs into the municipal fleet was a positive step towards cleaner and more energy-efficient transport. Fleet performance can be further improved because users tend to optimise their routes leading in turn to financial savings for the municipality. This might be a compelling argument for other municipalities and organisations to include EVs in their fleets as well.

3.5 VALENCIA - PALMA DE MALLORCA: ENGAGING PUBLIC ORGANISATIONS WITH E-CAR SHARING

Car sharing and especially e-car sharing are not widely common among the Spanish public, which mainly owns private cars. However, the sector is progressively gaining prominence. The eBRIDGE partners Sustainable Urban Mobility (MOVUS - Movilidad Urbana Sostenible) and the Regional Government of the Balearic Islands (CAIB - Govern de les Illes Balears) are working together to bring EVs and e-car sharing to the Valencian and Balearic regions. During eBRIDGE, MOVUS optimised and validated the E:Sharing concept and CAIB launched the Electric Car Sharing Committee of the Balearic Islands as a founding member.
E:Sharing started in 2011 as the first commercial e-car sharing service in Spain for business and private travel. In close cooperation with the Valencian Institute of

Business Competitiveness (IVACE - Institut Valencià de Competitivitat Empresarial), E:Sharing has been driving electric mobility in the Valencian region.



Picture 21. E:Sharing in Valencia. *Source: MOVUS*

The creation of the Electric Car Sharing Committee of the Balearic Islands (ECSCBI) was led by CAIB in cooperation with IVACE. As responsible for the regional energy strategies, both institutions shared a common vision of energy efficiency and sustainable transport. The experience of IVACE with the Valencian Committee of Electric Car Sharing was a sound starting point for supporting CAIB with the concept and implementation of the Balearic committee.

3.5.1 PROJECT ACTIVITIES

The eBRIDGE Valencia-Palma pilot analysed the potential of the E:Sharing service for business and private mobility, and set the framework for the implementation of the ECSCBI.

The E:Sharing pilot comprised the optimisation and validation of the E:Sharign system, accompanied by marketing and promotional activities. Validation of the service was carried out through fleet monitoring and user surveys and interviews. This led to an improved service, by identifying new tools to make the service more competitive and attractive to the customers. In addition to the regular E:Sharing customers, two cooperating companies, Automóviles Sagunto S.A. and GND S.A, which include EVs in their fleets, agreed to take part in the customer analysis, enlarging the pilot data pool.

The user feedback collected during the initial phase of the pilot indicated the need for shifting the focus to companies and public entities as relevant target

groups for the promotion of the E:Sharing system. An intensive promotion of the E:Sharing service among the new targeted customers resulted in the involvement of two major public entities joining the service.
In the Balearic Islands, the creation of the ECSCBI was conceived as part of an integral plan for the promotion of electric mobility and car sharing in the region. The Committee brings together local authorities, political representatives and relevant stakeholders (including citizens associations and user groups), providing a common place for promotion of electric mobility in the region.
A knowledge transfer meeting between CAIB and IVACE took place in September 2014, and the first committee meeting with local stakeholders followed in December, when CAIB officially launched the Electric Car Sharing Committee together with the City Council of Palma de Mallorca and the Municipal Car Park Society of Palma (SMAP - Societat Municipal d'Aparcaments i Projectes de Palma). Attendees signed an agreement on further developing the committee activities, including regular meetings.

3.5.2 KEY FINDINGS

The eBRIDGE Valencia-Palma pilot showed that the E:Sharing offers a viable alternative for business travel. At present, the majority of E:Sharing users are employees of public administrations.
The foundation of the ECSCBI supports the further development of electric mobility in the Balearic Islands. The regional elections held in May 2015 introduced changes in the government structure; so far, electric mobility continues on the political agenda.

Promotion of e-Car Sharing among Public Entities

The intensive promotion of the advantages and benefits of e-car sharing carried out by MOVUS achieved two major objectives during the project: the involvement of the Valencian Health Ministry and the City Council of Valencia as regular users of E:Sharing.
Initially conceived as a tender for the provision of "traditional" mobility services, a turning point came when the ministry was made aware of the potential of EVs and e-car sharing. Since then, the home-care unit of the Hospital Virgen de los Lirios in Alcoy is the first medical institution in Spain using e-car sharing to provide home-care services. In a similar way, the employees of the Department of Urbanism of the City of Valencia became regular users of E:Sharing.

Picture 22. E:Sharing fleet at Hospital Virgen de los Lirios in Alcoy. *Source: MOVUS*

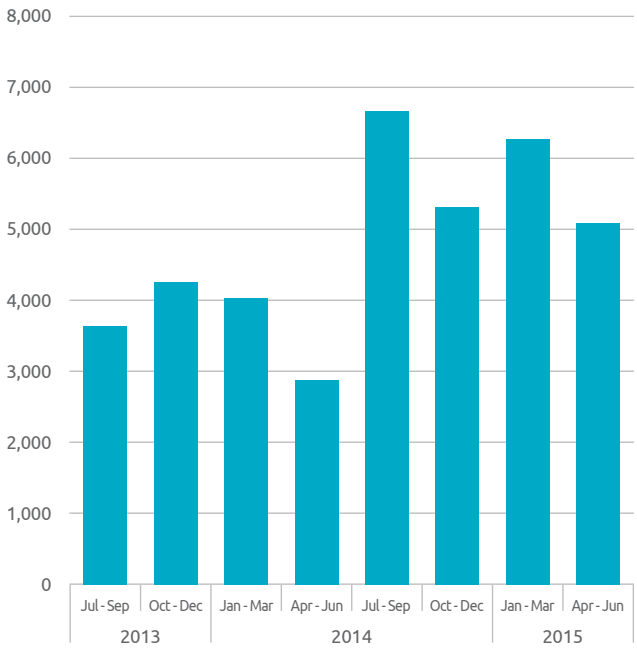
Evaluation of the E:Sharing Service

The evaluation of the E:Sharing service implied two lines of work: vehicle monitoring analysis and employees' attitudes assessment. The operational analysis of the monitoring activities and the surveys and interviews led to better understanding of the driving experience and fleet performance in order to build a strong business model. The introduction of a fleet management system allowed greater control and savings from business travel. On average, the E:Sharing fleet covers 5,000 km per month, representing 12 % travel costs savings for the customer public entities. In addition, the use of EVs contributed to improving the positive image of the organisation. The majority of E:Sharing users found the experience positive and better compared to ICEs; as some of the employees substituted grey mileage[80] with the sharing fleet, it seems that the

80 Grey fleet vehicles are usually employee privately-owned vehicles, or a vehicle that the employee has hired outside of any company-provided scheme. Grey mileage is the business trip distances covered with a grey fleet vehicle (Source: Fleet News)

"sharing experience" was also perceived positively.
The employees adapted vehicle choice to the trip purpose, booking the compact, easy-to-drive and more suitable vehicles for city trips (Think City and Peugeot iOn).

Figure 13. Evolution of distance (km) covered by the E:Sharing fleet. *Source: MOVUS*



This was the case for the employees of Valencia City Council, who used the vehicle for short, but frequent daily trips. The mobility needs of the employees of the Hospital Virgen de los Lirios in Alcoy required different kind of vehicles: compact models (Peugeot iOn, Think City) for local, urban trips and more robust models (Renault Fluence) adequate for medium-long trips to other municipalities. Overall, a change in vehicle preference could be observed from larger to smaller models.
Employees' perception of EVs improved with regular use. Range anxiety decreased during the pilot as confidence grew. As a result, employees adapted their trip schedule to charging possibilities, planning and rationalising routes and tasks more efficiently.
Overall, employees perceived the e-car sharing service as an improvement of their daily mobility, contributing to less use of own vehicles and providing access to innovative vehicles. Moreover, a number of employees of the home-care service indicated that such a solution should be extended to similar services in the hospital.

Creation of Electric Car Sharing Committee of the Balearic Islands

The ECSCBI was officially launched in December 2014. Future meetings include the participation of other Balearic city councils attached to the programme "Electric Mobility in the Balearic Islands" (MELIB - Mobilitat Elèctrica a les Illes Balears). Further information is available on the MELIB website (http://melib.caib.es).
The MELIB card is the identification label for EVs in the Balearic Islands. It was created by the regional government in cooperation with private and public stakeholders to promote the standardisation of measures and incentives across the Balearic region. EVs with the MELIB card can benefit for instance from parking and driving privileges, free charging and tax relief in all Balearic cities that have approved these incentive. A number of companies have shown a growing interest in e-car sharing as travel distances in the islands are ideal for EVs.

Picture 23. MELIB identification label. *Source: CAIB*

3.5.3 LESSONS LEARNED

As car sharing and e-car sharing are still relatively new concepts, an intensive promotion of the E:Sharing ser-

vice is crucial to make potential customers aware of the benefits of electric mobility and the use of EVs. In such conditions, resilience is of high importance: e-car sharing operators need to adapt to the customers' needs and expectations, changing marketing strategies when needed, introducing new products and actively seeking market niches for their business offer.
In addition, operators in challenging markets should strive to provide high quality service maintenance and customer care to ensure customer loyalty. The results of the E:Sharing pilot indicate a high potential of e-car sharing for business customers, with reduced travel costs and improved organisation image. Moreover, e-car sharing contributes to lowering grey mileage for business travel: E:Sharing replaced the use of employees' private cars, releasing them from maintenance tasks and improving their overall mobility. In terms of future developments, the high number of SMEs in Valencia and the fact that very often these companies do not own a vehicle fleet or travel strategies, are favourable conditions for the further promotion of the E:Sharing service.

User Attitudes

E:Sharing is well accepted among customers. Employees of the participating organisations appreciated using EVs. Adaptation to and acceptance of the new technology were fast and did not pose major problems.
The regular usage of the E:Sharing service proved to be highly effective in reducing common barriers to EV use, e.g. range anxiety and lack of knowledge of and confidence in EVs. This contributed to a more rationalised vehicle selection according to trip requirements, including route planning for charging when needed. Regular users showed optimised routes, reducing the overall mileage and as a result, improving the productivity (in terms of number of medical visits) on a single battery charge. Regular users with better knowledge on the costs of own mobility indicated improving attitudes towards EVs and positive purchase willingness.

Fleet Operation

E:Sharing proved to be an effective alternative to the use of grey fleets, reducing mileage, costs and emissions fromo business travel. Organisations can benefit from reduced travel costs and improved image.
In the case of the Hospital Virgen de los Lírios, costs were reduced by about 12 % with the use of the E:Sharing service. In the case of Valencia City Council, the savings in comparison to a combustion car were about 50 % (compared to a rented car and fuel costs).
CO_2 emissions were cut by 67 % per vehicle and km (based on emissions for Renault Mégane 106 g CO_2/km, and Peugeot iOn 35 g CO_2/km, with the Spanish energy-mix).
As a result of the implementation of the E:Sharing service in the Alcoy hospital, additional local public charging infrastructure was developed. A public-private partnership initiative implemented 4 charging stations with slow and fast chargers in the City of Alcoy.

Policy Level

The Balearic government changed recently. The work developed so far has been the fruit of a strong political will to bring electric mobility forward: the creation of the ECSCBI is just one of the numerous initiatives that the previous government supported.
Political changes in the government structure require time. At the moment and until the new government strategies are set up, the activities and plans developed by the former government continue as planned.

3.6 VIGO: HELPING COMPANIES TO KNOW EVS

Vigo is the largest metropolitan area in Galicia and home of the Galician Automotive Cluster (CEAGA - Cluster de Empresas de Automoción de Galicia). Since its creation in 1997 the number of companies belonging to the cluster has grown to 106 companies, including the PSA Peugeot-Citroën plant and the Galician Automotive Technological Centre.
In 2011 the Galician regional government and CEAGA developed the Galician Electric Mobility Plan MOBEGA (Plan de Movilidad Eléctrica de Galicia), with the aim

of bringing electric mobility closer to the citizens. The project was a pioneering initiative in Europe for the promotion of electric mobility and the creation of an interurban charging network. After the completion of the project, part of the MOBEGA fleet was derived to the eBRIDGE Vigo pilot in 2013 to set up the CEAGA e-car sharing fleet.

