Summary

Summative Evaluation Report: Learning from Seven European electric fleets

This report describes and analyses the main technical and behavioural aspects of the eBRIDGE fleets, and relevant lessons learnt from the seven involved sites.

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1. Executive Summary

This report is the third deliverable of Work Package 4 Evaluation and Scenarios, of project eBRIDGE. It describes and analyses the main technical and behavioural aspects of EV fleet usage after two years of project eBRIDGE implementation, and relevant lessons learnt from the seven involved sites.

It is essential to evaluate any intervention which is expected to result in perceivable change; this may include trial schemes, newly implemented policies, or other comparable measures. Without evaluation, it is not possible to gauge the success -or failure- and lessons learnt from these interventions; and it is often the case that even large government initiatives do not have an integrated evaluation component. It is not surprising, then, that often societies are faced with the continuation of an unsuccessful scheme, or the withdrawal of an actually effective policy. This results in wasting time and resources, or losing potential positive outcomes.

In eBRIDGE, we conceived and implemented a two-fold evaluation strategy which allowed us to obtain a clearer picture of the project outcomes. This approach, inspired by current principles of relevant research, includes formative and summative stages. The formative stage provides early feedback to the evolving pilot schemes - that is providing early knowledge emerging from the schemes, and ways of improving them. The results of formative evaluation were the main focus of eBRIDGE Deliverable 4.1. The summative stage aims at understanding what change occurred during the project, as well as what is the potential for change, including behaviour change, which may emerge from the project after its completion.

As eBRIDGE evolved, we monitored all sites' progress towards the project's objectives, measured key indicators, and analysed them for changes during the project. This was performed in two main ways: (a) by measuring the user perceptions and self reported behaviours relevant to Electric Vehicles (EVs) and their use and (b) by measuring objective trip and vehicle use data. Comparisons between early and late measurements of these indicators will be a main focus of this report. The results of these analyses are presented here.

Comparisons with literature on EV diffusion and adoption, as well as the evolution of car-sharing schemes, showed encouraging increasing trends for both EVs and car-sharing, but also that the overall take up of both is low. This may be due to several barriers, but also represents significant opportunities in the area. Our surveys and interviews showed these barriers revolve around costs of purchase and vehicle autonomy; and despite drivers having generally positive experiences driving the EVs, they would not consider buying one. Drivers would, nevertheless, continue using the EVs if given the option. The overall attitude towards EVs remains mainly positive; remarkably, negative attitudes were extremely rare. Overall, these findings indicate a positive general outlook for the continuation of EV use; however this use and expansion will have to take place within specific contexts (i.e. short range) and ownership arrangements (i.e. shared ownership).

2. Background and Purpose of the Deliverable

eBRIDGE started in 2013 aiming to demonstrate that the introduction of fleet schemes can facilitate the introduction of electric vehicles in urban areas. This, in turn, should improve market conditions for electric mobility. The project covers several aspects including profiling each country's EV market penetration, developing a methodology to evaluate the effects of introducing a fleet scheme and providing concrete advice to aspiring fleet schemes' stakeholders.

On this backdrop, the main aim of Work package 4 (WP4) —'Evaluation and Scenarios'— is to analyse and evaluate the short-term effects of fleets during the project, as well as the mid- and long- term effects likely to occur after the conclusion of the project. Developing scenarios for the implemented solutions will help assess the feasibility and scaling-up of this project's results.

The present Deliverable—*Summative Evaluation Report*, D4.3—reports on work conducted within the first two years of the project; it therefore relates to the implementation, monitoring and comparison of a range of travel and behaviour measures and indicators over this two-year period. The report thus aims at:

- Briefly describing the evaluation framework and indicators developed for use within eBRIDGE, for the benefit of continuity with other deliverables;

- Summarising early, formative evaluation findings on the barriers and drivers of EV use prior to or soon after pilot project launch, which were used to inform the evolution of pilot projects so that they addressed particular user needs and situational factors in each pilot;

- Comparing data from a diverse set of metrics at different time points in the project to evaluate progress and change.

The report is structured around these three aims. In the following pages we will briefly describe the evaluation framework and indicators developed in eBRIDGE (section 3), a summary of the behavioural measures findings (section 4) and a summary of the travel data findings (section 5).

It should be noted that formative evaluation, although the main focus of D4.1, was an ongoing process throughout the project: pilot sites continuously evolve and adapt, and benefit from knowledge accumulated during the project. Moreover, each pilot project was at a different stage of development when eBRIDGE began – for instance Lisbon started receiving their vehicles in late summer 2013 partly due to local elections, and by autumn they were in the process of setting up a management system; while Berlin has well established data collection procedures but only allow data release once per year; therefore not all types of data are available for all projects. These differences are reflected in the present report and the attempt was made to compare similar aspects of similar pilot sites depending on data availability at the time of writing.

3. Evaluation Methodology[1]

Evaluation constituted a key component of eBRIDGE, and in task 4.1— *Development of evaluation framework and indicators* —we developed appropriate quantitative and qualitative evaluation methods for EV fleets, as well as measures which were applied across the seven demonstration sites in six countries. These methods and measures were described in detail in D4.1 *Formative Evaluation Report*; however we also include a summary here, as the present summative evaluation also uses findings from the earlier formative steps and the two steps are, to a certain extent, interrelated.

3.1 Evaluation Framework and Methodology

Our evaluation framework comprises two main steps:

- *Formative evaluation* comprised the provision of early feedback to demonstration sites on barriers to and facilitators of EV uptake, and emerging impacts and experiences of delivering e-mobility schemes. These improved delivery in order to exploit the pilots' potential to bring environmental, economic and social benefits.

- *Summative evaluation* focused on assessing (a) attitude and behaviour change using both self reported and objectively measured data; and (b) short-term and long-term impacts from the demonstration projects. Moreover, specifically as far as the long-term impacts are concerned, they depend on further, uncontrolled factors outside of the scope of this report—such as policy context. A better methodology for dealing with such uncertainties is scenario building, and this is the subject of a separate deliverable—D4.4 *Scenario Modelling.*

Our research methods comprised both (a) *qualitative* methods, such as interviews, were used to expose reasons behind particular choices; and (b) *quantitative* methods, such as surveys and trip data, were used to map the scale and frequency of perceptions and behaviours, and make results comparable and generalisable (Bryman, 1988). Using both methods in parallel improved result reliability through triangulation (Fielding & Fielding, 1986), and helped understand how the project evolved in time.

3.2 Evaluation Indicators

3.2.1 BACKGROUND

Evaluation measures for this project were developed in collaboration with site leaders. This process ensured several important aspects of data integrity, including data representativeness and contextual factors. *Data representativeness* is important to ensure a fair spread of opinions. This mitigates the risk of acquiring a biased sample with polarised

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[1] For a more detailed description of methods please refer to Deliverable 4.1 *Formative Evaluation Report.*

views. *Contextual factors* are important for research and application as they can substantially influence the outcome of a project. Both of these aspects are very important, as participating sites varied from small, new fleets, to large fleets, established for a number of years. Similarly, management systems ranged from fully automated online booking platforms, providing access to the vehicle via a smart card (Berlin, Valencia, Milan), to manually booking the vehicle and physically taking the keys from a fleet manager (Vigo, Carmarthen). Vehicle and trip data monitoring and recording methods were also diverse and ranged from manually recording the vehicle mileage and battery status, to full satellite (GPS) tracking of the vehicle's battery status, location, speed, and even altitude in one case.

3.2.2 INDICATORS

Consequently, we developed two sets of indicators. They correspond to two categories of evaluation data; with each type of data requiring different data collection methods:

(i)   *User perceptions and self-reported behaviour.* A review of the relevant research literature exposed users' EV experiences and perceptions identified in previous studies. Findings from previous studies helped scope the key parameters and themes to be examined in the survey and interviews. These measures exposed positive and negative perceptions of EVs; helped address common misconceptions about them; uncovered users' needs and expectations from the vehicles; and helped shape the setup of each fleet.

