



Factsheet

Carmarthen – Potentials and Barriers for Expanding the Use of Electric Vehicles in the Carmarthenshire County Council Fleet

Leading sustainable transition to electric fleets in local government carpools by maximising the potential for fuel savings and minimising emissions from local government travel.



Photo: Neal Thomas (Carmarthenshire County Council)

eBRIDGE: Empowering e-fleets for business and private purposes in cities

Programme	STEER
Project number	IEE/12/713/SI2.644746
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At a glance

Increasing transport costs as well as concern about greenhouse gas emissions led Carmarthenshire County Council to consider concentrating their existing vehicles into a car pool, and then expanding this car pool with electric vehicles.

At that critical point, central Welsh Government funding was the catalyst that enabled the acquisition of the electric cars, and the installation of the relevant infrastructure – a daring move especially at times of austerity.

Carmarthenshire County Council was the first local authority to implement an electric vehicle fleet in a car pool. This was a challenging decision given the costs involved, and the lack of relevant experience. That decision, however, attracted interest from other local authorities, who followed the evolution of the project, and expressed an interest in following up with similar projects.

Today the car pool is still mixed, with an almost equal share of diesel and electric vehicles, and is enjoying high rates of utilisation, while achieving significant savings for the Council. Especially the electric cars have been widely adopted and enjoy high levels of use; and they have proved suitable for all but the most demanding uses (e.g. long trips, or carrying equipment).

The majority of drivers find the electric cars easy to drive, at times exceeding their expectations, and the range adequate for most of their ordinary uses. Although a small minority of drivers still prefers the diesel cars, this seems to relate to a variety of external reasons, rather than the quality of the vehicles, or the driving experience.

The Council aims at installing further recharging points in Carmarthen, to encourage further use of the EVs, and alleviate range anxiety. Pending further funding – which is outside the Council's control – the ambition is to achieve higher savings and emission reductions, and electric vehicles are seen as a vital component of this process.



Carmarthenshire: a Pioneering County Council

Carmarthen is the county town of Carmarthenshire, one of Wales' 22 local authorities. Carmarthenshire is the third largest Welsh county by area, and the fourth by population, totalling over 184,000 people. It is located in South-western Wales.

Carmarthenshire County Council (CCC) is the administrative body of the County. It employs over 9,000 people, located in various areas across the county. The Council's headquarters are located in Carmarthen.

Due to the Council's organisational structure and geographical disparity, employees often have to travel across sites for work purposes, such as to perform various duties or attend meetings. These sites are located at varying directions and distances from each other (see illustration), so the introduction of centralised Council transport in the form of a circular bus or similar was not realistic. Instead, the Council opted for grey fleet travel and mileage claims, i.e. reimbursing staff travel on a trip-by-trip basis.



In 2010, the Council centralised 6 of their existing internal combustion (diesel) cars at Parc Myrddin, Carmarthen, aiming at reducing staff grey mileage, increasing the use of existing Council owned cars, and reducing overall costs: thus the Council's centralised carpool was born. Employees would now use pool cars for work purposes, by booking and using one of the available pool cars. They would only use their private cars and claim back their expenses if they could not use a pool car. After one year of centralised car pooling, encouraging results began emerging with reduced costs and increased use of pool cars.

In 2011 the Council also received central government funding to support – among other



transport measures – the introduction of two electric vehicles (EVs) into the car fleet. The EV option was preferred to standard combustion engine alternatives, as, apart from the Council's mobility requirements, EVs would also contribute towards improving the local environment (air quality) and towards the UK government carbon reduction targets. The location of possible destinations for employees' travel were well within the travel range (see map) of commercially available light EVs, and therefore range should not pose a problem for the implementation of this scheme.

Carmarthenshire County Council was the first local authority in Wales to introduce their own fleet of EVs. This was a pioneering scheme, with no previous relevant experience in Wales or in a comparable organisation. However, early results were encouraging and the Council looked favourably upon expanding their EV fleet.