CEAGA e-Car Sharing is a corporate electric fleet of 4 BEVs (Citroën C Zero and Peugeot iOn) managed by the eBRIDGE project partners CEAGA Foundation and the technological consultancy INOVA (I Nova Consultores en Excelencia e Innovación Estratégica).

panies and further stakeholders. As an automotive cluster, CEAGA played a main role for the promotion of EVs acting as a powerful multiplier of the benefits of electric mobility and EVs among the cluster stakeholders.

3.6.1 PROJECT ACTIVITIES

The Vigo pilot explored the potential of EVs for business travel among the CEAGA companies. Each participating company pilot included vehicle monitoring activities, employee surveys and interviews with managing staff, and a comprehensive report for the partici-

Picture 24. eBRIDGE Vigo pilot. *Source: CEAGA*

During the pilot, a selection of 35 CEAGA cluster companies, heterogeneous in terms of size and field of activity, tested and evaluated EVs performance for business trips with the aim of improving fleet performance and raising awareness of EVs among the cluster com-

pating company.

Any company of the cluster could participate as testing partner. Supported by INOVA, CEAGA coordinated the EV cession to the partner company and provided the supporting documents and guidance for the operation

of the vehicles. CEAGA was also responsible for the maintenance of the testing EVs, covering issues such as change of tires or minor repairs.
The company pilots were organised through a contact person (usually at the human resources department of the company) who acted as a "fleet manager" and received a brief training on how to manage the EVs. The fleet manager took care of the bookings through the user control sheet, handed over the vehicle key, the survey, and the user and charging EV guide to the testing employee.
The EVs could be booked for business trips during the working day and were usually parked and charged in the evening at the company parking facilities.
At the end of the booking, the EVs were returned to the fleet manager, who checked the vehicle status, collected the key, the supporting documents and the user survey.
EV performance was analysed through the evaluation of the vehicle and trip data collection. The EVs were equipped with an on-board unit that recorded general car booking and trip data, e.g. total km, trip duration, average speed, etc., as well as consumption data, e.g. battery status, average costs per km, etc. The data were accessible through an online platform. This comprehensive data collection allowed a deeper analysis of the EV usage and travel patterns that were reported to the company in the final results report.
Pre- and post-driving employee surveys were carried out to assess the potential for improved attitudes and behaviour change towards EVs. Interviews with the fleet managers were carried out on the basis of a questionnaire designed in cooperation with Cardiff University.
Finally, the testing results were consolidated in a findings report which included aspects such as average cost per km, battery consumption per trip, etc. Doing so, the companies were provided with useful information on own EV experience, and were able to learn about the benefits of EVs for their business trips.
As part of the pilot, additional promotional activities aimed at raising awareness of electric mobility and EVs in general were carried out.

3.6.2 KEY FINDINGS

The Vigo pilot proved the suitability of EVs for business travel of the testing companies. A heterogeneous group of companies provided useful information on EVs performance, user acceptance and managing staff attitudes towards EVs for business travel.

Fleet Performance

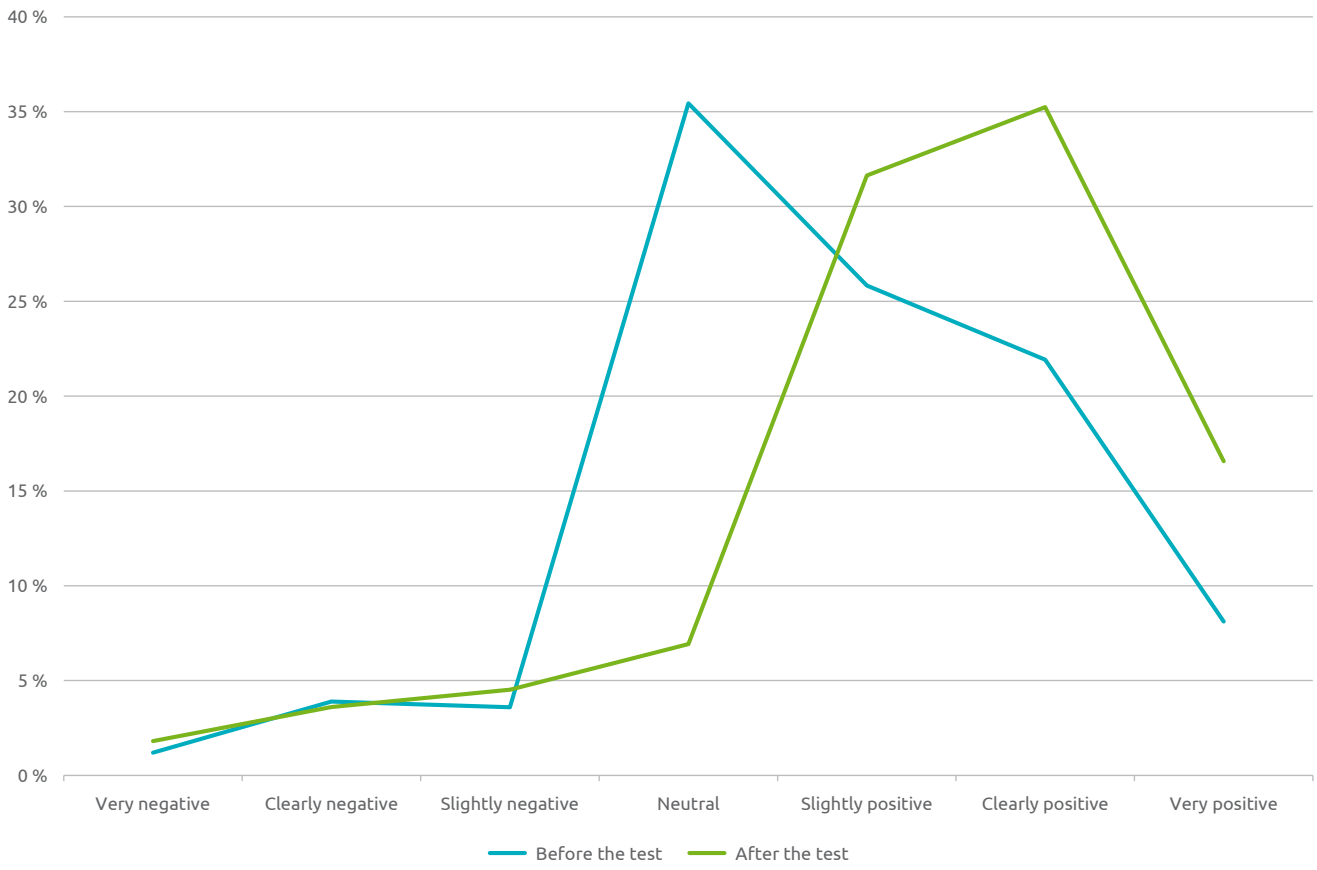
From June 2013 to March 2015, over 500 employees have driven EVs for business trips.
The mobility patterns of the monitored trips showed that business travel can be easily performed with EVs: the average trip was less than 10 km, with duration of about 15 minutes, and an average speed of 30 km/h.
With more than 62,000 km and 7,300 business trips, the CEAGA e-car sharing fleet has contributed to saving over 7 tonnes of CO_2 at a current electricity cost of 0.04 EUR/km. The fuel cost savings (arising from the difference of the diesel and electricity price) amounts 12,000 EUR.[81]

Employees' Attitudes towards EVs

Comparing the survey results before and after the test, a positive change in user attitudes and vehicle acceptance could be observed: the share of employees who felt indifferent about or had a negative attitude towards EVs before the test (44 %) decreased to less than 17 % after the test.
The most frequent responses regarding EVs were positive. Employees consider EVs as a good concept for urban usage, with comfortable (noiseless) driving and good engine response, as well as further positive environmental aspects.

81 Fuel cost for a conventional car in Spain of 0.24 EUR/km (Source: FleetData Market Research) and 0.04 EUR/km for EVs during the eBRIDGE Vigo pilot.

Figure 14. Employees' attitudes towards EVs before and after the test. *Source: INOVA*



Among the barriers to EV use, range anxiety was an issue for almost 60 % of the employees, although clearly not directly affecting them, given their average trip length and duration. Additional barriers were the high price of EVs compared to conventional cars, the lack of knowledge about EVs and their maintenance as well as the lack of charging points. Considering the current number of charging points available, the latter barrier might correspond to a lack of awareness of the actual state of charging infrastructure, possibly due to inefficient information and promotion measures.

Purchasing willingness among the employees before the test was relatively high: 33 % consider or have considered buying an EV, but the willingness decreased to 18 % after the driving test (-15 %). Employees indicated battery range, price, lack of knowledge on maintenance, lack of charging stations, and limited space in the vehicle as barriers to EV purchase.

When comparing EVs and conventional cars performance, employees rated EVs as better in terms of respect for the environment, whereas, predictably, price, range and refuelling experience of EVs were evaluated as poorer. In terms of safety and range, EV performance was rated as worse by a higher share of employees (12 % and 14 %, respectively). In this case it is worth mentioning that considering the average trip length of the monitored trips (less than 10 km) this might correspond to persistent misconceptions about how EVs should perform, and not how do they actually do.

Managing Staff Attitudes towards EVs

The managing staff indicated the following EVs' advantages: cheap maintenance, low fuel cost per km, comfort, good acceptance by the employees and the possibility of home-charging. The environmental benefits of electric powertrains were especially mentioned. In terms of disadvantages, the interviewees mentioned the high purchase price, low autonomy, long charging time, more expensive insurance and the lack of public charging points.

Carlos Casal, HR Manager Benteler Automotive Vigo
"*In the eBRIDGE project our company has tested the Citroën C-Zero for three months. We covered about 2,520 km and spent approximately 49 EUR to recharge the car, which means a cost of 0.02 EUR/km. This is a very competitive price compared to that of fuel vehicles.*"

Picture 25. Vehicle cession to Carlos Casal. *Source: CEAGA*

Rogelio Fernández, Viza Automoción
"*It´s very positive that employees from the automotive sector can drive this kind of vehicles with the objective of learning more about environmental aspects and test new technologies. People like the silence of these vehicles and would like to repeat the experience.*"

Promotional Activities

CEAGA carried out numerous promotional activities among employees and further stakeholders. The pilot activities and relevant eBRIDGE news were disseminated through the local partners' websites, social networks, news in the CEAGA Magazine "Infocluster", articles on regional press and other local media. CEAGA informs via e-mail more than 1,500 employees about relevant news in the sector, including internal communications. During the project, over 10 targeted communications were sent to foster companies' involvement with the Vigo pilot.

3.6.3 LESSONS LEARNED

The results of the Vigo pilot show that the business trips of the participating companies can be perfectly accommodated by EVs, with additional economic and environmental benefits in terms of fuel cost savings and reduced local emissions. This applies particularly when the charging network is provided and supplied with renewable energy.
The pilot has successfully contributed to raising awareness of EVs among employees and stakeholders of the cluster, increasing the number of companies and employees familiarised with EVs, reducing private car mileage of business travel and increasing the number of companies using EVs.

Employees Acceptance

Eighty-one percent of employees had not driven an EV before the pilot. This might be the reason for the indicated lack of knowledge in terms of operational, maintenance costs and safety of the pre-driving survey.
Providing targeted information, driver trainings and continuous learning about EVs operation helps reduce misperceptions about EV performance, balancing expectations with real operation. Additionally, helping users understand their own mobility needs can contribute to increasing confidence on EV reliability in general.
The general EV driving experience before and after the test showed improved attitudes towards EVs. The vast majority of employees (93 %) rated EV driving experience as good or very good. In addition, 95 % would like to repeat the experience: note that this percentage is slightly higher than those who rated the experience as

good or very good, which might reflect an additional interest to deepen the learning process of those with a less positive experience. Range anxiety, however, is still a persisting issue.