Our survey questions focused on self-reported behaviour (e.g. driving frequency), vehicle perception and attitudes towards EVs; spillover effects (i.e., behaviour change in a different context, such as vehicle choice or style of personal driving as a result of EV use for business). The qualitative interviews with site managers were part of the formative evaluation, have been covered in D.4.1 and will not be detailed further here.

(ii)   *Objective behavioural, energy, and transport data.* These measures were developed through a bottom-up analysis in collaboration with site leaders. This process, further detailed in D4.1, yielded a broad list of measures that were common for most partners, and which were generally feasible to handle within the constraints of this project. However, each partner deviated to some extent in terms of available metrics; therefore it was not possible to achieve a perfect match of all measures across all sites. Instead, comparisons among measures and sites were made where possible; this was accomplished by comparing data from the beginning of the project to these at the end of the project, for most but not all sites.

4. Summative Evaluation

As discussed in section 3, the purpose of summative evaluation is to assess what has been learned from a project or intervention, and what has changed in its duration. Of particular interest to eBRIDGE, a comparison of perceived barriers and drivers to EV uptake before

and after the project would help understand what actions are most effective in order to facilitate the introduction of EVs in fleets in Europe, as well as what impacts and experiences emerged from the delivery of specific e-mobility schemes.

It is established from previous studies that although electric mobility is prioritised in Europe (Lue et al., 2014), European public understanding of EVs is limited, although interest in low-emission vehicles is high (e.g., DEFRA, 2009). EST (2010) found two-thirds of the UK public would like to have a low-carbon car if they could afford one, and 75% would consider fuel efficiency an important factor when buying their next car. This trend is supported by the rapid growth in sales of small, energy-efficient vehicles (Nykvist & Whitmarsh, 2008; Piñeiro & Xenias, 2014; SMMT, 2015) in recent years.

On the other hand, Graham-Rowe et al. (2012) found that mainstream car consumers perceived the current generation of EVs as a "work in progress" and too costly, despite offering environmental benefits. Concerns about vehicle range have also been expressed (e.g. Xenias & Whitmarsh, 2013; Ernst & Young, 2010).

Other research shows cost savings and environmental benefits are the most important factors that would positively influence consumers' decision to purchase an EV as their next vehicle. Access to charging points and battery driving range, and price, are the most important factors discouraging purchase of an EV (Ernst & Young, 2010). In some cases, members of the public have some (limited) experience with EVs (Graham-Rowe et al., 2012), but commonly public perceptions are based on little knowledge of current EV technologies. Moreover, there are widespread misconceptions. This suggests that major barriers to EV uptake are *lack of familiarity and experience* of EV use, both which were of core interest for eBRIDGE and are being assessed for any changes before and after the project.

At the same time, large numbers of new cars are bought by fleets; in the UK this is true for about half of all new cars (Piñeiro & Xenias, 2014). Not surprisingly, then, car-sharing schemes, and other fleet-schemes, are particularly likely to adopt EVs. For example, the Niches project highlighted the City of London's scheme to promote EV adoption in car share schemes; this can lead to a benefit-to-cost ratio of up to 4.1 (Niches, 2012). Similarly, in Spain the majority of EV sales are directed to fleets (Piñeiro & Dapena, 2014). Other initiatives like the British '*My electric avenue*' scheme (http://myelectricavenue.info/) clusters together local residents who are encouraged to lease an EV for use by the lease sharers at a street or neighbourhood level. New schemes emerge continuously and this is a very fast moving area for business and users alike; and therefore an important area to learn from.

Another aspect of introducing vehicles in fleets is that of infrastructure creation: previous research highlights that fleet demonstration projects create initial infrastructure build-up necessary for mainstream adoption (see Nykvist & Whitmarsh, 2008) and spread the financial risk which cannot otherwise be borne by individual consumers. UK consumers' interest in lower-cost mobility solutions has also contributed to a growth in car share schemes and car clubs in recent years (Nykvist & Whitmarsh, 2008). There are currently over 500 UK-based 'closed' (i.e. organisation-based, local, or regional) car share schemes, over 40 'open' schemes, and 26 active UK-based commercial car club schemes. In 2015,

these schemes totalled over 186,000 members and 3,240 vehicles (CarPlus, 2015a, 2015b, 2015c). This is a 17-fold increase from the 2006 levels of 11,000 members (Nykvist & Whitmarsh, 2008). Despite this impressive increase, car share schemes members still only represent 0.29% of the UK population. Similarly, a German National Platform for Electric Mobility report (focusing on German users) mentions increasing numbers of car sharing schemes and EVs on the road (NPE, 2012). Private automobility costs remain relatively stable over time (Whitmarsh & Xenias, 2015), suggesting that it might be harder to entice car users to give up individual car ownership. However, shared car ownership may also be able to address the changing nature of 21st century automoblitiy (Wells & Xenias, 2015).

Although not many cross European comparisons were found available in the English language, the cited examples are indicative of an increasing trend towards shared automobility with an EV focus. Although it is clear that car sharing and car clubs are growing faster than car ownership, they have yet to reach their full potential-and EV sales have experienced intermittent growth in the recent past (Vaughan, 2011). Importantly, sharing—rather than owning—a car brings with it broader benefits, such as choice of more physical exercise and the use of alternative transport modes: car club members reported making local bus trips (36%), walking 20 minutes or more (83%), and cycling (44%) at least once a week (CarPlus, 2015a). Therefore these important synergies are encouraged in line with other strategies in the direction of sustainable travel.

Consequently, this summative evaluation contributes to the understanding of the impacts of EV fleet implementation in European urban areas. As mentioned earlier, contextual factors ranging from delays due to local elections, or late delivery of vehicles, to limited datasets for commercial reasons, dictated type and quantity of available data.

4.1 Methods

Summative data has been gathered through several methods, as detailed below, from the following pilot sites.

	Berlin	Bregenz	Carmarthen	Lisbon	Milan	Valencia	Vigo
Interview	✓	✓	✓	x	✓	x	✓
Survey	✓	✓	✓	✓	✓	✓	✓
Site visit	✓	✓	✓	✓	✓	x	✓
Trip data	✓	✓	✓	✓	✓	✓	✓

Table 1. Evaluative methods applied by March 2015. Source eBRIDGE (2015)

4.1.1 USER SURVEYS

As part of the formative evaluation step, we designed a survey based on our literature review. It was then translated into the languages of those partners willing to implement them and distributed at the Bregenz, Carmarthen, Lisbon, Valencia and Vigo sites.

The aim of the survey was to explore EV users' experience with the vehicles. Of particular interest to eBRIDGE, the survey also looked at how users compared EVs to conventional (internal combustion) vehicles ard enquire about reasons for which users would (or would not) like to purchase an EV for personal use. This aspect of the survey examined the concept of *behavioural spillover* that is the transference of a specific behaviour to a new context; in this case the private adoption of an EV. Separate, independent surveys were conceived and carried out at the Berlin and Milan sites.

- *First survey:* The first wave of user surveys took place in November-December 2013 on the following samples: Bregenz, (20 out of 390 potential users responded), Carmarthen (42 out of 152 potential users responded) and Vigo (49 out of 92 potential users responded). Berlin (254 out of 750 potential users responded) conducted their own study at the same time but released their data in early 2014. Lisbon (1160 out of 6274 potential users responded) and Valencia (12 out of 50 potential users responded) collected data in the spring of 2014. Milan did not have the necessary infrastructure ready in time for the requirements of the formative assessment stage.