This was also important for the current electric mobility situation in the UK: as of 2012 only 0.59% of the UK vehicles were classed as alternative fuel vehicles, of which approximately half were electric of various types – totalling approximately 130,000 (Piñeiro & Xenias, 2014). Introducing EVs in smaller cities was expected to impact not only on direct sales, but also on the EV diffusion potential, via awareness raising and drivers' familiarisation with this technology. After the successful trial of the first EVs, another 4 EVs were introduced into the Council's fleet in 2013.



The Carmarthen Pilot


The Carmarthenshire County Council mixed car pool joined the eBRIDGE project with a fleet of six diesel and two electric cars in the beginning of 2011 (and the option to order an additional four EVs). The Council had three main goals for their participation in eBRIDGE: (a) to continue monitoring the use of the car pool and compare the use of conventional vehicles to that of EVs; (b) to promote and increase the use of EVs by overcoming current perceived barriers related to EVs (e.g. misconceptions about battery range) and work with users to optimise fleet performance; and (c) to assess the overall EV experience and share their



knowledge with other comparable organisations, e.g. public authorities.

Approximately 140 members of staff work in Carmarthen’s Parc Myrddin campus have access to all conventional vehicles. Specifically for the EVs, there was a rolling training programme planned and executed in the past 18 months, so that all employees would be also eligible for the EVs.

Carmarthenshire County Council EV specifications

Models	Mitsubishi iMiEV / Peugeot iOn	Technical Specifications	
		Description	Utility vehicle, 4 seats
		Motor	49 kW/64 HP
		Battery	Lithium manganese-oxide
		Consumption	16 Wh/km
		Range	149 km (93 Miles)
		Charge time	100% in approx. 7h 80% in 30min (Fast)
	<p>Source: Neal Thomas, CCC based on Carmarthenshire County Council data. (Photo: Phillip Thomas).</p>		<p>4* NCAP Safety Award/ Cheapest mass-produced EV in the UK/ Electric Car of the Year 2009 & 2010</p>

Drivers usually book one of the cars on the day they need it, or just the day before. There is normally reasonable availability of vehicles and advance booking is not often necessary. The process is not automated, and is done via a fleet manager: the driver collects and returns the keys manually (similar to a conventional car rental office). This also constitutes the checkpoint through which car trip data, such as mileage, are recorded by CCC. The Council regularly monitors the fleet vehicle use; it has also measured drivers’ attitudes and perceptions, and relays these data to Cardiff University for further processing and evaluation, as part of eBRIDGE work.

The EVs are normally charged on dedicated charging stations on the CCC car park. Occasionally drivers also connect the EVs on other locations, e.g. at a meeting venue, especially if the venue is far from Carmarthen and the driver is concerned about the battery range. CCC installed two additional charging stations in Carmarthen (off campus), aiming to encourage further use of the EVs by reducing feelings of range anxiety.