Companies and Managing Staff Acceptance

The participating companies acknowledge EVs potential to reduce fuel costs and environmental impacts of business travel. The managing staff particularly valued the low fuel cost per km, positive acceptance by the employees and environmental benefits. High price, limited range and long charging time were confirmed as main barriers to EV adoption. Offering employees e-car sharing for business trips is a practical way to neutralise the price barrier. The long charging time barrier can be lowered by providing charging stations at the company premises (perhaps including fast charging) as well as allowing employees charging at home. This would imply that the EV can be also used for private (commuting) trips.

3.7 CARMARTHEN: LEADING THE TRANSITION TO ELECTRIC FLEETS IN LOCAL GOVERNMENT CARPOOLS

Carmarthenshire County Council is the administrative body of Carmarthenshire, one of Wales' 22 local authorities and employer of over 9,000 people located in several areas across the county.
The headquarters are located in Parc Myrddin in Carmarthen with a staff of 140 employees. Due to the council's organisational structure and geographical distribution, employees often have to travel across the council sites for work purposes. As the sites are located at varying directions and distances, the council initially opted for grey fleet travel, paying employees' mileage claims on a trip-by-trip basis.
Concerned about increasing costs and environmental impact of staff travel, in 2010 the Council decided to centralise 6 of their diesel cars at the council premises in Parc Myrddin. After one year of operation, staff travel costs sunk while the use of the pooled cars rose. Encouraged by the positive results, in 2011 the Council added 2 BEVs to the carpool, which would also contribute to improving air quality and to achieving UK government emission reduction targets. The successful trial of the first 2 EVs was followed by the introduction of 4 additional BEVs in 2013.
The introduction of the mixed carpool was neither accompanied by a broader strategy on fleet monitoring or fleet validation nor by a marketing approach. To address these issues, Carmarthenshire County Council joined eBRIDGE with Cardiff University as the local eBRIDGE leading partner in the beginning of 2013.
The introduction of EVs in rural areas and smaller towns like Carmarthen can have a direct impact on the EV diffusion potential, via awareness raising and drivers' familiarisation with EV technology. The eBRIDGE pilot in Carmarthenshire examined whether this applies within the framework of a mixed municipal fleet of conventional and electric cars.

3.7.1 PROJECT ACTIVITIES

The Carmarthenshire County Council carpool joined eBRIDGE with a mixed fleet of 6 diesel cars and 2 BEVs – 2 Mitsubishi iMiEV. Four additional BEVs (Peugeot iOn) were acquired during the project. Charging takes place either at the Council premises or at the destination. With the aim of encouraging further use of EVs by reducing feelings of range anxiety the Council installed 2 additional off-campus charging stations in Carmarthen.

Picture 26. Carmarthenshire County Council electric fleet.
Source: Cardiff University, Dimitrios Xenias

Booking is accomplished via a fleet manager who provides and collects the vehicle keys manually. There is reasonable availability of vehicles and advance booking is usually not necessary, so the employees can book the car on the day they need it, or just the day before.
Professional driving training took place on a rolling basis in 2013 and 2014 to ensure that every member of staff eligible to use the carpool was familiar with the EVs before booking them for the first time. The training programme helped drivers learn how to handle the small differences between conventional and electric cars and how to drive them efficiently.
Understanding the needs and travel patterns of employees, as well as usage patterns of both types of vehicles was essential for the success of the pilot, as it allowed a better planning of future charging investment and the assessment of the financial impacts of the carpool.
Monitoring of fleet vehicle use and trip car data (including mileage, and trip duration) was recorded regularly and additional assessments of drivers' attitudes and perceptions were carried out.
Driving experience monitoring was recorded through face to face interviews and group discussions, online surveys and interviews with fleet managers.
While many employees chose EVs as their main means of transport for in-county trips, instead of diesel vehicles, others seemed to be reluctant to adopt EV use due mostly to range anxiety based on misperceptions of EV range, as showed by the interviews, and lack of confidence.
To address this, information cards were developed and placed in all pool cars outlining the advantages of driving an EV, encouraging employees to try it next time and particularly focusing on the true battery range in realistic conditions.
Additionally, normative messaging aimed at increasing EV use was applied in early 2015. This approach provides feedback to members of an identified group and behaviour on how a comparable group performs for the same behaviour. In this case, the Council employees received an e-mail updating them of their EV fleet performance against other comparable eBRIDGE project sites. In this way the drivers perceived driving an EV as the norm rather than the exception.

Picture 27. Information card placed in diesel cars.
Source: Cardiff University, Dimitrios Xenias

As a pioneer local authority in Wales, Carmarthenshire County Council was approached by other interested authorities, aspiring to establish their own EV pool. Aside from formal and informal contacts, a knowledge transfer event took place at Cardiff University in November 2014. It was organised in collaboration with CarPlus, the leading UK charity on car sharing and sustainable transport, and attended by over 25 practitioners of shared mobility and electric mobility, among them representatives from several regional City and County Councils and the Welsh Government, mobility-relevant NGOs and the Climate Change Commission for Wales.

3.7.2 KEY FINDINGS

The introduction of EVs in the Carmarthenshire County Council carpool resulted in substantial financial and en-

vironmental savings, and proved that EVs can cover a good number of work related trips.

Financial and Environmental Savings

In terms of CO_2 emissions, a full-battery 60 mile trip would emit 7.9 kg of outsourced CO_2, translating to approximately 132 g CO_2 per mile (82 g CO_2 per km) or 1,320 kg for 10,000 miles per year (UK energy mix 2014 produced 494 g CO_2 per kWh of electricity). This compares to 2,252 kg CO_2 for one of the council's diesel cars (average 225 g CO_2 per mile or 140 g CO_2 per km) with additional local tailpipe pollutants, e.g. particulate matter.
In terms of financial savings, the council estimates that EVs would reach a break-even point compared their diesel cars, after approximately six years of ownership. This is a custom made and complex calculation based on the particulars of the Carmarthen pilot, which uses a rental agreement for diesel cars but owns EVs outright. This model is also based on currently unfavourable conditions for EV after sales support, distribution, and maintenance networks, for instance lack of specialised personnel or long waiting times for minor repairs. Thus the reported break-even point should lower to significantly less than six years as market conditions become more comparable to those for ICE vehicles.

EVs Usage Rates

EV usage increased to an average of over 80 % during the project lifetime compared to less than 70 %, on average, before eBRIDGE started. Average mileage increased from 22 miles (35 km) to 26 miles (42 km) per EV per day. This was despite the fact that two of the EVs spent considerable periods (of several weeks) out of circulation for technical checks in 2014, and that EVs increased from 2 to 6 during the project. This was also despite the fact that the spring of 2015 was the wettest in Carmarthenshire since 2010, and drivers stated a preference for diesel cars in bad weather. Therefore, overall substantially more electric miles were completed while at the same time diesel miles remained stable.
Monitoring of the EVs showed that travel patterns changed notably during the pilot. EVs were preferred for short trips between 1-20 miles (1-32 km). Trips exceeding 60 miles (96 km) were almost exclusively made with diesel cars.

Figure 15. Distribution of trips by vehicle type and distance (June 2013). *Source: Own work based on Carmarthenshire County Council, Neal Thomas*

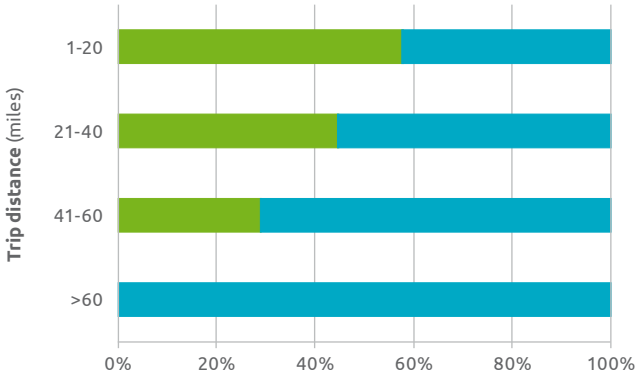
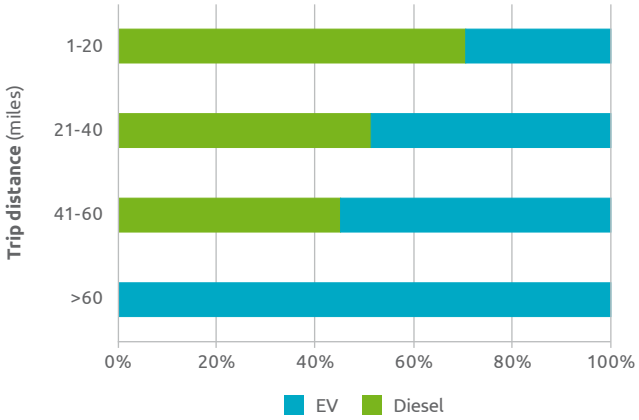


Figure 16. Distribution of trips by vehicle type and distance (June 2015). *Source: Own work based on Carmarthenshire County Council, Neal Thomas*



These results, however, do not reflect full use of the true range of the EVs. Even if the range provided by the car manufacturer, 93 miles (150 km), is not practically achievable, at least 60 miles (96 km) should be possible in real-life conditions. Therefore, substantially more EV use should be achievable in the 21-40 mile (34-64 km) range, and even in the 41-60 mile (66-96 km) range.

Driver Experience

Many employees preferred the EVs to diesel cars as their main means of transport for in-county trips. However, others seemed to be reluctant to adopt EVs due to mostly range anxiety and lack of confidence.
Potential barriers to EVs adoption were assessed through user surveys and interviews. The results showed that at least some of the range anxiety concerns expressed were not justified: some interviewees reported a perceived EV range as low as 5 to 10 miles (8-16 km). In real terms, as of 2015 the least efficient recorded trip performed on a single charge was 40 miles (60 km) mostly due to heavy load of ancillary equipment. The most efficient trip recorded was 70 miles (112 km).
Specifically, perceived barriers to EV adoption were range anxiety, the unsuitability of the vehicle for some work purposes (for instance carrying heavy equipment) and purchase price. Vehicle design, charging times and battery life were also mentioned.

Knowledge Transfer

The Carmarthenshire experience attracted other local authorities which expressed an interest in following up with similar initiatives. The knowledge transfer event in collaboration with CarPlus brought together over 25 hands-on practitioners in the fields of shared mobility and electric mobility. Attendants identified the barriers for a wider expansion of shared electric mobility in the UK with focus on Wales. The main findings referred to charging infrastructure specifically, the unavailability of chargers, their difficulty of use and the lack of compatibility of charger and vehicle type.
The complete workshop report can be found on www.ebridge-project.eu.

3.7.3 LESSONS LEARNED

The experience of Carmarthenshire County Council shows that the carpool expansion with EVs has been successful and that EVs are suitable for use in a municipal fleet in rural areas. Although acquisition costs are high, fuel savings, efficient usage and environmental benefits pay off in the longer term. Furthermore, the creation of a local charging infrastructure for future public use, as well as the accumulation of local expertise on EV procurement and management created additional second-order effects which would not have occurred otherwise.