- *Second survey:* The second wave of user surveys took place in the Spring of 2015 and after each specific pilot project had been running for at least 12 months, as part of the summative evaluation, to the following samples: Bregenz, (54 out of 390 potential users responded), Carmarthen (36 out of 152 potential users responded), Vigo (513 out of 547 potential users responded), Lisbon (884 out of 6274 potential users responded) and Valencia (11 out of 50 potential users responded). Berlin did not conduct a second survey due to participant fatigue, which describes the saturation of participants with providing data. Milan also conducted an independent survey in the Spring of 2015 and released their data in May 2015 – but there were neither common elements with the eBRIDGE survey, nor previous user survey available to compare with.

The combination of user surveys, managers interviews (see D4.1) and relevant literature, helped provide a more complete understanding of EV perceptions than any single measure could have achieved.

4.1.2 VEHICLE/TRIP DATA

A further point of reference we introduced to this report was trip data-specifically mileage. Although we were not permitted to link these data to specific users and their perceptions or experience with EVs, it was important that we monitor the evolution of trip length and duration and vehicle availability where possible. These measurements were taken at different stages of the project, depending on the particularities of each site. This was important so as to inform the change experienced in each project over time, as well as the possible effects of targeted interventions (see 4.1.3). As a bare minimum, number and length of trips were recorded in all cases; however, as was the case with all data, some sites did not release this data due to commercial sensitivities. It is worth noting that the trip data reported here

correspond to summative data of interest to the evaluation of the project as a whole. The reader can find a much more detailed presentation of trip data, CO_2 profiling and related specific data in Deliverable 4.4 Scenarios modelling.

4.1.3 INTERVENTIONS

In a sense, the whole of project eBRIDGE can be seen as an intervention on existing EV fleets, which would otherwise not have been exposed to this diverse European project. For example, eBRIDGE partner sites had regular contact with their drivers to inform them of eBRIDGE news, request their participation in eBRIDGE surveys, or similar events. These activities raised their site's profile in ways that would not be available outside this project.

However, there were also two experimental interventions targeting specific sites. The first comprised the provision of information on specific barriers which were identified during the formative stages. Specifically in the case of Carmarthen fleet, locally identified perceived barriers were targeted, such as the true range of vehicles and ease of recharging; further benefits of the locally available EVs were also highlighted and summarised in a laminated card (see figure 1). The cards differed, depending on whether they were targeting an EV or a diesel car driver, and were placed at a visible place on the car's dashboard (see figure 2).

Figure 1 In-car information cards. Source: eBRIDGE (2015)

The second intervention comprised sending an email to employees / drivers of EVs. The content of this email was designed according to normative messaging practices (Nolan et al., 2008). By informing participants of the actions of a comparable group on a specific behaviour, they were expected to consider that behaviour was the norm rather than the exception-in this case EV driving. Similar approaches have been successfully deployed elsewhere (Goldstein et al., 2008) although content details are tailored to each case and must be guided by a behavioural sciences practitioner with relevant experience.

Two sites were deemed appropriate for the implementation of these interventions – Carmarthen and Lisbon. This was dictated by the need to contact a closed pool of regular drivers and obtain multiple data from sites with consistent activity.

Since there was no way of connecting the driver data with trip data, the exact extent of these interventions cannot be ascertained. However, focused contrasts of the user and trip data on the specific sites, before and after the special interventions took place was expected to reveal at least in part whether the intervention had observable effects.
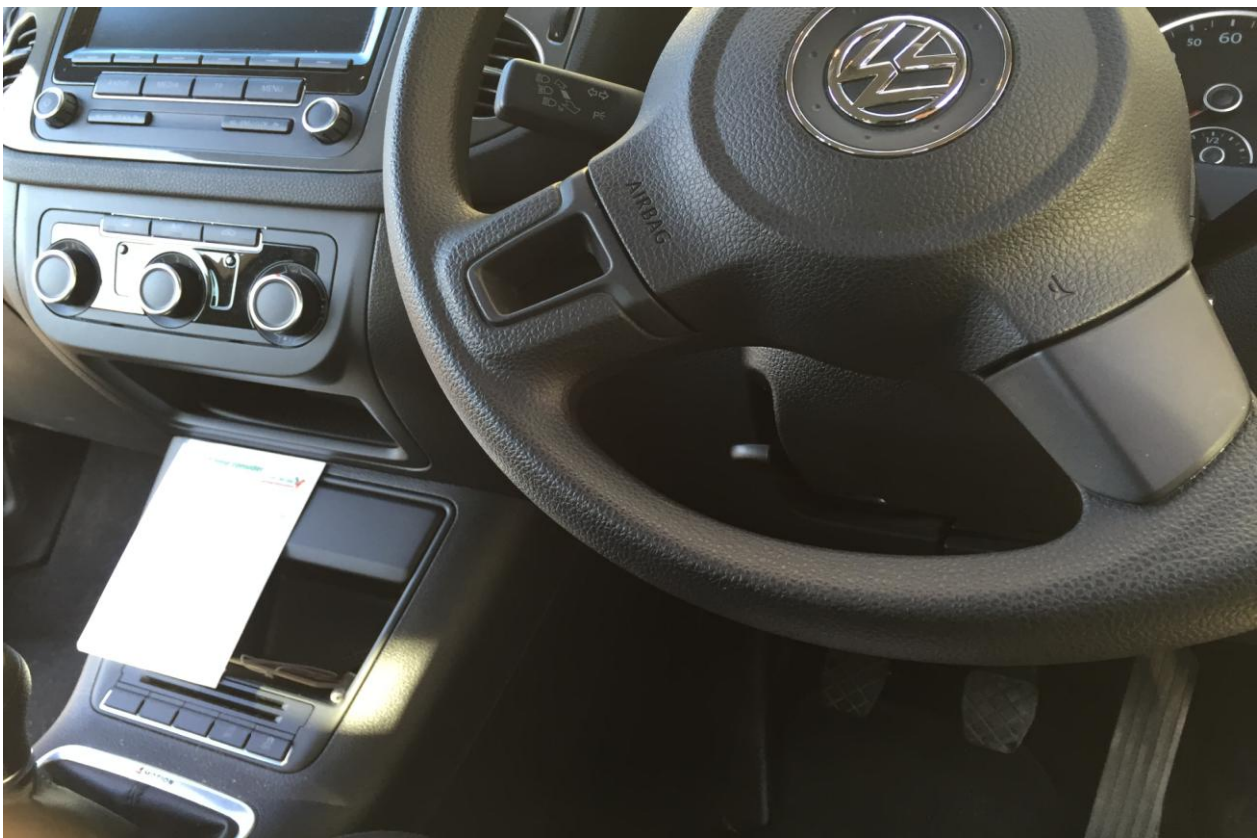

Figure 2 Indicative position of in-car information card. Source: eBRIDGE (2015)

4.2 Results

The analysis of our combined methodologies included key comparisons of our metrics at the beginning and end of the project, as well as before and after our specific interventions on the relevant sites. Combined with the findings from D4.1, these provide insights on how the project evolved over time.