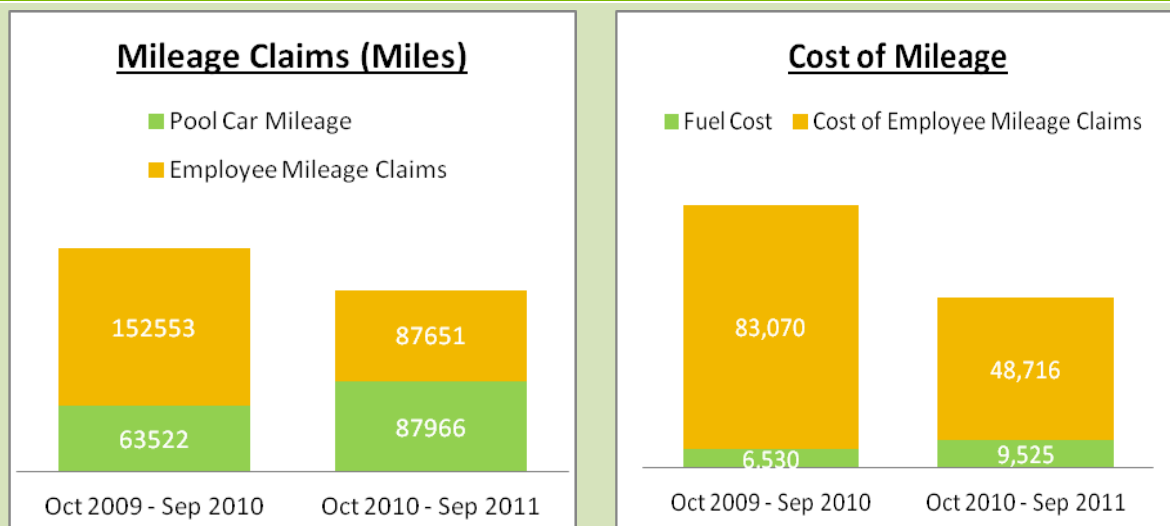


Photo: D. Xenias (Cardiff University)

Potential and Barriers for Expanding Mixed Fleets. Usage patterns of an electric car pool vs. conventional vehicles

In 2013 the Council continued their EV fleet expansion with the acquisition of an additional four EVs. Two of these would join the existing two EVs in Parc Myrddin, and the other two would be allocated to different areas. This being a pioneering scheme in the area, there were conclusions to be drawn, lessons to be learned, and experience to be shared with other interested parties.

Mileage costs and claims before and after the implementation of carpooling



Source: Neal Thomas (Carmarthenshire County Council)

The first important finding was that centralisation achieved its goals: comparing mileage and claims figures from 2009 - 2010, and 2010 - 2011 it is clear that private car mileage and mileage costs (which includes car maintenance and wear costs) were reduced by over 42%,



and pool car mileage was increased by over 38% in the same period.

With the increase of pool car mileage, there was a commensurate increase on car pool fuel costs; therefore the next step would be the successful take up of EVs in the expanding fleet, and the maximisation of their use. Achieving this goal would help the Council reduce their car fuel bills in the long term, by converting fuel purchase expenses to much lower (per km) electricity. This was a somewhat challenging step, because it required a change in driving style and special training (albeit short) on the use of EVs; and a point of intersection with eBRIDGE. During the project, Carmarthenshire County Council was interested in promoting, monitoring and assessing the use of EVs and the user experience, and in sharing its knowledge with other local authorities in the region.

Promotion has already started by way of informational emails to employees, and a rolling training programme, where qualified drivers learn how to handle the small differences between internal combustion and electric cars. This increased use initially, as employees were either curious to try the electric car, or had to book it in order to train in it.

Further promotion of the scheme occurred during a site visit by eBRIDGE, where substantial interest was generated and employees were interviewed about their experiences. Finally, there are more activities planned awaiting the release of new promotion tools, currently under development by eBRIDGE.

Monitoring of the conventional and electric cars is ongoing, and should give a basic view of vehicle utilisation, availability, users' preferences, and average consumption. Of crucial importance for CCC was to understand the users' travel patterns of the two types of vehicle, and benefit from this for better planning of their travel plan, future infrastructure investments, and financial impacts of the scheme.

Full Council EV fleet as of 2014



Photo: Neal Thomas (Carmarthenshire County Council)



Carmarthenshire County Council, being a local pioneer in the introduction of electric vehicles in their fleet, was approached by other local authorities for further information on the project. This is expected to culminate in a knowledge transfer event in 2015.