User Attitudes

The vast majority of the employees reported a positive attitude towards EVs, feeling more confident with EVs use after an initial familiarisation period. Their participation in eBRIDGE activities contributed to the clarification of many of the misconceptions about vehicle range. Nevertheless, there is still potential to improve EV use in terms of mileage and number of trips.
The Council employees were enabled to experience EVs through their employer, which contributed to the diffusion of knowledge of EVs. This was a unique opportunity that would not have been available to local drivers otherwise, as there are hardly any EVs in Carmarthenshire, and certainly none publically accessible. Nevertheless, initial aspirations in terms of EV spillover to private life were too optimistic. The reasons for this are twofold: On the one hand, the planned opening of the Council's fleet to private use could not materialise. On the other hand, even with generous financial incentives and tax reductions, EVs are still more expensive than diesel cars, a fact that hinders private EV ownership.

Fleet Operation

The Council's electric fleet more than doubled within the course of eBRIDGE: starting from 2 BEVs there are now 6 EVs available to the employees for day-to-day duties. A substantial part of the Council staff mileage is taken over by EVs, thus lowering both the Council's emissions and fuel expenditure.
One important barrier for the expansion of the elec-

tric carpool was the lack of charging infrastructure in the region. Although the majority of ordinary trips could be covered by the current vehicle range, or complemented with battery top up at destination, a particular set of trips performed by employees carrying tools and heavy equipment were not suitable for EVs use.

The maintenance of the off-site charging points, especially fast chargers, is still an issue because they were frequently out of order, and took a long time to repair due to the lack of local qualified personnel. It is uncertain whether this affected the EV usage in any way. Funding permitting, the Council currently plans the installation of additional charging points in strategically selected locations (e.g. along the route to most popular destinations for meetings). This is expected to alleviate range anxiety for longer trips.

Municipal Level

The positive financial and environmental performance of EVs compared to diesel cars identified the potential for further carbon and cost savings for every new EV introduced in the carpool. At a critical moment, Welsh Government funding functioned as a catalyst for the Council's acquisition of EVs. Despite the highlighted advantages of EV use in a local authority carpool, the implementation of such a scheme relies greatly on external factors (e.g. election cycles or central government policies) outside the control of Carmarthenshire County Council. Due to spending cuts, the further expansion of the EV fleet will now have to be funded differently. To assist the Council with their fleet expansion plans, Cardiff University carried out an assessment of funding opportunities based on information provided by the EU-project Clean Fleets (www.clean-fleets.eu).

4 MODEL CASE: COMMERCIAL E-CAR SHARING

When discussing business models, the obvious implication is that they must be able to create economic profit. In the case of electric fleets and e-car sharing, the major challenge is to reduce the additional costs arising from the implementation of EVs compared to conventional fleets. This chapter aims at providing an overview of the different fleet operational and business models, as well as a brief introduction to the problem fields of e-car sharing. As a result, a theoretical operational approach for a large-scale e-car sharing offer is presented.

4.1 FLEET OPERATING MODELS

The operating models for electric fleets, both company-owned and car sharing, do not differ greatly from the models for conventional fleets. Currently the most common fleet models are:

Company fleet
A company (corporate) fleet is a car pool of vehicles dedicated to the mobility of its employees. Employees can have a personal company car assigned or make use of the pooled vehicles on demand. Cars can be company-owned or leased.

Corporate car sharing
Company-owned fleets imply operation costs as well as dedicated human resources for fleet management and maintenance, which is time-consuming and expensive. Corporate car sharing is the form of running a company-owned fleet as a car sharing scheme. The implementation of car sharing technology, according to some providers, can help reduce costs up to 40 %, for instance through optimised vehicle usage and fleet downsizing, but also cutting the administrative costs of fleet management. The automation of the process offers additional cost reduction potential, optimising fleet usage and easing fleet management.

Commercial car sharing
Car sharing is the short and ultra-short-term form of renting a car. Customers register once as members of the scheme, and vehicles can be booked on-demand without prior reservation. There are two forms of car sharing: station-based, where the vehicles must be picked up and returned at a fixed station, and free-floating, where the vehicles can be picked up and dropped off at any authorised parking spot within the operative area. Car sharing offers are suitable both for business and private use.

Peer-2-Peer car sharing
Peer-2-Peer car sharing (P2P CS) is a special form of car sharing where a number of vehicles either from public entities, companies or private individuals are connected to a virtual fleet by electronic devices that are installed in the vehicles. Online platforms and mobile applications allow the user to book cars from the fleet. Apart from the fact that the vehicles are not owned by the operator, P2P CS works just like “conventional” car sharing.

4.2 PROBLEM FIELDS OF ELECTRIC CAR SHARING

The operation of e-fleets is negatively influenced by a number of problem areas. In the case of e-car sharing, the overall effect is often amplified by a combination of circumstances.

Figure 17. Problem fields of electric car sharing. *Source: choice GmbH*

Investment and Residual Value

The rapid development of EV technology and the decreasing battery performance over the expected useful lifespan, make EVs technically obsolete in a shorter time-span compared to conventional cars. Also, car sharing fleets have higher vehicle rotation than other fleets. Conventional cars have a typical useful lifespan of up to 3 years. In the case of EVs, lifespan might be even shorter, though our collective experience in eBRIDGE so far suggests longer timeframes. Additionally, there are still no benchmarks for EV residual value. All this makes resale of older EVs questionable and is mostly reflected in lower residual values at the time of vehicle discharge.

Experience and Visibility

Until now, potential users were hardly able to experience electric mobility themselves. Even though several pilot projects and an increasing number of fleets provide access to EVs, the visibility of the offers is still low and operators must cope with marketability problems. Very often, electric mobility is an unknown, theoretical concept for most individuals rather than everyday practice. This is reflected in some of the eBRIDGE survey results, as is the case of Carmarthenshire City Council, where some employees indicated perceived EV range as low as 5 to 10 miles (8-16 km). Still, the majority of users involved in the eBRIDGE pilots indicated that range anxiety decreased significantly after getting familiar with the new technology and vehicle features.

The Chicken or the Egg

Electric mobility suffers from a fundamental problem when it comes to the available charging infrastructure and market uptake of EVs. In a situation with only few EVs, public administration hesitates to invest the large sums required to develop adequate public charging infrastructure. A lack of charging infrastructure in turn prevents the private sector and end users from adopting EVs, which delays prices to sink as EVs demand is low. These effects form a vicious circle which hinders widespread EV deployment without external support.

Charging Infrastructure

A deficient charging infrastructure is often the reason for complicated, long-seeking charging processes, resulting in users' range anxiety. For fleet operators a lack of infrastructure limits business opportunities (vehicle usage) due to the EVs short battery range. The lack of public charging stations, low share of fast chargers and lack of charger interoperability hinder efficient charging, thus limiting vehicle availability due to long

charging times or long distances between compatible charging points.

Bureaucracy

Compared to the operation of a conventional fleet, either in car sharing mode or as corporate and/or public administration fleet, the bureaucracy load becomes considerably heavier whenever privately owned charging infrastructure is to be built on public premises. Approval time and the lack of standard approval processes delay the overall implementation of charging infrastructure, and with that, of electric fleets.

Reliability and Range

Most EVs still present relatively low total range (below 150 km). Even though this range easily covers almost all inner-city trips, most users still feel significant range anxiety. As discussed earlier, this is to be observed mainly among non-habitual users, but even regular users of EVs might experience range anxiety depending on the trip purpose. A revealing fact is that vehicles with low battery levels are often not rented, even though the remaining range would have been sufficient for the trip in question.

Dispatching and Service

Vehicles with medium and low battery levels are often not chosen by users, either in fleet mode or car sharing mode. This leads to slow discharge until the critical battery level is reached, triggering a service process that consists of setting aside depleted vehicles from the available car pool until the charging has been completed. Though trivial, it is worth mentioning that in the same way that conventional vehicles must be refuelled by the respective driver at the specific tank capacity, EVs must be plugged in. The definition of clear responsibilities on the side of the fleet operator would help strength drivers' commitment to vehicle charging as part of a habitual routine. Still, the lack of available (not in use) charging points at the time of vehicle return or simply the lack of familiarisation with the charging process often prevents EV users from plugging in the vehicle upon return, inducing a higher service effort for the fleet operator, and with that higher running costs.

Unique Selling Proposition

Adding to the fact that EVs are highly energy-efficient, have fast acceleration as well as low noise levels, there are hardly any factors that persuade potential users to choose an EV instead of a conventional one. Environmental benefit aspects such as the absence of harmful exhaust gases appear not be appealing enough, as they have a positive effect on society as a whole, rather than on the actual user. A strong unique selling proposition (USP) compelling enough to attract and retain all end users has not been found.

Willingness to Pay

In the absence of a strong USP, additional willingness to pay for e-car sharing compared to conventional services is rather low, which means that the supplementary costs generated by the operation with EVs cannot be passed on to the customer as a higher service price and must be borne by the operator.

4.3 EXTERNALITIES OF ELECTRIC MOBILITY

Externalities are benefits or costs that affect a party which did not cause them. The affected party neither pays for these benefits, nor receives any compensation for the costs caused by third parties. From an economic point of view this lack of compensation in either way is considered a market failure that requires governmental intervention, especially when imbalances between private gains and society losses become a relevant global issue, such as air pollution, health threats and the loss of public space.

Positive externalities caused by electric mobility are:

- Noise reduction and with that a reduction of noise-induced health effects or health risks for citizens.
- Reduction of soot and pollutant emissions and with that a reduction of pollution-induced health effects or health risks citizens.
- Overall GHG reduction and subsequent mitigating impact on climate change.
- Increasing fossil-fuel independence for individuals and organisations.
- Improved image and positive marketing effects for companies or public administration operating electric fleets.

Incentive measures of electric mobility might also induce initial negative externalities. These include:

- Initially, increased total number of EVs in car sharing systems in inner-cities, until other effects materialise, like the reduction of car ownership induced by car sharing use which will eventually balance the additional number of car sharing vehicles.
- Intensification of inner-city land use and parking space issues in the short-term, generated by the increased amount of e-fleet vehicles.
- Reduced turnover for parking management where free parking applies for EVs.
- Capacity overload for dedicated lanes (e.g. bus lanes) where EVs are allowed to use them.

4.4 ELECTRIC CAR SHARING AS A PUBLIC TRANSPORT SERVICE

In light of the issues described above, we can conclude that so far commercial e-car sharing is not economically promising, especially when considering the lack of revenue opportunities. The gap between costs and turnover is currently so high, that EVs in car sharing fleets can be only introduced supported by public funding. A possible solution might be that operators could be compensated for the positive externalities caused by e-car sharing offer. For this, new market actors and stakeholders should be involved in the process of finding a suitable approach.

A general look on bike and car sharing offers shows that the long-term success of sharing systems depends mostly on the initial dimension of the service, based on the premise "supply creates demand". This is particularly true for free-floating systems. For this reason e-car sharing should be implemented at a larger scale, with broader coverage of both operational area and charging network, and supported by a larger fleet.

Consequently, potential users would perceive increased visibility of e-car sharing and ideally feel motivated to book vehicles. At the same time a large-scale service dimension opens up the opportunity of reaching additional target groups. For complex and costly offers to work, the fleet operator should ideally have a large stakeholder network as well as policy support and financial resources.

Thus, a natural next step would be a city administration that takes over the role of operator and market a large-scale e-car sharing service as a public transport service. This can be done either directly (through a public service operator) or by proxy (through a sub-contractor). An advantage compared to private operators is that cities consider a number of overarching goals that go beyond economic considerations. In this sense, the city-operator can benefit from the non-monetary benefits of such schemes and thus promote the service as a core part of an integral sustainable mobility strategy. These benefits are summed up here:

Support to National, Regional, and Local Strategies

Most countries, regions and cities have set up targets for the diffusion of electric mobility. Cities-as-operators can influence the achievement of these targets in a more direct way and benefit from synergies with existing policies and supporting strategies.

Integrated Management
City administrations-operators are in the position to steer certain aspects of an e-car sharing offer in a more effective manner than private operators, such as the development of favouring policies, effects of the e-car sharing offer on urban transport, urban development and spatial planning, compatibility with the city landscape, and the development of infrastructure.