4.2.1   USER SURVEYS

User general experience

The user experience has been variable but positive or very positive in the five sites we acquired comparable data from (Figure 3). Quiet operation and silent motor were advantages

identified by drivers and fleet managers, as was novelty -many drivers chose EVs in order to familiarise themselves with them. With such diverse samples, general trends are more important than detailed comparisons; robustness over time is also important and encouraging for involved fleets as it shows a positive user experience throughout the project.
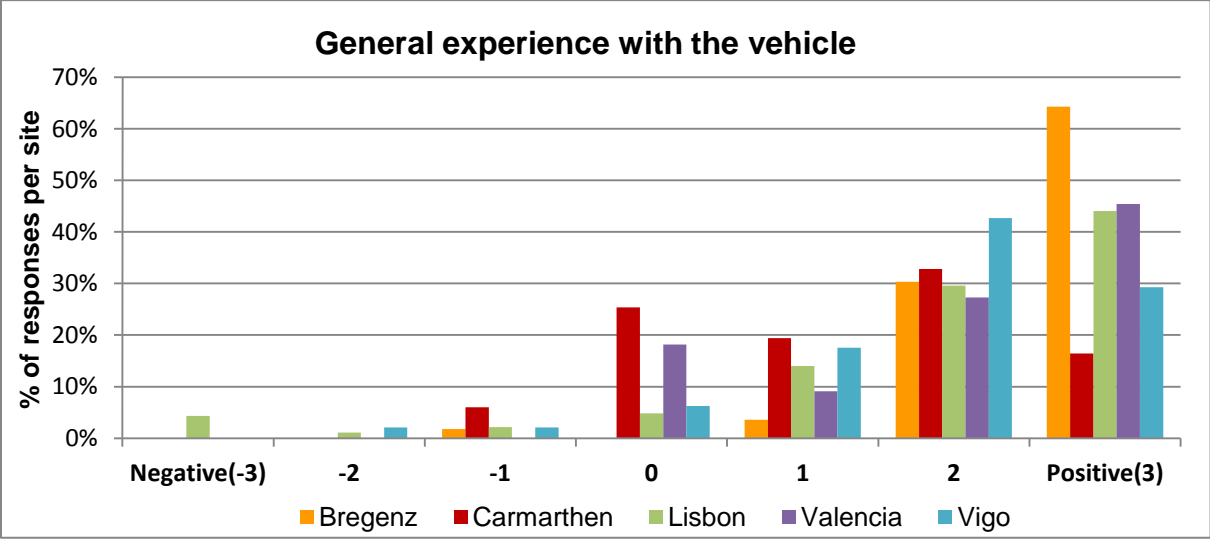

General experience with the vehicle

Figure 3 Users' general experience, five sites. Source eBRIDGE (2015)

Perceived operational / maintenance costs

A different pattern of results emerged when survey respondents were asked whether EVs or conventional cars were more economical to run and maintain. A noticeable polarisation of responses was evident with significant percentages indicating that participants did not know the difference in costs involved (Figure 4). A notable exception, however, was the Austrian sample, in both waves of the survey. It is not clear why this was the case, but a plausible explanation may rest with the different levels of involvement with maintenance (some Bregenz drivers are also the owners of the vehicles, which was not the case in other sites). The high numbers of drivers who did not know whether ICEs or EVs are cheaper to run and maintain was a surprising result in itself, given that most drivers were provided some degree of training and familiarisation with the EVs. An analysis between EV users and non users in Lisbon showed a picture similar to that of the general Lisbon sample, suggesting that it is not the use of the EV that determines knowledge of its expenditure and liabilities, but rather financial responsibility for it. Note that private, individual EV owners were not interviewed in this project, and therefore it is not possible to directly compare the reciprocal views of private users who would be responsible for these costs. It is important however that fleet managers responsible for operation and maintenance praised the reduced running costs of EVs –as detailed in D4.1 and in Xenias (2014).
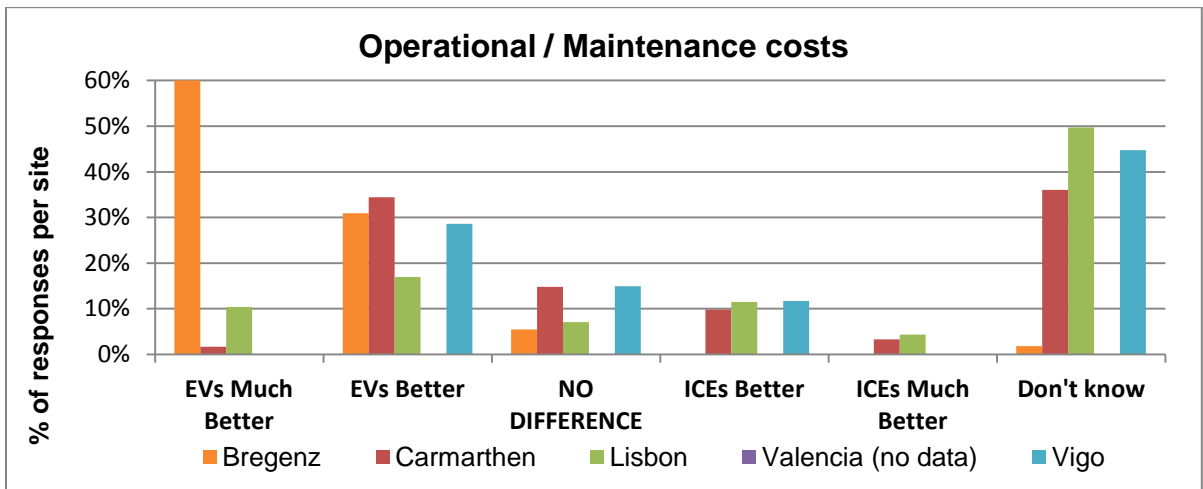
Operational / Maintenance costs

Figure 4 Perceived operational/maintenance costs, five sites. Source: eBRIDGE (2015)

Willingness to use EV again, and potential for purchasing an EV

An clear picture emerged for both waves of the survey when asking drivers if they would use the EVs again. The overwhelming majority of users –reaching 100% in some cases— indicated that they would use EVs again. On the other hand, drivers' consideration for buying their own EV revealed the exact opposite picture, with the vast majority not considering purchasing their own EV. Given the often cited barrier of high acquisition cost of EVs, this result is not surprising. Data from Bregenz were unexpected; but given that this is also the only peer-to-peer scheme in eBRIDGE, this result likely reflects the attitude of existing EV owners. The comparison of drivers who had experienced EVs to those who had not (see Figure 5) was intriguing. This comparison was only possible in Lisbon and Vigo. Lisbon EV users were equally divided on their purchasing intention, while non users where slightly in favour of buying an EV. However, Vigo drivers were less likely to purchase an EV after driving one. Since their overall attitude was more positive after driving (see next section) it can only be assumed that something in the driving experience was powerful enough to influence their purchasing intention. This can be any of a number of barriers identified locally, such as the size of the vehicle and their suitability for certain uses at work (also see D4.1).
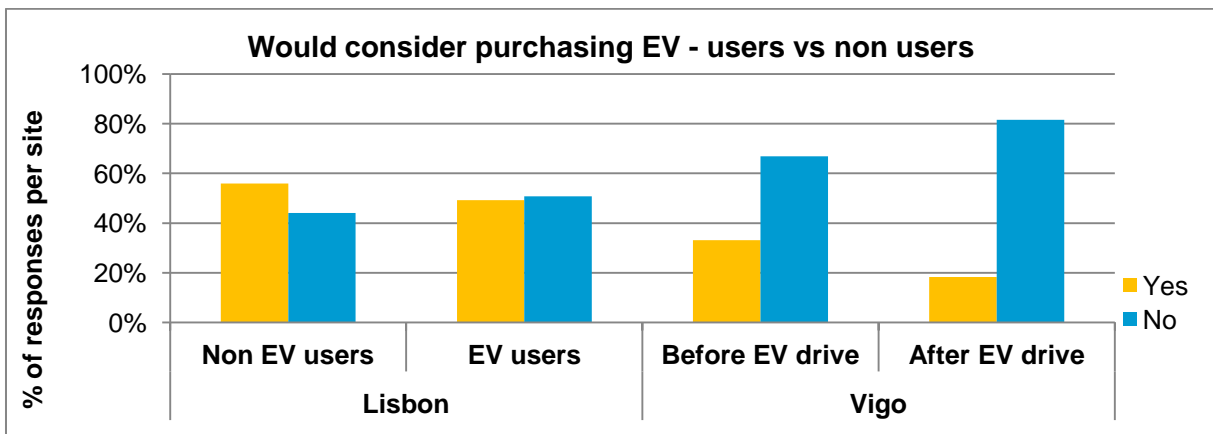

Would consider purchasing EV - users vs non users

Figure 5 EV purchasing intention. Source: eBRIDGE (2015)

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Reported barriers to EV adoption

Results here largely corroborate previous findings citing high acquisition price and limited autonomy as the key barriers to EV adoption; also found in our 2013 Carmarthen data. Although we will not detail further barriers per site here due to space limitations, a direct comparison between EV users and non users from Lisbon revealed interesting patterns (Figure 6). These were contrary to expectations, with EV users reporting higher levels of range anxiety and concern for cost compared to non EV users. One possible reason for this may be the compatibility issues between EV types and charger types; this worsens range anxiety, especially for new EV drivers (further details can be found in *D4.1* and the *Expert Perceptions of barriers and opportunities for shared electric mobility report* (Xenias, 2014).