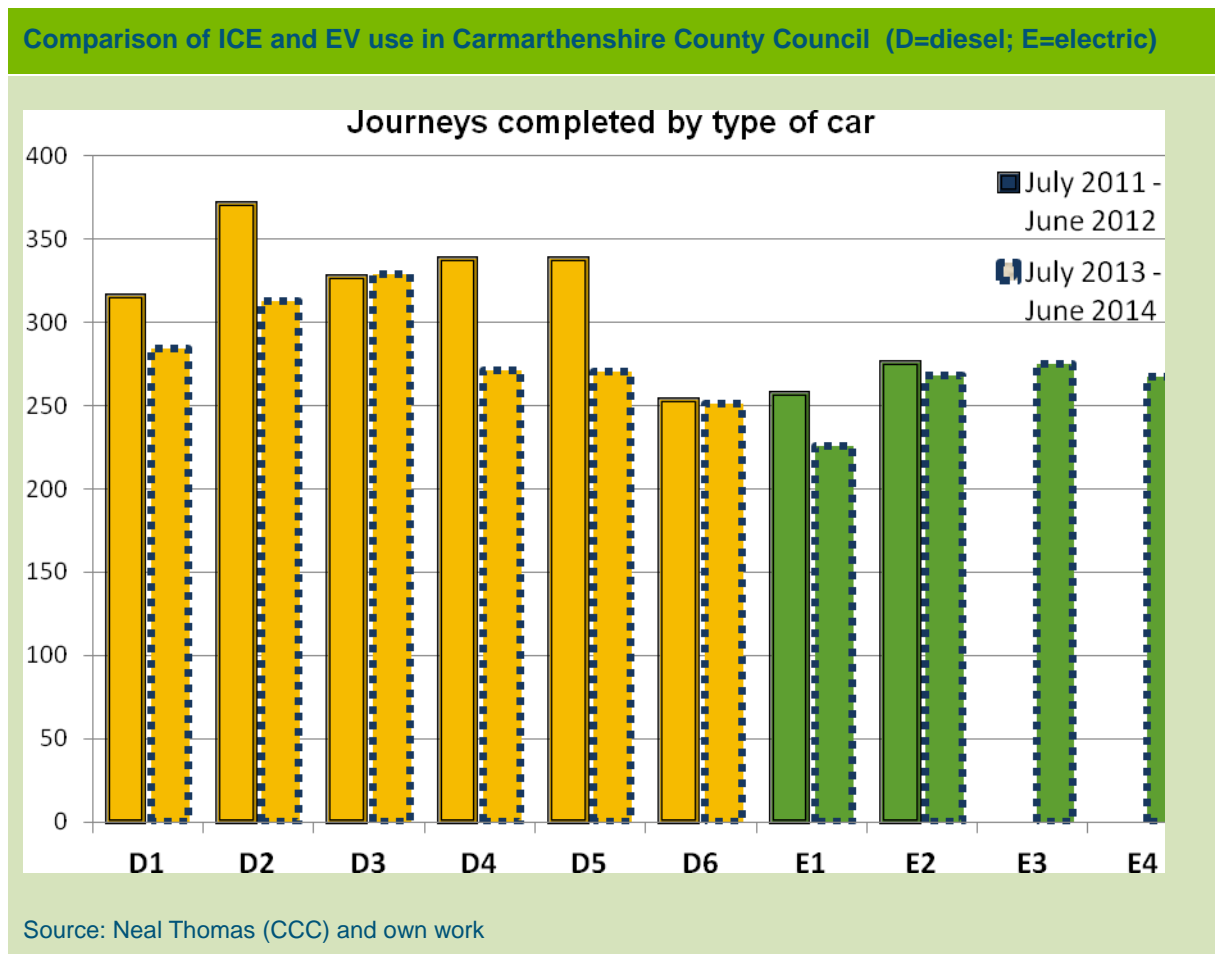
There is potential for usage improvement, as the EVs were underutilised at the beginning of the project. However, one important barrier to the expansion of the Council's EV fleet is the lack of charging infrastructure in the region. Although the current vehicle range covers the vast majority of employees' trips, it is inevitable that not all will be suitable for EVs. In addition, a particular cluster of employees relating to manual work will require heavier vehicles in order to carry tools and equipment and for them EVs are not a viable alternative at this point. Finally, there are some misconceptions regarding the EVs performance and use, which eBRIDGE is aiming at dispelling before the end of the project.

On the other hand, the majority of employees are able to use the EVs, usually travel for meetings and to destinations which are well covered by their range, and are generally satisfied with the experience. Nevertheless, there is still potential to maximise EV mileage and number of trips.