Social Dimension
Part of the EU goals for a sustainable Europe is the development of competitive and cities with high quality of life standards. A city administration is thus responsible for safeguarding and ensuring the health and well-being of its citizens in the best way possible. In that context the reduction of air and noise pollution as well as clean and affordable transport are desirable targets.

Image and Marketing
City administrations are responsible for positioning the city in terms of vision, long-term strategy development, image, and urban appearance. A public operator can directly steer the e-car sharing service regarding these target dimensions.

Human Resources and Know-How
Ideally, the city has sufficient staff in the fields of urban development, transport planning and fleet management. These resources are ideally well-trained and familiar with the internal processes as well as with the city-specific framework conditions.

Financing
Public administrations have access to funds and financing opportunities. They can either finance the offer with own budgets or apply for national, regional or local funding support. Compared to the overall budget of bigger cities, the costs for a large-scale e-car sharing scheme are likely to be relatively low.

Stakeholder Networks
Cities have a reputable image and are usually well connected with most relevant stakeholders. This represents a considerable advantage for fruitful alliances when developing a project that brings many stakeholders together.

5 THE eBRIDGE KEY FINDINGS

The eBRIDGE project has tested the suitability of EVs for business and private trips in 7 pilot fleets with positive results: EVs work for the vast majority of trips and users' acceptance improves with regular use.
The assessment of electric mobility in the project countries provided relevant information in terms of policy and market development. Based on this and the results gathered by the pilots, we have drawn conclusions and recommendations for the improvement of electric mobility markets in the eBRIDGE participating countries, as well as for transferability of the project results to other interested cities.
This chapter starts with an overview of policy aspects and incentive measures in force in the eBRIDGE countries. A summary of the most relevant aspects of the development of scenarios for CO_2 emissions reduction follows. Finally, the chapter provides a set of recommendations for the improvement of the operational performance of electric fleets and useful tips for efficient marketing and communication, with the aim of inspiring interested parties to adopt EVs and boost electric mobility.

5.1 POLICY FRAMEWORK FOR ELECTRIC MOBILITY

A well-balanced policy framework is key to the broader diffusion of electric mobility. Incentives spur both regulation and demand for a successful EVs deployment. There are a few inspiring examples including Norway and the Netherlands. However, it is important to note that there is no one-size-fits-all solution, and even the most successful policies might not be as transferable as wished, as successful policies in a specific context do not ensure the equivalent degree of success even under similar conditions.
The purpose of this chapter is to provide an overview of the current incentives for EV deployment. A non-exhaustive list of the most common policy measures is also provided, including a brief reference to EU Directives. Successful policies are also expected to address the following questions.

WHAT PROBLEMS ARE WE FACING?

- Cities: Air pollution and noisy, congested urban environments are common challenges for European cities. Local authorities need effective measures to address them.
- Operators: Fleet managers cope with problems related to high emissions and high operational costs, both during vehicle usage and vehicle downtime.

CAN ELECTRIC FLEETS CONTRIBUTE TO SOLVING THE PROBLEMS?

- Electric fleets address these problems in two ways: EVs produce lower local emissions while a shift to fleet use (specifically car sharing) reduces the overall number of vehicles in the long run (assuming that users replace own car with car sharing services).
- The implementation of EVs in business or administration fleets directly reduces emissions and running costs. A consequent shift to e-car sharing additionally reduces vehicle downtime costs and leads to more efficient car use.
- Also, organisations joining e-car sharing offers can reduce travel costs considerably, compared to the costs associated with the operation of own fleet (or using employees' vehicles as grey fleet).

5.1.1 MONETARY INCENTIVES

Monetary incentives are an effective way to support the purchasing and operation of EVs in fleet schemes. However, they imply a budget commitment by public authorities that is costly and should be carefully planned.

Direct buying incentives
High purchasing price of EVs can be directly addressed by paying out a lump sum or a sum of money proportional to the purchasing price by public authorities. eBRIDGE examples for this are the United Kingdom, Austria, Spain, Portugal. Direct buying incentives are undoubtedly a policy measure that involves large budgetary resources.

Depreciation
Vehicles used in companies, whether as company fleet cars or as car sharing vehicles, are depreciated over their useful life expectancy similar to any other asset. Depending on the country and the tax legislation applied, depreciation time is around 7 years for conventional cars. These rules are often transferred to EVs without acknowledging that the battery as major part of the vehicle has a considerably shorter useful lifespan. An effective way of addressing this is to allow adequate depreciation times for EVs that consider the effective battery lifespan.

Tax reduction
Tax reduction is a very common measure to lower the total costs of ownership. Tax reduction or even exemption can be provided for all taxes related to EV purchasing and operation. Norway is a prominent example for the exemption of EV purchase taxes. Here an exemption of purchasing taxes and VAT is provided, making the gross price of any EV competitive with conventional ones. A more common measure is the full or partial exemption of EVs from motor vehicle taxes. All eBRIDGE countries apply some form of tax reduction.

Funding
National or regional governments in most eBRIDGE-countries provide direct funding for vehicles implemented in R&D projects. The effects of these measures are obviously limited but they provide an excellent opportunity to showcase electric fleets and how they can contribute to improving the overall mobility system. DB Station und Service AG, in cooperation with DB FuhrparkService is developing an intermodal transport hub in the Berlin-Südkreuz train station including e-car sharing (Flinkster), bike sharing (Call a Bike) and electric buses operated by the Berliner Transport Operator (BVG – Berliner Verkehrsbetriebe).

Low-interest loans
Low interest loans provide an opportunity for fleet operators to reduce capital costs when purchasing EVs. However, in times of low overall interests, as is the case today, the effect is very limited and the measure can only be of complementary nature.

5.1.2 NON-MONETARY INCENTIVES

Non-monetary incentives are a way to make the operation and use of EVs more attractive for reasons other than bridging the purchasing-price-gap.

Parking privileges
Free parking for EVs generates additional benefits for fleet operators and users of company and municipal fleets. On the one hand they reduce operation costs by cutting parking cost; on the other hand they add flexibility to the actual use of the car as the user might have access to parking space that is not available for conventional cars. Free parking for EVs is available for instance in Austria (Klagenfurt), Spain (Palma de Mallorca), Italy (Region Emilia-Romagna), Portugal (Lisbon), and the United Kingdom (some boroughs in London). Germany recently approved a law that will enable cities to decide at municipal level whether to apply this measure.

Driving privileges

Users can either access congestion zones that are not accessible for conventional cars at all (or at a certain price) or use lanes that are otherwise reserved for public transport or high occupancy vehicles. This makes the use of EVs faster and more flexible in congested inner-city areas and thus adds a real usage advantage. Milan, for instance, allows EVs to the congestion charge zones at no cost. The use of bus and high-occupancy lanes is favoured in Madrid, though this measure is strongly controversial.

Free charging

Free charging at public charging points reduces the overall operational costs for fleet operators. The actual effect depends on the energy costs that would occur without the privilege. The total effect of this measure is limited and should be combined with parking privileges (i.e. free parking with charging). Free charging is possible at public charging stations in several cities in the eBRIDGE countries such as Berlin, Lisbon, Valencia, Vigo, Milan and many Austrian municipalities. Also, free parking while charging is quite usual in all eBRIDGE countries.

5.1.3 REGULATIONS

Emission ceiling

Cars are responsible for around 12 % of total EU emissions of CO_2. EU legislation[82] sets mandatory emissions reduction targets for new vehicles which can be a strong motivation for electric mobility. To help drivers choose new cars with low fuel consumption, EU Member States are required to ensure that relevant information is provided to consumers, including a label showing fuel efficiency and CO_2 emissions.[83]

Procurement guidelines

Vehicle procurement guidelines as part of a company or local administration sustainability strategy can influence decision-making and fleet manager's willingness to adopt EVs. Depending on whether guidelines are voluntary or compulsory, they influence the implementation of EVs differently. Procurement guidelines can either establish direct targets for the introduction of EVs (absolute or shares) or emission targets. The Lisbon City Council has committed to introducing EVs to a share of at least 20 % of all newly procured vehicles. In the same way, the Berlin Senate pursues the goal of introducing 10 % EVs to all newly procured vehicles[84].

5.2 SCENARIOS FOR CO_2 EMISSIONS REDUCTION

EVs are potentially an important element of a clean and sustainable transport future. Across the world, governments have started to implement CO_2 emission cuts based on vehicle tax systems, targeting either acquisition taxes or annual road taxation. The "50 by 50" Global Fuel Economy Initiative aims at increasing the global car fleet efficiency by 50 % by 2050. To reach this ambitious goal, a higher portion of private transportation has to be electrified as conventional cars are getting closer to the limits of the theoretical efficiency of combustion engines and are unlikely to improve much further. According to Citigroup Global Markets, CO_2 emission standards are a strong driver to introduce "zero" or "near-zero" emission cars. Electricity is likely to become the preferred energy vector for a new generation of road vehicles. But the overall reduction potential of EVs is highly dependent on the assumed mixture of electricity supply and the related carbon-intensity. EVs could shift emissions to power generation facilities. Environmental benefits arising from a wider implementation of electric mobility must be designed in a holistic way ensuring that emissions reduction in the transport sector is not offset by increases of emission in other sectors.

This section presents the key findings arising from

82 Regulation (EU) No 333/2014 of the European Parliament and of the Council of 11 March 2014 amending Regulation (EC) No 443/2009 to define the modalities for reaching the 2020 target to reduce CO_2 emissions from new passenger cars.

83 Car labelling Directive – Directive 1999/94/EC, EU, 2015.

84 BEM, 2014.

the eBRIDGE pilot sites Berlin (Germany), Bregenz (Austria), Carmarthen (Wales), Lisbon (Portugal), Milan (Italy), Valencia (Spain) and Vigo (Spain) in order to analyse the usage patterns and travel behaviour of the participating electric fleets. The fleets are either privately-owned or commercial car sharing schemes and can be used for business and/or private travel.
The data collected in each trial covered 3 areas: a) characteristics of the EV fleet; b) the distance and duration of each EV trip; and c) the battery state of charge and the energy consumption.
This analysis is relevant in the European context, as there is limited (although rapidly growing) recording of data of actual EVs usage and charging patterns. The complete report "eBRIDGE Evaluation and Scenarios" is available on www.ebridge-project.eu.

5.2.1 ANALYSIS OF EV TRIPS

The data collected covers a period of more than two years. The variation in the results depends on the type of fleet: work-only fleet vehicles or all-purpose fleet vehicles, as well as by the type and frequency of the data collected during trials.
The majority of trips took place during daytime, with different peak hours. Number of trips decreased consequently during night hours (from 0:00 to 6:00 am). In addition, trip distribution does not differ greatly for work-only fleets and car sharing fleets.
The weekly distribution of trips indicated the main booking periods, which for all-purpose car sharing fleets was Saturday. In the case of work-only fleets, the distribution along the week was more uniform, with very low number of trips during the weekend, as expected.
The monthly trips do not show remarkable differences either for the type of fleet, or the months covered. The same applies for monthly travelled distance, which shows some peaks due to operational reasons (e.g. number of EVs available, fleet expansion). There are no significant differences between warm and colder periods. All the fleets however showed an increasing trend of distance travelled.
Trip duration differs from fleet to fleet. For work-only fleets, the average duration differed according to the target business distances, this being shorter for urban trips and longer for county trips, for instance. All-purpose car sharing fleets showed longer trip durations, mostly between 1-6 h. This is highly influenced by the operator pricing policy (typical trip duration for free-floating systems is approx. 30 minutes and approx. 5 km).
Trip distance for the majority of the trips in all cases was less than 50 km, with most of the trips below 15 km. This shows that range anxiety is not justified for the majority of trips.
Average speeds per trip were available only for Lisbon and Vigo. Average speed was relatively low in both fleets, below 30 km/h, indicating that the EVs were used mostly for inner-city trips.