Cited barriers to the adoption of EVs*
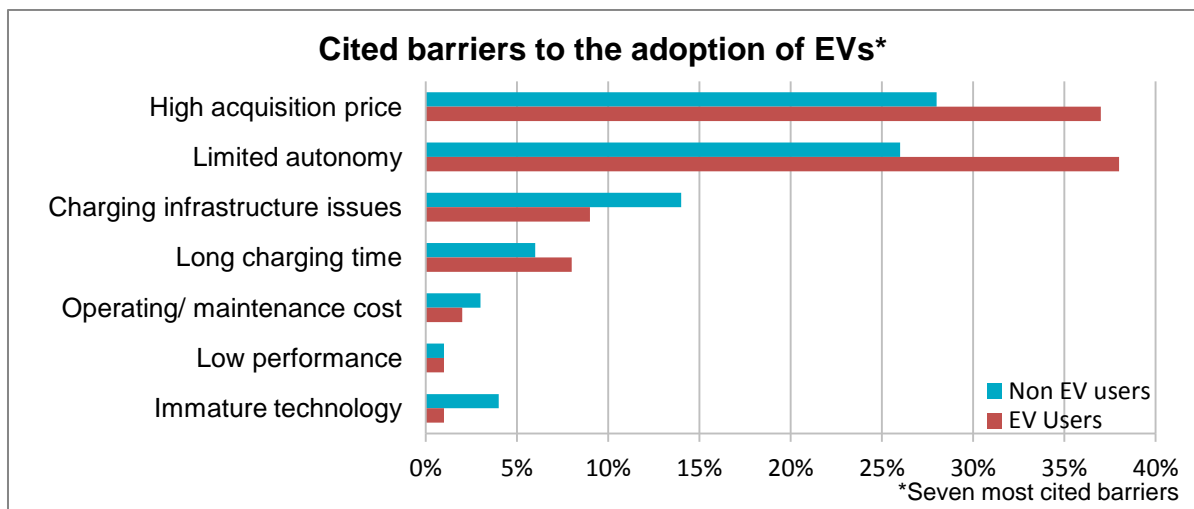
*Seven most cited barriers

Figure 6 Barriers to purchasing EVs-Lisbon. Source: eBRIDGE (2015)

Size of vehicles was also reported as important in Carmarthen and Vigo, with many drivers finding EVs too small – elsewhere this varied with the particular details of each pilot; these include location (at city centre or further afield) and main use of the vehicle (carrying tools and other equipment as opposed to going to meetings). Finally, participants from Bregenz and Carmarthen mentioned reduced comfort in the winter as heating and similar ancillaries consume large quantities of energy which reduces the EVs already limited range.

Overall attitudes towards EVs

An overwhelmingly positive response from most participants continued the previous trends on overall attitudes towards EVs. All sites reported positive or very positive attitudes towards EVs with low to negligible neutral or negative attitudes, in both survey waves. Additional comparisons were possible for users vs non users of EVs, as well as to assess the effectiveness of our normative email intervention. With regards to the former, Lisbon and Vigo were contrasted and there was a noticeable increase of positive attitudes to EVs for drivers with EV experience, compared to those without experience of driving EVs, as seen in Figure 8. Therefore direct experience with the EVs improved user attitude toward them.
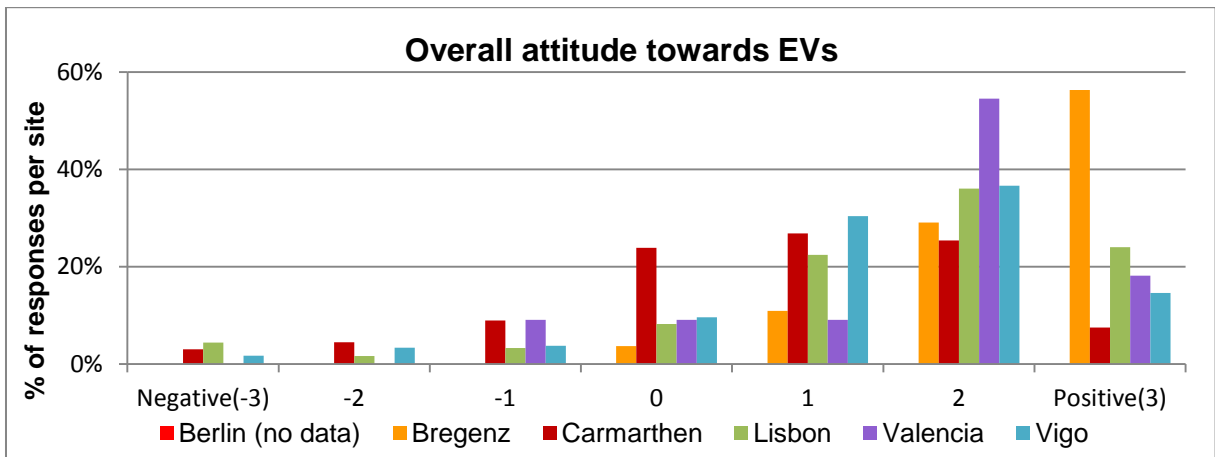
Overall attitude towards EVs

Figure 7 Attitude towards EVs, six sites. Source: eBRIDGE (2015)

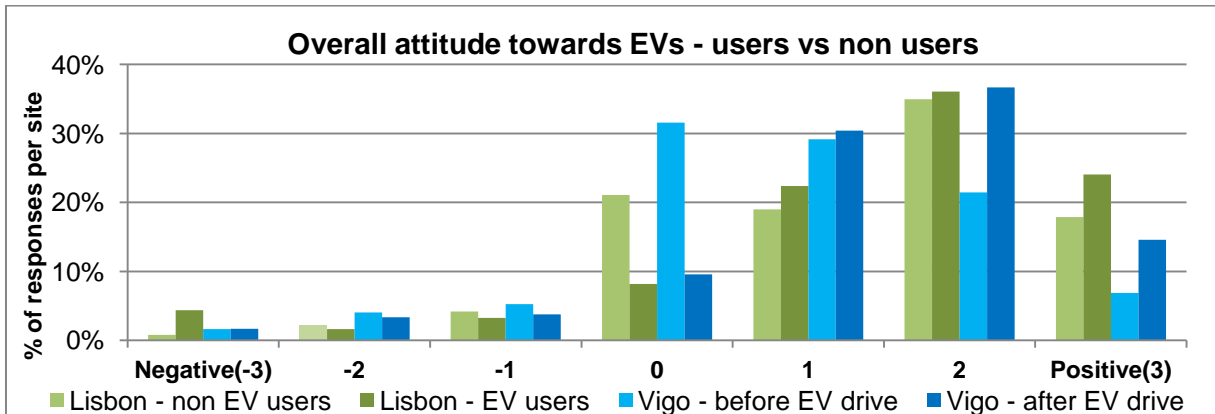**Overall attitude towards EVs - users vs non users**