Emerging Travel Patterns: Comparing EVs to ICEs

Some interesting patterns emerged from analysing data from the first half of the project. The first finding concerns a noticeable reduction of approximately 15% to diesel vehicle journeys, compared to EVs. It is worth reminding that EV introduction was gradual; therefore there are only two complete years that can be reported here for a fair comparison between vehicle types (2012 – 2013 only reported partial mileage for two of the EVs).

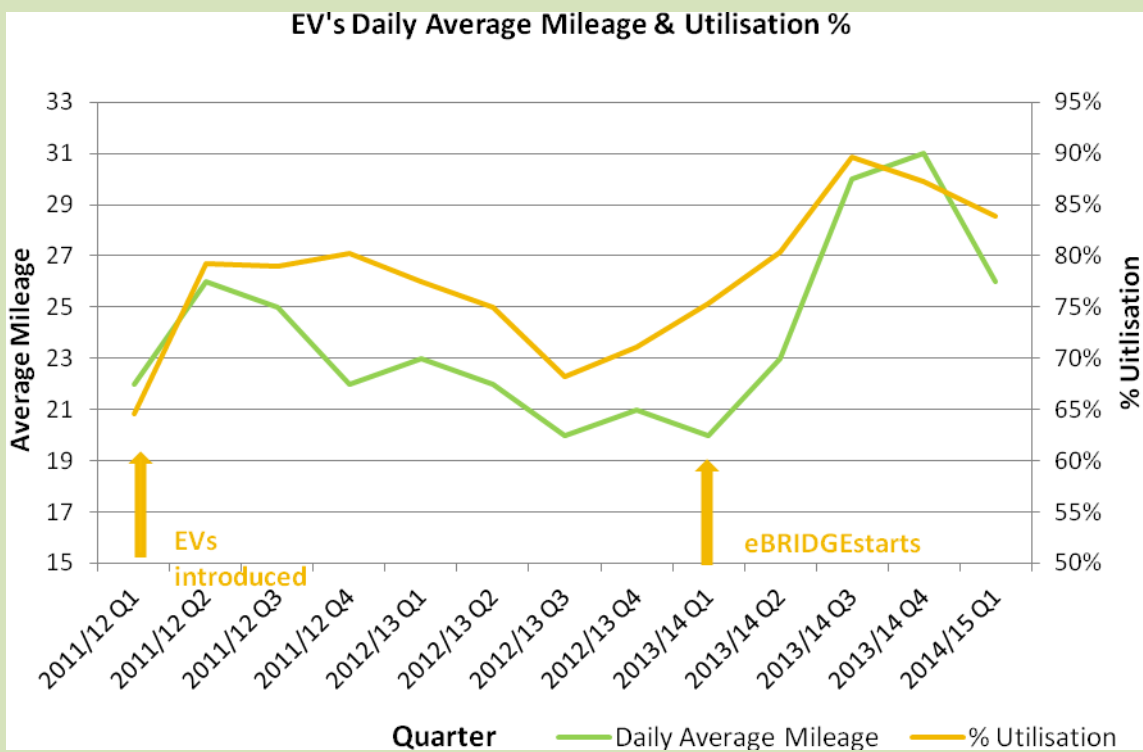


This reduction was not reciprocal to the increase in EV journeys, which suggests that there was an overall increase on vehicle use in the entire carpool. Nevertheless, this reduction in diesel car use represents tangible savings for the carpool operator (Council), which would otherwise have to pay for these trips in diesel fuel bills.

Interestingly, there was a parallel increase of overall mileage and utilisation percentage for EVs, as seen in the next figure, which might suggest that EVs might have been mainly chosen for more, but shorter, trips.



Electric vehicle mileage and utilisation



Source: Neal Thomas (CCC) and own work

This prompted further analysis and breakdown of vehicle type by journey range, which is summarised below. Indeed, as indicated by the number of trips per vehicle, it becomes clear that EVs are preferred for shorter journeys (1-20 miles/1-32 km) compared to ICE vehicles and this relationship inverses as journey distance increases with almost no trips at all for journeys longer than 60 miles/96 km. It is important to note that, although there appears to be some variation in the number of trips completed by each EV, this is considered a chance finding: all EVs are practically identical to each other, and placed in the same location. Therefore this variation in use can be ignored at this point.