5.2.2 ANALYSIS OF EV ELECTRICITY CONSUMPTION

The characteristics of EV demand are very relevant to understanding the charging behaviour and charging stations usage. This can be used by the distribution system operators to estimate the additional electricity demand for EV charging and assist network planning operators to accommodate the EVs additional load.
Identifying the peak hours of charging demand is useful for network managers in order to design a sound charging strategy. In the case of Lisbon, the majority of charging events started during daytime, which can result in an increase of the electricity demand during peak hours (Portugal 18:30-21:00). The installation of smart chargers could manage the charging events postponing them to off-peak times in a day, minimising the load of existing electricity infrastructure.
The weekly charging events indicates the days with high electricity demand, which in the case of the Lisbon fleet (work-only trips) showed a homogenous profile with no major differences among weekdays. When considering the monthly charging events, the Lisbon fleet showed an increasing trend, congruent with the growing usage of the EVs and the fleet expansion during the project.

Energy consumption of the fleets is highly correlated with the total fleet mileage. The monthly energy consumption of the work-only fleets showed certain higher energy demand during the colder seasons, which could respond additionally to a higher use of the heating system. The car sharing fleets did not present significant differences in their energy demand along the year. In any case, it is important to note that the number of vehicles available in car sharing schemes fluctuates quite often due to vehicle maintenance, repair, replacements, fleet expansion, etc. and with that, fleet energy demand.

The duration of the charging events provides information about the usage of the charging infrastructure and additionally about trip's length and range anxiety. In the case of the Lisbon fleet, the majority of the charging events lasted between 60-90 minutes, indicating that EVs were frequently charged so that the batteries did not reach lower charge levels. Specifically for Lisbon, it was found that the drivers used to charge the batteries whenever possible, a clear indicator of range anxiety. This behaviour was improved over time as they became familiar with battery range in real conditions.

Energy consumption per charging event provides useful information about the technical requirements of the charging stations, facilitating the design of targeted charging stations with suitable charging equipment, e.g. slow and/or fast chargers. In Lisbon, the majority of charging events required between 1-4 kWh.

Different driving speeds result in different energy consumption. In Lisbon, the majority of trips were performed at low speeds (urban trips) and showed battery consumption between 0-10 %. The weekly probability of charging station occupancy for the Lisbon fleet showed identical occupancy profiles during the weekdays, that is, higher probability than during weekends, which indicates that the majority of charging events take place during the weekdays.

To sum up, a diversity effect is observed for charging demand between pilots due to the different usage of fleets. Trial data analysis has shown that the shape of the EV charging demand depend on several factors, such as the number of EVs involved, user type and day of the week. The energy used per charging event depends on a number of factors: battery capacity, length of charge, the type of charging and driving behaviour.

It can be expected that charging behaviour will improve in time as the user becomes familiar with the battery range in real conditions, with a beneficial effect in reducing the barriers to widespread EV adoption. Understanding the charging profile of vehicle drivers and the impact of charging to local grid reliability is a key concern for utility providers. Additionally, evaluating charging characteristics and behaviours can provide valuable insights into the optimal charging levels required for home, workplace and public charging.

5.2.3 ANALYSIS OF CO_2 EMISSIONS

When considering the well-to-tank emissions of EVs for 2020, the predicted electricity generation mix is highly important, as EVs do not cause local emissions but could shift emissions to power generation facilities.

Analysis of CO_2 emissions and scenario development was based on estimates of the number of ICEs and EVs and total distances travelled, as well as on the carbon intensity projected for 2020 and 2030 in eBRIDGE countries. This analysis considered 4 scenarios for EV uptake: Business as Usual (BAU), Medium (M), High (H) and Extreme (E), and the choice of these scenarios was based on the data availability for each country.

The scenarios showed different emission reduction potential for eBRIDGE countries. The reduction potential (in Mega tonnes, Mt) was in the case of the United Kingdom between 0.5-2.2 Mt by 2020 and 2-10.5 Mt by 2030; Spain 1.5-3.2 Mt by 2020; Germany 1.5 Mt; Portugal 0.03 Mt by 2020; and Austria 0.35 Mt by 2020. These results referred to the electrification of the total passenger car fleet of each country.

Considering only the fleet vehicles in the electrification scenario, the CO_2 reduction figures (in tonnes, t) are much lower, as shown in the following table.

Table 8. Table 8: Projected CO_2 emission reduction of the eBRIDGE countries rental fleet (t).
Source: Cardiff University, Marmaras, C; Xydas, E; Cipcigan, L.

Country	PORTUGAL		UNITED KINGDOM		GERMANY		AUSTRIA	
Scenario	2020	2030	2020	2030	2020	2030	2020	2030
BAU	494.9	-	1,052.6	7,881.3	2,163.3	10,336.5	-	-
M	1,016.5		3,118.7	10,771.1	-	-	1,079.0	
H	-		6,042.6	29,423.5	3,328.2	18,376.1	-	
E	-		12,085.1	54,118.3	-	-	-	

One of the key factors for the determination of any environmental benefit from EVs was found to be the energy mix used for charging the EVs. This fact, though not surprising, highlights the relevance of coupling electric mobility and renewable energy sources development.
In 2013 the eBRIDGE countries showed a significant share of renewable energy in their electricity generation mix: Austria 68.1 %, Portugal 49.2 %, Spain 36.4 %, Italy 31.3 %, Germany 25.6 % and the United Kingdom 13.9 %. The increasing trend of renewable sources in the energy mix of the eBRIDGE countries indicates potential for further CO_2 reduction as carbon intensity of the electricity generation decreases over time.

5.3 IMPROVED OPERATIONAL PERFORMANCE

Improving fleet operational performance is key for an efficient, sustainable fleet system. Operators of electric fleets face a number of specific challenges that go beyond those of operating a conventional fleet.
Fleet performance was enhanced through optimisation measures like fleet adaptation and consolidation and matching EV model and service purpose. Likewise, integration with public transport and the adaptation of the fleet to environmental restrictions increased the intermodality of the mobility offer and user convenience.
Significant financial and environmental benefits arose from the use of EVs in all pilots, with the reduction of local GHG emissions and fuel costs savings being the major achievements.
Finally, new market niches like expert mobility management services for the elaboration of travel plans have been explored and integrated in the portfolio of activities of car sharing operators.

5.3.1 CHOOSING THE RIGHT VEHICLE FOR THE RIGHT PURPOSE

EVs suffer from two main shortcomings compared to conventional vehicles. On the one hand the effective range is limited to approximately 150 km at best; on the other hand charging takes substantially longer than simply refuelling.
The effects of these shortcomings become obvious if EVs replace conventional cars in fleets that are used for longer distances, or too many trips in a short timespan or for longer periods of time. To avoid this, a detailed analysis of user mobility patterns and EVs usage patterns should be carried out before and during the implementation of EVs.

User Mobility Patterns

During eBRIDGE, the assessment of user mobility patterns was carried out mainly by means of surveys and the analysis of automatically collected user data. For

instance, the project partner DB FuhrparkService introduced a mobile application, DB Rent Tracks, that allows users to track their individual mobility behaviour. The application is currently used in companies that wish to optimise their travel management. This software enables employees to track their mobility behaviour over a certain time-span (e.g. two weeks). Based on this data a detailed analysis of travel patterns can be provided.

Picture 28. Mobility Management Software: DB Rent Tracks.
Source: DB Rent GmbH

Vehicle Usage Patterns

The analysis of vehicle usage patterns helps identify the replacement potential of conventional cars by EVs. For instance, in the case of the Carmarthenshire County Council, a sound understanding of needs and mobility behaviour of the employees as well as usage patterns of EVs and conventional cars were key to assess the financial and environmental impacts of the car pool as well as to better plan future charging investments.
It is recommended to consider single vehicles rather than average usage rates, as this might lead to misleading conclusions. The collection of data can be based either on a logbook that is filled by employees or on automated data logging as in the case of on-board-units for car sharing.

Picture 29. Carmarthenshire County Council charging.
Source: Cardiff University, Dimitrios Xenias

5.3.2 LOWERING BARRIERS

Apart from the technological limitations of EVs, user perceived barriers are still a major issue for a wider diffusion of electric mobility. EVs available in car sharing or company/local administration fleets are not used as frequently as the available conventional cars. Very often range anxiety, lack of familiarity with and trust in the new technology are the major barriers to EV acceptance and adoption.Practical aspects such as longer charging time and limited load capacity are often considered as bearable barriers as users familiarise with the vehicles.
It could be observed that EVs regular use improves users' confidence, alleviating range anxiety and favouring a faster adaptation to the vehicle special features.
For instance, the project partner CML reported a change in the initial charging behaviour and driving style of the EV users: at the beginning of the pilot, CML chauffeurs used to charge whenever possible, an evident sign of range anxiety which gradually decreased as the drivers became familiar with the vehicles. Also, the number of speeding fines decreased, as drivers adopted less aggressive, conscious driving styles.

The E:Sharing customers at Hospital Virgen de los Lirios in Alcoy showed improved driving styles and effective charging, which led to more efficient route planning and increased number of medical visits within the vehicle range.
Accordingly, we recommend making users familiar with EVs as a first step towards EV acceptance and adoption. This can be done at different levels:

Increasing Visibility
Visibility can induce interest and eventually a demand. Electric mobility is barely noticeable in many cities. Apart from a limited number of vehicles mostly publicly funded, only few EVs can be found on the roads. Making electric mobility and EVs attractive and appealing for the end-user requires a conscious marketing plan, including a good branding and eye-catching design. Additionally, an effective communication strategy targeting specifically potential car sharing customers and/or employees by means of advertising, newsletters, internal information or even direct contact, definitely help raise awareness of EVs and the specific service. For instance, the members of the Austrian P2P-eCS initiatives reported that being part of the initiative made them feel as pioneers of a new mobility who act as ambassadors of EVs and electric mobility. Some of the initiatives developed their own EV branding, which increased the sense of belonging and visibility of the P2P e-CS scheme.

Picture 30. Austrian Peer-To-Peer e-Car Sharing initiative in Auersthal (Lower Austria). *Source: Caruso Carsharing*

Facilitating User Experience
Newcomers are mostly positive and very enthusiastic about their first EV driving experience. This practical, hands-on contact makes electric mobility a tangible experience, enabling users to learn the new technology in a way that is both exciting and reassuring. The eBRIDGE pilots carried out demonstration events and user trainings bringing EVs closer to the respective target groups. This is particularly important to attract new customers, and can be done by means of professional training sessions and/or test drives for selected business customers. In the case of car sharing fleets, EV demonstrations and test drives during events is a useful way to raise awareness of EVs and increase customer acceptance.

Picture 31. Mobility Week Event Lisbon City Council.
Source: CML, Department of Marketing and Communication

5.3.3 CHARGING & AVAILABILITY MANAGEMENT

Lower availability due to (long) charging times and lower utilisation due to low battery levels make e-fleets rather inefficient compared to conventional fleets, as charging status and battery level are factors that strongly influence user's vehicle choice. Company fleets can easily address charging management by encouraging employees to plug-in the vehicles after the booking whenever a charging station is available.
Additionally, smart booking systems are able to distribute the available EVs, according to the battery status and trip distance. This way, vehicles with lower battery levels might still be used for short trips, while vehicles

with higher charge levels can be assigned to users with longer trips.
Car sharing operators can incentivise customers to actively cooperate with vehicle charging. Station-based car sharing should provide charging points at the stations, as the vehicle must be returned there, but also using any of the public charging network points between destinations. Free-floating systems can likewise make use of the public charging network, and also consider creating synergies with energy utilities to increase the number of charging points available. For example, users who plug in the vehicle after the booking can be rewarded with free driving minutes, bookings, and similar incentives.