Figure 8 EV drivers vs non drivers comparison. Source: eBRIDGE (2015)

Regarding the normative email intervention, EV drivers who received our normative message (email) reported substantially improved attitudes towards EVs compared to drivers that did not receive this intervention (control group). This shows that such simple intervention has measurable effects. Although not possible within eBRIDGE, it would be interesting to measure whether these effects are long lasting –e.g. 6 months after the intervention.
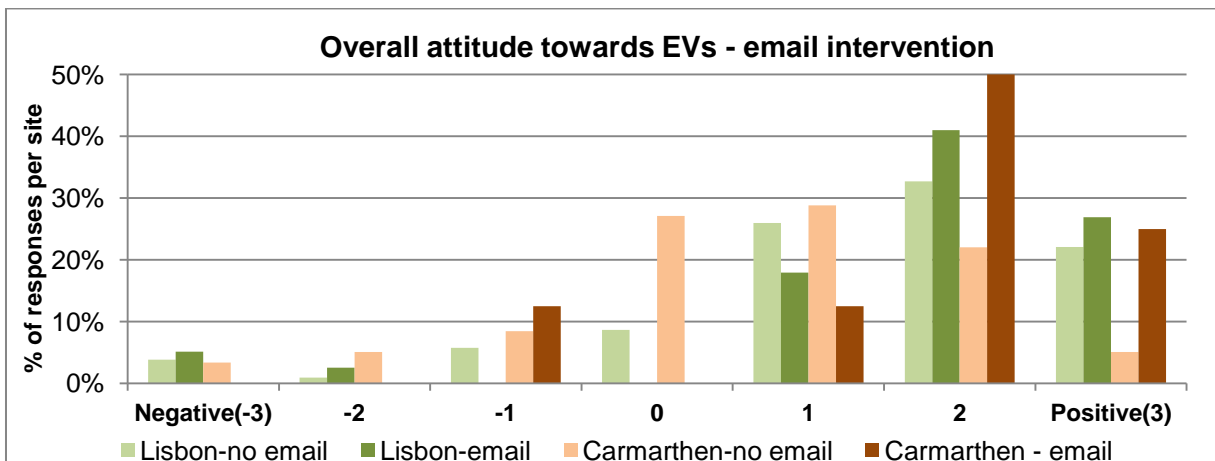

Overall attitude towards EVs - email intervention

Figure 9 EV drivers vs non drivers comparison. Source: eBRIDGE (2015)

4.2.2 TRIP DATA

In this section, summary data of trips and vehicle bookings are presented. The five sites with data comparable for this section showed variable performance in EV kilometres over two years of project eBRIDGE (Figure 14). Several contextual factors impacted on this result, for instance the Lisbon fleet was not operational until the end of 2013, and some fleets only reporting data from a very small number of cars.
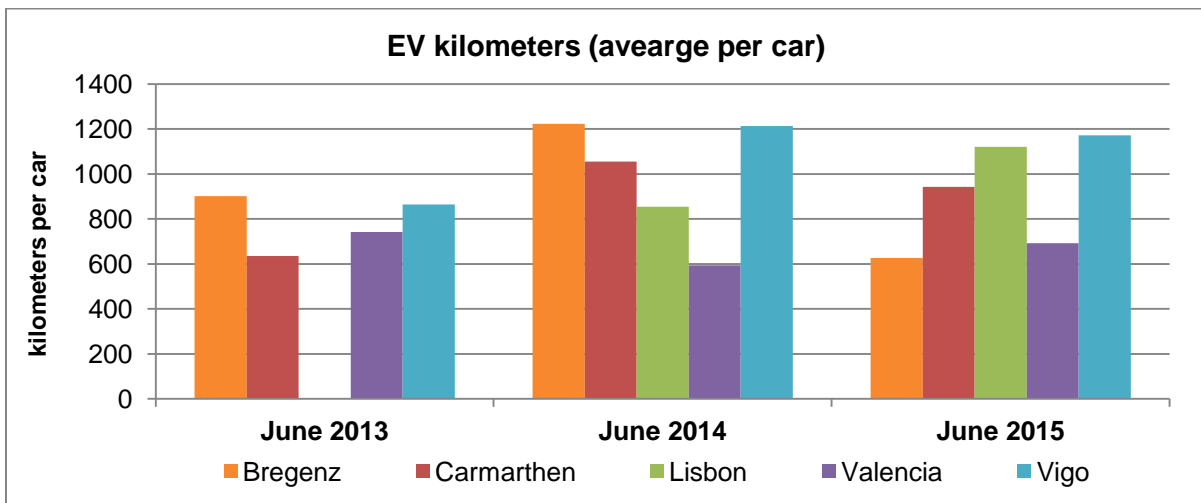

Figure 10 EV kilometres per car (average), 5 sites. Source: eBRIDGE (2013-2015)

A clearer picture emerges for Carmarthen where data extend to before the commencement of eBRIDGE and interesting comparisons revealed a fluctuation of the numbers of employees in their preference to EVs as opposed to Diesel cars. After the initial introduction of EVs in the fleet in 2011, their use fluctuated during eBRIDGE but EV preference then stabilised for the remainder of the project; and in spring 2015, following our intervention, the preference for Diesel cars was decreased while it remained stable for EVs (Figure 15).
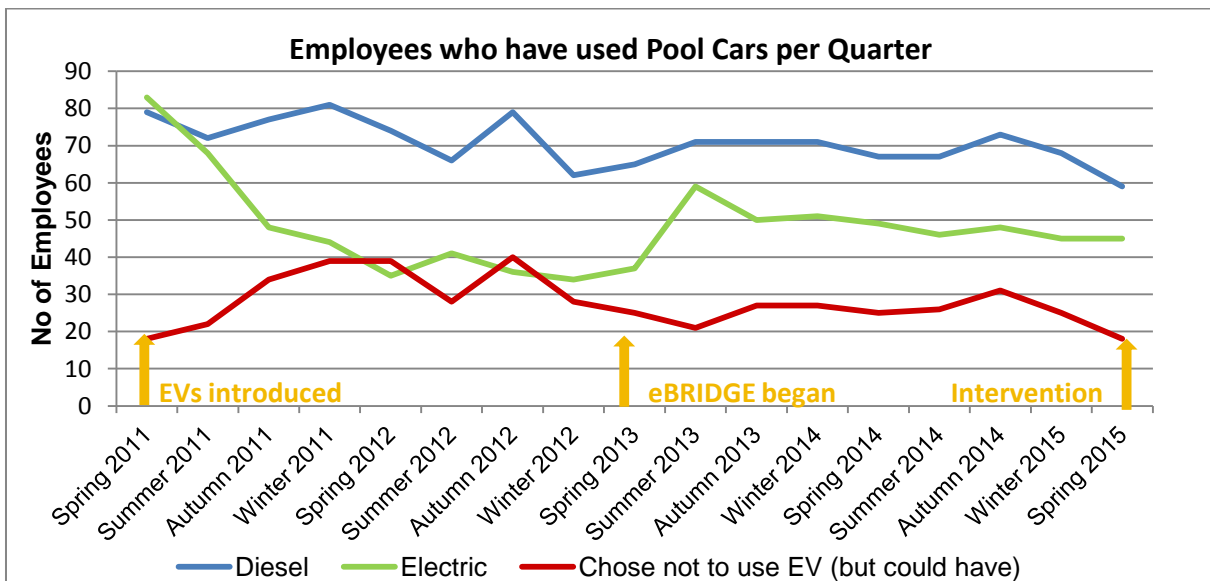

Figure 11 EV/Diesel preference in Carmarthen throughout eBRIDGE. Source: eBRIDGE (2015)

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5. Conclusions and Next Steps

This report summarised the evaluation framework and indicators developed specifically for this project and in close collaboration with site managers. Details are presented in D4.1 *Formative Evaluation Report.* Throughout the project, we liaised closely with all pilot schemes involved in eBRIDGE. We monitored the schemes for changes in context or structure such as organisation structure or operational requirements. We modified our evaluation tools and materials as necessary, and provided additional help where possible.