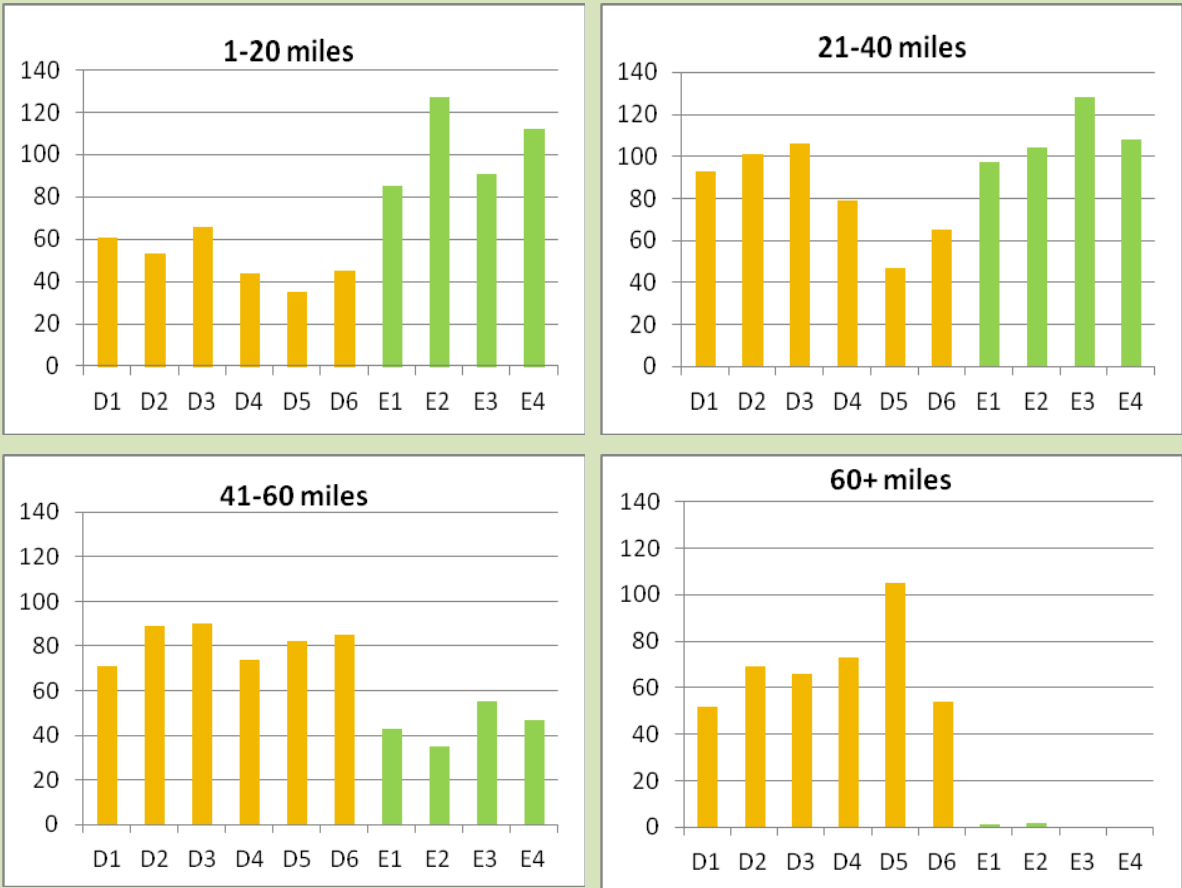
Although this result at first glance seems reasonable, given the known journey range of EVs, it does not reflect the true range of EVs, as seen in the vehicle technical summary (see page 5). Even if the stated 93 miles/150 km is a theoretical value, at least 60 miles/96 km should be achieved in real-life conditions. Therefore, more EV use should be achievable in the 21-40 mile/34-66 km range, and even in the 41-60/66-96 km mile range.