Picture 32. e-Flinkster charging station in Berlin.
Source: choice GmbH, Benjamin Häger

Finally, operators should be aware that efficient charging and availability management supported by adequate software and dedicated staff is necessary to ensure efficient operation of e-fleets.

5.4 EFFECTIVE MARKETING & COMMUNICATION

The development of an effective marketing and communication approach is also very important for the successful promotion of e-fleets.
The eBRIDGE pilots carried out numerous activities to raise awareness of the participating e-fleets and electric mobility in general among their specific target groups. These activities can be classified from general awareness raising measures to more specific measures to increase user acceptance, and improve user experience with advanced services and useful partnerships.

5.4.1 AWARENESS RAISING

Branded Vehicles

A branded EV is an eye-catcher that acts as a mobile advertisement for itself, thus achieving greater public awareness of electric mobility and EVs in general. Branded vehicles are a common (and sound) practice of commercial car sharing to allow customers the quick identification of the car sharing EVs, as well as a way to differentiate them from conventional cars. This is especially useful for EVs which benefit from driving and parking privileges. Extending the branding to other means of transport is very useful if the e-fleet is integrated with public transport. For example, GuidaMi car sharing in Milan provided by the local transport company ATM combined the labelling of the car sharing vehicles with corresponding advertising on the tramways.
The branding can be developed in cooperation with future vehicle users. This supports user acceptance and strengthens users' identification with the vehicle scheme. Branded EVs also identify drivers as pioneers, making a bold statement about their lifestyle and environmental attitudes.

Picture 33. GuidaMi branded e-car sharing vehicle and tramway.
Source: ATM, GuidaMi

Public Relations & Commercial Agents

Professional public relations and sales agents are very common among commercial car sharing operators to promote and sell the service. For smaller fleets, commercial agents can be a very useful way to engage new customers. They distribute promotional material to the media as part of the marketing activities but also build and maintain relationships with the target groups, mostly as contact person for media and users' requests, and acting as advocates of electric mobility.

The eBRIDGE partner MOVUS in Valencia has a dedicated PR and sales agent who is responsible for the promotion and dissemination of the E:Sharing service. Personal and direct contact with public bodies, such as universities or municipalities, and private companies broadens the scope of promotion and facilitates the organisation of EV demonstrations and workshops, contributing to a wider awareness raising of e-car sharing and EVs.

Promotion Material

Awareness of EVs and their integration in car sharing schemes in particular is still an issue. Targeted promotion material like flyers, brochures or videos helps make the public aware of electric mobility and car sharing, tackling directly the most usual misperceptions around EV and EV use. Targeted material can provide information to specific customer groups, e.g. business customers or municipalities. Distribution channels are manifold, ranging from face-to-face contacts to online channels. The target audience reached varies from individuals to a wider audience, respectively.

All eBRIDGE pilots used various promotion materials to spread the word about their activities. The Valencian pilot for example designed flyers containing information about special tariffs for hotels and public entities in order to promote the E:Sharing service among these target groups.

Picture 34. E:Sharing flyer targeting public entities.
Source: MOVUS

The Austrian pilot used testimonial video clips showing enthusiastic EV users telling about their driving experiences, which is especially inspiring for new users. The video as well as other promotion material can be found in the download section of the eBRIDGE website.

Press Releases

Taking care of a good media promotion can be very helpful especially in the initial stage of a new e-fleet service. A press release is a compelling, short, news piece to communicate with the general public but also target groups and stakeholders about a specific achievement, launch of new services, and so on. Using several communication channels, including newspapers, TV, radio, websites, and e-mail lists helps reach different user groups; local news channels or internal bulletins can be used to directly reach target groups at local areas, companies and institutions.

The eBRIDGE partner CEAGA promoted the Vigo pilot among the local stakeholders through press releases and info-notes through the CEAGA website and the automotive cluster's magazine "INFOCLUSTER", but also at regional newspapers such as La Voz de Vigo.

5.4.2 USER ACCEPTANCE

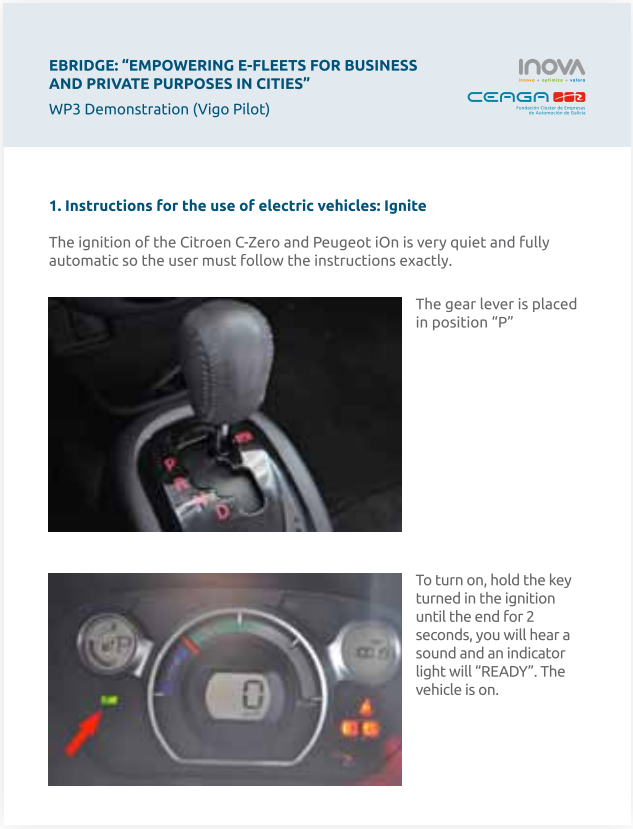
Workshops and Information Events

Approaching new customers who are not familiar with EVs and car sharing can be a challenging task, as car sharing and e-car sharing in particular are not wide-spread concepts. In this sense, workshops and information events (also attached to larger events such as conferences or seminars on the topic) are very useful to directly address the desired target group, providing specific information, enabling expert discussions, and facilitating a space for the exchange of experiences. This kind of events can be combined with test drives, allowing interested people to experience EVs hands-on.
Information and experience exchange workshops played a crucial role in the establishment and strengthening of local relations in the Austrian pilot. These are privileged occasions to talk directly with the user community and potential new members, learn their opinion and affirm their behaviour. Eventually, satisfied and motivated EV users are an ideal way of disseminating the benefits of e-car sharing and attracting new users.

Picture 35. Roundtable discussions at an Austrian workshop.
Source: NÖ Energie- und Umweltagentur

Driver Training

Training sessions for new EV users play a central role in the correct handling of the cars and alleviating new drivers' concerns in a safe environment. Targeted information on the vehicle features and handling are key for the drivers to become confident with new features such as lack of engine ignition, automatic gearbox, charging process, or to understand the information provided at the car display. Being trained in how to use an EV adequately (charging, efficient driving style), is most important, as this contributes to improved driving styles and optimised battery performance, achieving longer trips in a single charge.
Rolling trainings allow as many drivers as possible to take part in the sessions. Training should be planned with plenty of time to explain the technology in detail and allow time for questions as well as for actual driver training. They can be either conducted directly via professional trainers or indirectly via specially instructed employees (e.g. fleet managers) who pass the information to the EV drivers. Additionally, providing EV user guidelines in written form (simple instructions supported by illustrative pictures) can substitute face-to-face instruction.
The employees of the participating companies in Vigo received, together with the vehicle key, a user guide to the usage and charging of the EV. Additionally, the Human Resources managers were briefed on the adequate handling of the cars, providing support to drivers and answering specific questions.
The employees of Carmarthenshire County Council took part in a rolling training programme that made them eligible to drive the EVs. This was a safety requirement from the Council which helped employees familiarise with EVs with the help of a professional instructor.
The chauffeurs of the Lisbon City Council received specific training sessions on driving techniques and general aspects of EVs. The drivers of the pooled vehicles were briefed by the fleet manager.
In Austria, users were provided with tips for energy efficient driving, i.e. smooth driving at lower speeds



EBRIDGE: "EMPOWERING E-FLEETS FOR BUSINESS AND PRIVATE PURPOSES IN CITIES"
WP3 Demonstration (Vigo Pilot)

1. Instructions for the use of electric vehicles: Ignite

The ignition of the Citroen C-Zero and Peugeot iOn is very quiet and fully automatic so the user must follow the instructions exactly.

The gear lever is placed in position "P"

To turn on, hold the key turned in the ignition until the end for 2 seconds, you will hear a sound and an indicator light will "READY". The vehicle is on.

EBRIDGE: "EMPOWERING E-FLEETS FOR BUSINESS AND PRIVATE PURPOSES IN CITIES"
WP3 Demonstration (Vigo Pilot)

To start, depress the foot brake and release the parking brake. Far shift lever position "P" to "D" and go releasing the foot brake progressively, causing their movement was ahead.

2. Instructions for the use of electric vehicles: Automatic changing gear

Citroën C-Zero and Peugeot iOn are fully automatic, both the gearshift and in its operation.

The shift lever has 4 positions:

- **"P"**: Parking position. Used to park the vehicle. If you want to remove the ignition key, it is only possible in that position.
- **"R"**: Position to get the vehicle moving backwards.
- **"N"**: Coasting of the vehicle.
- **"D"**: Position to get the vehicle moving it forward.

Picture 36. User Guide for EV drivers in Vigo. *Source: CEAGA; INOVA*

making a rational and smart use of electric devices (stereo, GPS navigation system) and heating and air conditioning systems.

Demonstration Events

Demonstration events enable participants experience EV technology firsthand. During these information and showcase events, EVs can be fully experienced, including information sessions and test drives. Such events make an important contribution to mitigate misperceptions and lack of knowledge of EVs. A successful demonstration event should address the interests and information needs of the participants (fleet managers, employees, public authorities, relevant stakeholders, as well as the general public). It is recommendable to organise targeted events as part of a larger event to reach a broader audience. These demonstrations usually generate high interest and are very well received since the large majority of people have not been in touch with electric mobility before. Repeating these events periodically keeps the topic alive and helps increase end-user confidence on EV technology.

The eBRIDGE partner DB FuhrparkService showcases various EV models, among other electric cars and pedelecs in the Platform electroMobility at the EUREF campus. This is part of a demonstration laboratory, visited frequently by national and international delegations and companies. During specific events, for instance the eBRIDGE Conference "Urban eMobility 2020", held in October 2014, participants had the opportunity to test drive EVs on campus.

Picture 37. Test drive at the Berlin eBRIDGE Conference 2014.
Source: choice GmbH, Benjamin Häger

Role Models

As EVs are still not commonplace, end-users' confidence and willingness to embrace electric mobility are rather low. Well-known, acknowledged persons like department directors or top managers who regularly use EVs send a powerful message of the organisation's commitment to electric mobility and thus set an example for others to follow.
The Mayor and Department Directors of the City of Lisbon make use of official EVs for their daily travel. Accompanied by various promotion activities, the City Council contributes to building confidence in electric mobility as an alternative to conventional cars among employees and citizens.

Normative Messaging

Triggering behaviour change towards EV use and adoption is a complex issue as a number of barriers like battery range and purchase price still persist. There are, however, useful techniques which in certain contexts can help motivate the end-user and mitigate these barriers.
Normative messaging is a social psychology technique where the members of an identified group and behaviour are given feedback on how another comparable group performs for the same behaviour. In subtle ways, which must be carefully designed, the target group can be encouraged to improve their performance regarding the desired behaviour. Normative messaging is most effective when implemented directly at the point of relevant behaviour.
Cardiff University used normative messaging with Carmarthenshire County Council employees of their EV fleet performance against other comparable eBRIDGE pilots. By comparing with other electric fleets users, EV driving is communicated to the users as the norm rather than the exception. This was expected to increase EV usage as driving an EV for business trips would be perceived as the normal thing to do.