Key findings that emerge from our evaluations indicate that drivers had positive experiences with EVs; also, that they would mostly repeat the experience of driving an EV. These were robust and improving trends at the start and end of the project. Predictably, the vast majority of drivers also reported that they would not consider purchasing an EV for private use, and the most frequently cited reasons for this were high acquisition cost and range limitations. The driving experience of EVs did not seem able to reverse this trend and acquisition cost appears to be an insurmountable barrier for our participating drivers; which is not surprising especially in times of austerity experienced by most European economies. Therefore for EV adoption by individual drivers, a key facilitating measure would relate to lowering the retail price, since current prices are unanimously viewed as prohibitive. However, the driving experience did improve the user perception of EVs which suggests that if contextual factors – e.g. economy– improve, there should be more subsequent willingness to purchase EVs.

Increased autonomy seems to be another key factor that could facilitate further use of, and improved attitudes towards EVs. This could be achieved either by higher capacity batteries, more efficient powertrain, or increased opportunities to recharge along favourite routes. More charging infrastructure would help both existing schemes and potential new adopters, as would measures relevant to parking privileges and tax relief.

A separate trend that emerged from some participating sites is the unsuitability of EVs for the transportation of goods or equipment. Therefore, the use of EVs in some sectors may only be warranted if it does not involve carrying heavy loads, or if different vehicles are used. Moreover, there are compatibility issues between charger types and EV types, as there were no imposed national or international standards for EV chargers at the time of writing.

An interesting finding was the measureable impact of our psychologically informed interventions in two participating fleet sites in the UK and Portugal. In both cases, we recorded an increase in drivers' positive perceptions of the EVs. Although this was a small scale experimental intervention, and results should not be generalised without replication, this was a simple and easy to implement way of boosting motivation and sense of achievement in a pool of participating drivers. There were mixed results on corresponding mileage in those sites but this was attributable to external factors at the time of intervention.

The user surveys reported here were part of both the summative and the formative evaluation, and served as a repeated data point for comparisons across sites in the early and late stages of the project; therefore there is some overlap between D4.1 *Formative Evaluation Report* and D4.3 *Summative Evaluation Report*. These comparisons are important for intervention evaluation; they trace how the project evolved, whether the attempted interventions had any results, and help identify factors that influence these results.

Learning from this exercise helped understand real world impacts of the eBRIDGE associated sites/schemes in the short and medium term. They feed into further eBRIDGE Deliverables which compared aspects of the participating EV schemes, including D4.4 *Scenarios Modelling,* D3.2 *Key Findings on Impacts, Barriers and Potentials of EVs in fleets,* D5.2 eBRIDGE Toolkit: Successful operation and promotion of electric fleets in Europe; an insider's guide and D5.3 *eBRIDGE Guidelines for the implementation of EV fleets.*

To our knowledge this project is one of very few that has attempted a comparison across so many contexts and parameters, including a real-life intervention. There was wide variability in the quantity and quality of accessible data in this project, which limits our ability to draw generalisable conclusions with regards to EV fleet or user behaviour. Nevertheless, our somewhat complex emerging picture of results seems to suggest the following main points:

a) the overall potential for further use and expansion of EVs is positive;
b) mitigating cost could be a decisive factor for EV adoption;
c) EV use is more likely to remain in and around cities or limited geographic areas, due to limited battery range and issues with recharging infrastructure;
d) infrastructure needs to be compatible and interoperable-not all types of charger can serve all types of EV currently;
e) nuanced, psychologically informed interventions can have small but tangible effects on user perception of EVs-although results need to be replicated for confidence, and are subject to contextual factors.

Integrating points (a), (b) and (c) suggests that any viable solutions for the implementation of EVs should involve:

- *shared* (rather than private) ownership of EVs;
- in areas with *dense recharging infrastructure* (e.g. cities) rather than areas with sparse recharging network; and
- *personal or very light goods/equipment* (rather than heavy goods/equipment) transport—within the vehicle's range.

It became clear that EVs are not 'one size fits all' vehicles, but operate better within targeted uses; that car sharing schemes are necessary if EV use is to be broadened and increased in the short- to mid-term; as well as that individual ownership is hampered by high costs, and this is likely to continue in the future.

It is reminded that not all schemes participating in eBRIDGE are included in all analyses, as they had different characteristics (for example, different target audiences), and were bound by different limitations (such as limited release of data or different data collection methods and level of detail). Therefore, the present dataset needs to be treated as context specific, and with caution in terms of finding generalisability. However, we do not have a priori reasons to expect that the present results and conclusions will significantly deviate from those of other comparable schemes.

We hope that this information will help draw attention to the potential benefits and drawbacks involved in electric mobility schemes, and help existing and new EV schemes realise their full potential.

6. References

Bryman, A. (1988). *Quantity and Quality in Social Research.* London: Unwin Hyman.

Burgess, J. & Chilvers, J. (2006).Upping the ante: a conceptual framework for designing and evaluating participatory technology assessments. *Science and Public Policy, 33,* 713-728.

Carplus (2015a).*Annual survey of car clubs 2014/2015 – England and Wales (excluding London).* Carplus, UK

Carplus (2015b).*Annual survey of car clubs 2014/2015 – London.* Carplus, UK

Carplus (2015c).*Annual survey of car clubs 2014/2015 – Scotland.* Carplus, UK

Chambers, F. (1994). Removing confusion about formative and summative evaluation: Purpose versus time. *Evaluation and Program Planning*, 17 (1), 9-12.

DEFRA (2009). *Attitudes and Behaviour Towards the Environment.* Department for Environment, Food and Rural Affairs.

EA Technology Ltd (2013). http://myelectricavenue.info/ (accessed 15 November 2013).

Elden, M. & Chisholm, R.F. (1993). Emerging Varieties of Action Research: Introduction to the Special Issue, *Human Relations, 46* (2), 121-142.

Ernst & Young (2010).*Gauging interest for plug-in hybrid and electric vehicles in select markets Compared results*. Ernst & Young Global Automotive Center.

EST (2010).*Energy Saving Trust attitude tracker*. London: Energy Saving Trust.

Fielding, N.G. & Fielding, J.L. (1986).*Linking Data*. Newbury Park, California: Sage Publications.

Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research, 35,* 472–482.

Graham-Rowe, E., Gardner, B., Abraham, C., Skippon, S., Dittmar, H., Hutchins, R., & Stannard, J. (2012).Mainstream consumers driving plug-in battery-electric and plug-in hybrid electric cars: A qualitative analysis of responses and evaluations. *Transportation Research Part A: Policy and Practice, 46* (1), 140-153.

Luè, A., Bresciani, C., Colorni, A., Lia, F., Maras, V., Radmilović, Z., Whitmarsh, L., Xenias, D. and Anoyrkati, E. (2014). Future priorities for a climate-friendly transport. a European strategic research agenda towards 2030. *International Journal of Sustainable Transportation*, 140926101211007. (10.1080/15568318.2014.893043)

Maibach, E., Roser-Renouf, C., &Leiserowitz, A. (2008). Communication and marketing as climate change intervention assets: A public health perspective. American Journal of Preventive Medicine, 35(5), 488-500.