5.4.3 USER EXPERIENCE

Mobility Management Software

Travel plans are a useful instrument to optimise business mobility. Supported by technology-based tools and expert advice, organisations can benefit from a broad range of mobility services integrated in a tailored mobility portfolio adapted to the organisation needs, environmental policies, and budget restrictions. These tools are used to assess the organisation mobility patterns, helping identify travel needs and optimisation potential. Through smartphone apps, for instance, employees can track their daily trips automatically. This information provides the base for an extrapolation of the organisation's travel needs.
Mobility management tools are improving the way operators provide mobility services, as these tools allow benchmarking of an organisation's travel needs and facilitate the implementation of new services such as e-car sharing in an optimised, sound travel plan. This way, operators can benefit from a competitive advantage over traditional mobility providers. For the successful implementation of mobility management software, operators must ensure high quality tools that combine analysis of mobility patterns and potential for improvement in specific contexts. Operators should strive to become a partner of the organisation and contribute to the desired travel plan. In this sense, sales

staff should be trained as holistic mobility consultants, rather than merely sellers of mobility services.
A major challenge is to convince organisations to replace or complement own fleets with (e-)car sharing services. Based on the favourable conditions of the EUREF campus in Berlin, the eBRIDGE partners DB FuhrparkService and Choice developed a concept for a technology-based assessment of a company's mobility behaviour based on the principle described above. The tool chosen was the "DB Rent Tracks", a smartphone application based on the "InnoZ tracker", a similar tool developed outside the eBRIDGE project.

Picture 38. Integrated business mobility services. *Source: DB Rent GmbH*

As a result, DB FuhrparkService offers not only mobility products Flinkster, e-Flinkster, Call a Bike (bike sharing), chauffeur services and car leasing, but also comprehensive mobility management services that help define a mobility portfolio that suits the organisation best.

Web 2.0 Communication

Whereas Web 1.0 is characterised by static one-dimensional communication, Web 2.0 is based on the interaction with the internet users. Content is not only consumed but also produced by the users themselves, being an effective means of involving target groups. With the help of online tools, collaboration platforms, social media and a focus on mobile availability and responsive web design or dedicated mobile applications (apps), users can interact in real-time with the service provider and share valuable information about customer experience, suggestions for improvement, and express specific concerns and/or expectations. Furthermore, users can easily engage others through the dissemination of their personal experience in their online social networks.
The eBRIDGE partners FLI and ATM in Milan developed a marketing concept based on digital technologies combined with a gaming approach (e.g. digital logbook, social networks using geo-tagged information). This way, the GuidaMi car sharing customers can communicate their driving experiences in real-time and provide suggestions for service improvement. The results formed the basis for the customisation of the GuidaMi scheme according to the users' needs and expectations.
Online participation tools for city development are an innovative instrument to actively involve citizens with urban planning, ensuring public acceptance and increasing the efficiency of the intervention. Outside the eBRIDGE project, Choice in cooperation with the City of Berlin, developed and tested a digital map-based public participation tool. Through this tool the users of an e-car sharing service and other interested internet users can suggest locations for charging stations, contributing to a better targeted implementation of the charging infrastructure.

Picture 39. Citifier Website: Online public participation for the development of charging infrastructure. *Source: choice GmbH*

Cooperation with Leading Partners

Partnerships with key partners can contribute to a greater diffusion of electric mobility. Key credible partners can be acknowledged companies, institutions and non-governmental organisations active in the mobility field, but also individuals with significant networks, who can act as ambassadors of the new technology and help bring electric mobility to the centre stage.
This is especially important for small scale fleets and rural areas, where personal contact is very valuable. Multipliers and opinion leaders like politicians, experts, local energy or environmental associations can support the initiative and contribute to the creation of a successful dissemination network, co-develop workshops, information events, and so on, helping build trust and inspire others. Additionally, cooperation with partners with similar goals, such as European projects, is a highly recommendable way to expand the project network and the development of related activities.
ATM, the public transport operator in Milan partnered with IKEA to promote the usage of the e-GuidaMi fleet. The partnership introduced discounts on the GuidaMi membership fees, free trips, and similar incentives. At the participating IKEA stores, parking spaces were assigned to the shared EVs and equipped with chargers. A social media campaign encouraged customers to post photos going shopping with GuidaMi cars on social networks.
In Lisbon, the municipality is actively promoting the experience gained with the municipal electric fleet within the eBRIDGE project. Co-organised workshops with European-funded projects, such as "Pro-E-Bike", enabled participants to learn from others' experience and exchange knowledge on the use of EVs. With the occasion of the Mobility Week 2015, Lisbon City Council organised a diffusion campaign in cooperation with some of the most relevant stakeholders in the field of electric mobility, including public authorities, European projects, automobile manufacturers and utilities.

Picture 40. Cooperation partners Lisbon European Mobility Week 2015. *Source: CML, Dept. of Marketing and Communication*

Picture 41. The eBRIDGE Main Messages. *Source: eBRIDGE Lisbon Workshop 2015*

6 THE eBRIDGE MAIN MESSAGES

The eBRIDGE e-fleets tested innovative solutions to improve fleet usage and engage current users and potential target groups with EVs and e-car sharing. From an operational and user perspective, the EVs tested were able to meet the travel needs of the majority of users involved in the project in terms of vehicle performance and user expectations.

After 3 years of project development, with a total fleet of over 150 EVs and more than 1,800 users, the eBRIDGE Drivers of Change have proven that electric fleets are an effective way to raise awareness of electric mobility and improve users' attitudes towards EVs. The introduction of EVs in the participating fleets also generated positive environmental and financial impacts.

The operation of EV in municipal and company-owned fleets, though still challenging due to investment costs, operation uncertainties and initial users' mistrust, has shown that EVs perform as well as conventional cars for the majority of trips and purposes. Even in the case of the P2P e-CS initiatives, mostly run in rural areas, EVs achieved greater acceptance with no major issues in meeting users' needs. In these cases, both political will and commitment to long-term sustainability were fundamental to overcome the current disadvantages of EVs.

Car sharing fleets differ from municipal and privately-owned fleets in a crucial aspect: commercial operators must generate revenue from operating the system. This, considering the higher purchase costs of EVs and additional operational costs, makes e-car sharing rather expensive and so far, economically unfeasible for private operators, except where high mileage is achieved, as described in previous sections.

In light of this, we would like to emphasise that rather than revealing definitive guidance on electric fleets, this chapter provides a summary "at a glance" of the key findings and lessons gathered along the project. For us, this has been a learning process that has led to a better insight into the potential of electric mobility and EVs for urban travel and commuting. And perhaps this is the main point: accepting that any potential comes with certain constraints one has to cope with.

We at eBRIDGE are confident that the Urban e-Mobility 2020 revolution, as we envisioned it, is about to begin. And we are very positive about the role that EVs will play in making it come true.

THE eBRIDGE MAIN MESSAGES

GLOBAL ISSUES

- Electric mobility is a sound way of reducing local emissions and improving quality of life in cities and towns; global emissions can be reduced only if the electricity used to charge the EVs is generated from renewable energy sources.
- EVs as a stand-alone measure will not work: a holistic approach including energy generation, charging infrastructure, integrated urban development, and citizen engagement is necessary.
- EVs have the potential to cover a large share of trips made in urban and rural areas. Technology and charging infrastructure must develop accordingly to address current barriers.
- Electric mobility is not (yet) economically sustainable in almost any field of application. Investment to further explore relevant uncertainties, for example EVs depreciation and battery lifespan, as well as to develop standard charging infrastructure is needed.
- Policy can induce sustainable fields of application, such as congestion charge zones in city centres.

POLICY

- Monetary incentives (e.g. purchasing grants, tax reductions) have a strong effect on fleet operators' decision-making. However, spurring EVs end-user demand adequately is also necessary to achieve a mature market.
- Eventually, the second-hand EV market (former fleet cars) might induce side effects on actual users to adopt EVs.
- Non-monetary incentives (e.g. parking & driving privileges) and appropriate mobility policies should strive to achieve sustainable long-term effects.
- Promoting renewable energy use and expansion is pivotal for the successful implementation of electric mobility. Cooperation with local actors in the form of multi-stakeholder alliances is highly recommended.

THE eBRIDGE MAIN MESSAGES

USER

- EVs can cover short-distance and short-term business travels without significant range anxiety issues. Test drives, driver training, and regular EV use are needed to ease the learning curve.
- Driving training must be planned differently for private users and business users as their EV use motivation and trip purpose might differ.
- Business e-fleets and e-car sharing help familiarise users with the technology while avoiding the “purchasing cost” barrier.
- Lack of knowledge on EVs generates artificial barriers, as non-users perceive common barriers to be stronger. Familiarisation with EV technology significantly lowers perceived barriers.
- A spill-over from business to private use was not observed in eBRIDGE. Purchasing intention among the eBRIDGE users was rather low.
- The feature “electric” is not a unique selling point in car sharing. Users have hardly any additional willingness to pay more for an e-car sharing offer than for conventional offers.

OPERATION

- Fleet and charging management are costly. Free-floating schemes need more attention to charging. On-site renewable energy generation and availability of charging points help reduce costs. Lower vehicle availability increases the opportunity cost.
- Current EV models have lower maintenance costs than conventional cars, though the availability of repair workshops is rather limited.
- The need to charge determines the availability of charging points and increases EVs visibility.
- E-car sharing cannot generate additional turnover compared to conventional options. Additional willingness to pay is noticeable only for local authorities and companies. High-end vehicle models (Tesla, BMW i8) and subtle branding might increase the willingness to pay for end-users.
- E-car sharing provides easy and cost-efficient access to EVs, neutralising the purchasing price barrier. It can be easily integrated in travel plans adding flexibility to the mobility options.
- E-car sharing is a complex product to sell. Operators should consider providing additional services like mobility management services and strive to become an organisation partner for the definition and implementation of an optimal travel plan.
- Regular EV users appreciate the advantages of EVs (faster acceleration, quiet motor). Driving and access privileges can favour EV choice over conventional cars.
- Broad availability of interoperable charging infrastructure is key to achieving efficient operation and vehicle availability. This is especially relevant in the case of free-floating car sharing. On-demand, instant access is necessary.

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eBRIDGE
Power to urban fleets

THE eBRIDGE PROJECT

eBRIDGE is a co-funded EU project that promotes electric fleets for passenger transport with the aim of contributing to more liveable, vibrant and competitive cities and towns in Europe.

Based on the introduction of EVs in fleets, eBRIDGE gathers a selection of pioneering cities, so-called Drivers of Change, that have tested innovative solutions to make electric mobility a main part of their transport system.

During eBRIDGE, these schemes applied actions to optimise operational fleet performance, test and launch solutions to increase the convenience and ease of use of car sharing offers, and raise awareness on the suitability of electric mobility for urban transport and commuting.

The fleet schemes are located in Germany, Austria, Italy, Portugal, Spain and the United Kingdom, and aim at becoming real drivers of change in their communities and abroad.

THE eBRIDGE PARTNERS

The eBRIDGE team involves technical experts, academics, associations, public administrations, mobility providers and public transport and car sharing operators.

choice	www.choice.de
DB Mobility Networks Logistics	www.dbfuhrpark.de
Mobilitätsinstitut Vorarlberg Wir fördern nachhaltige Mobilität	www.mobilitaetsinstitut.at
FGM AMOR austrian mobility research	www.fgm.at
LEGAMBIENTE	www.legambiente.it
ATM	www.atm.it
Govern de les Illes Balears	www.caib.es
MOVUS	www.movus.es
CEAGA Fundación Cluster de Empresas de Automoción de Galicia	www.ceaga.com
INOVA innova + optimiza + valora	www.inovaportal.com
LISBOA CÂMARA MUNICIPAL	www.cm-lisboa.pt
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