Marmaras, C., Xydas, E., and Cipcigan, L., (2015). *Empowering e-fleets for business and private purposes in cities: Scenario modelling.* Technical Report.

Niches (2012).*Guidelines for Implementers of Electric Cars in Car Share Clubs*.WG4 Report.

Nolan, J.M., Schultz, P.W., Cialdini, R.B., Goldstein, N.J. and Griskevicius, V. (2008).

Normative Social Influence is Underdetected, Personality and Social Psychology Bulletin, 34: 913-923.

NPE – German National Platform for Electric Mobility (2012). *Progress report of the German National Platform for Electric Mobility (Third Report).* Berlin: GGEMO.

Nykvist, B. & Whitmarsh, L. (2008). A multi-level analysis of sustainable mobility transitions: Niche development in the UK and Sweden. *Technological Forecasting & Social Change, 75*, 1373–1387.

Pawson, R. and Tilley, N. (1997).*Realistic Evaluation.* London: Sage Publications Ltd.

Piñeiro, C. and Xenias, D. (2014). *e-mobility fleet schemes and market potentials in the United Kingdom.* Technical Report.

Piñeiro, C. and Dapena, B. (2014). *e-mobility fleet schemes and market potentials in Spain.* Technical Report.

Robinson, P.C. (1988). The management of language training. Language Teaching, 21(3), 146-157.

Rowe, G. and Frewer, L. (2000).Public participation methods: a framework for evaluation. *Science Technology and Human Values, 25,*3-29.

SMMT (2015). New car registrations (May 2015). Retrieved August 2015 from: http://www.smmt.co.uk/2015/06/new-car-registrations-grow-steadily-as-ultra-low-emission-vehicles-surge-past-10k-mark/

The Met Office (2015). Historical weather data for west Wales. http://www.metoffice.gov.uk/pub/data/weather/uk/climate/stationdata/aberporthdata.txt (accessed 10/07/2015).

Vaughan, A. (2011). Electric car UK sales sputter out. *The Guardian.* 21 Oct. http://www.guardian.co.uk/environment/2011/oct/21/electric-car-uk-sales-sputter

Wells, P. E. and Xenias, D. (2015). From 'freedom of the open road' to 'cocooning': Understanding resistance to change in personal private automobility. *Environmental Innovation and Societal Transitions*, 16, 106-119. (10.1016/j.eist.2015.02.001)

Whitmarsh, L. and Xenias, D. (2015). Understanding people and cars. In: Nieuwenhuis, P. and Wells, P. eds. *The Global Automotive Industry*. Wiley.

Xenias, D. & Whitmarsh, L. (2013).Dimensions and determinants of expert and public preferences for low-carbon transport policies and technologies. *Transportation Research Part A, 48*, 75–85.

Xenias, D. (2013). *Empowering e-fleets for business and private purposes in cities: Formative evaluation report.* Technical Report.

Xenias, D. (2014). *Expert perceptions of barriers and opportunities for shared electric mobility.* [Online]. Project eBRIDGE. Available at: http://www.ebridge-project.eu/images/ebridge/docs/ktn-meeting-report-final-layout-reduced.pdf

The Project

eBRIDGE is a co-funded EU project to promote electric fleets for urban travel in European cities. The project aims to bring innovation and new technologies to make today's mobility cleaner, more efficient and sustainable.

The project explores alternatives to the current mobility patterns and evaluate whether electric mobility is a feasible option to make cities cleaner and more sustainable.

The seven pilots, Berlin (Germany), Milan (Italy), Lisbon (Portugal), Vigo (Spain), Valencia (Spain), a selection of Austrian municipalities and Carmarthen (Wales) are developing actions to optimise operational fleet performance, test and launch solutions to increase the convenience and ease of use of car sharing offers and finally, raise awareness among the target groups through engaging marketing approaches on the suitability of electric mobility for urban transport and commuting.

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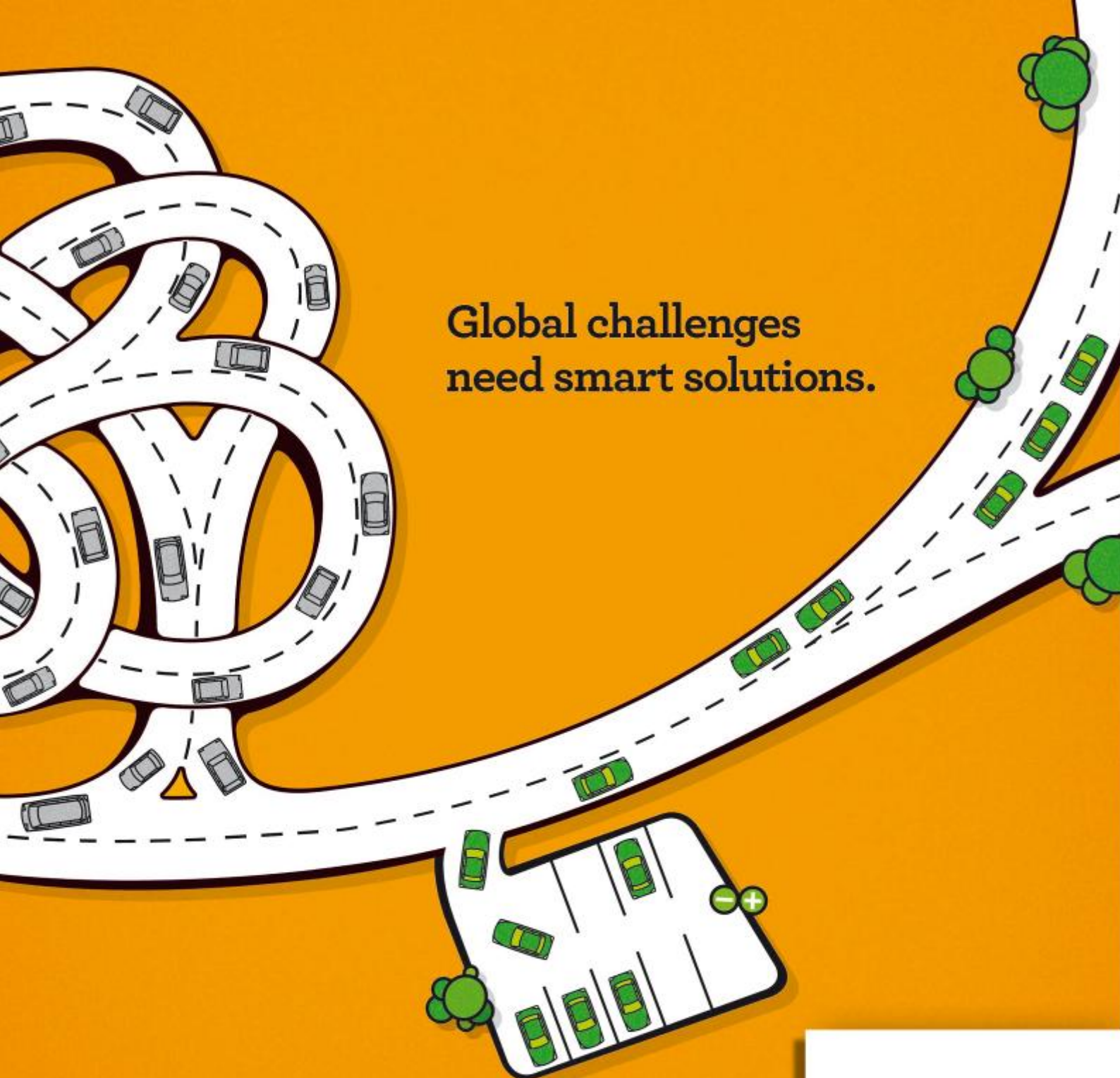
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Power to urban fleets

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