For longer trips, the installation of charging infrastructure in strategically selected places, as planned by the Council, should help alleviate range anxiety. This is expected to be especially true when the vehicle is used for meeting attendance, during which reasonable charge should be achieved, provided that the chargers are situated in appropriate locations.



Such locations could be selected by studying most popular destinations among drivers, paired with the purpose of these journeys. If frequently visited locations are identified outside Carmarthen, for instance, and the stated purposes are mainly meeting attendance (as opposed to maintenance, which would include tools and equipment carrying), then a charger could be installed along that route.

Number of trips by vehicle type and distance, July 2013-June 2014 (D=diesel; E=electric)

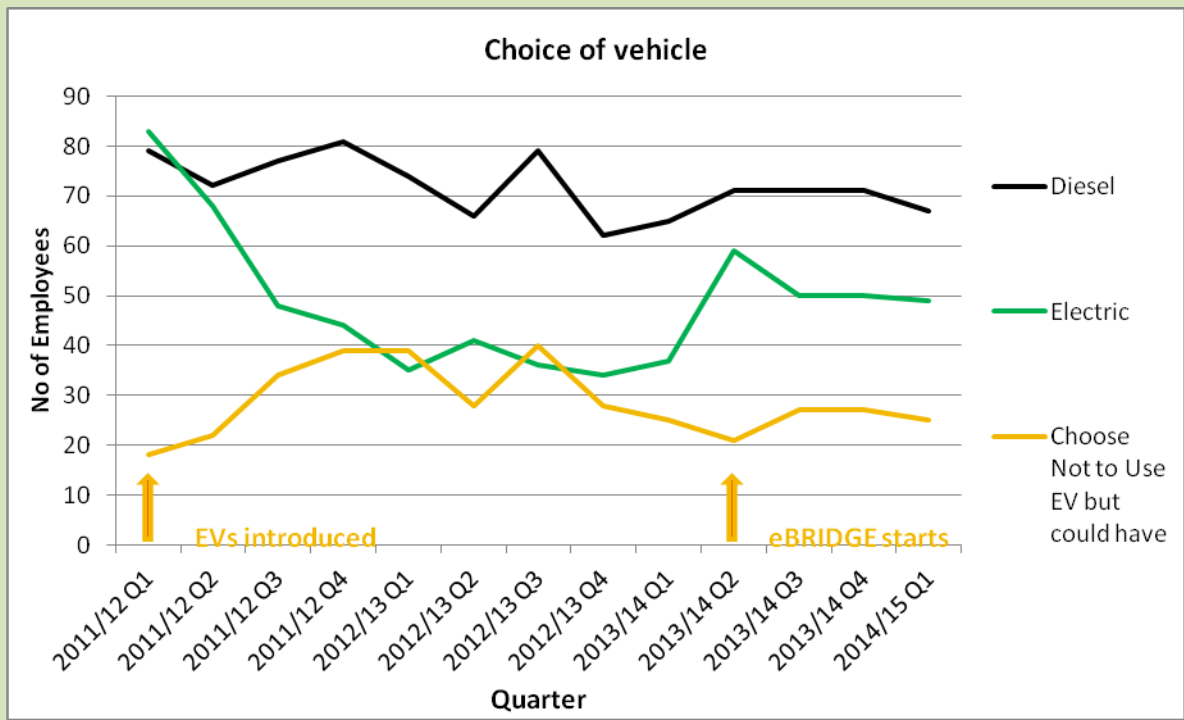


Source: Neal Thomas (Carmarthenshire County Council)

At the same time, analysis of the eligible employees' choice of vehicle revealed that a significant amount of employees who could have chosen an EV for their business trip, did not do so, as shown in the next figure. This suggested that further analysis of the reasons why drivers did not choose EVs when they could have done so, would help reveal the reasons behind their choice of vehicle. However, ethical reasons prevented us from identifying and asking these employees directly.



Employee choice of vehicle (Q1=Apr-Jun; Q2=Jul-Sep; Q3=Oct-Dec; Q4=Jan-Mar)



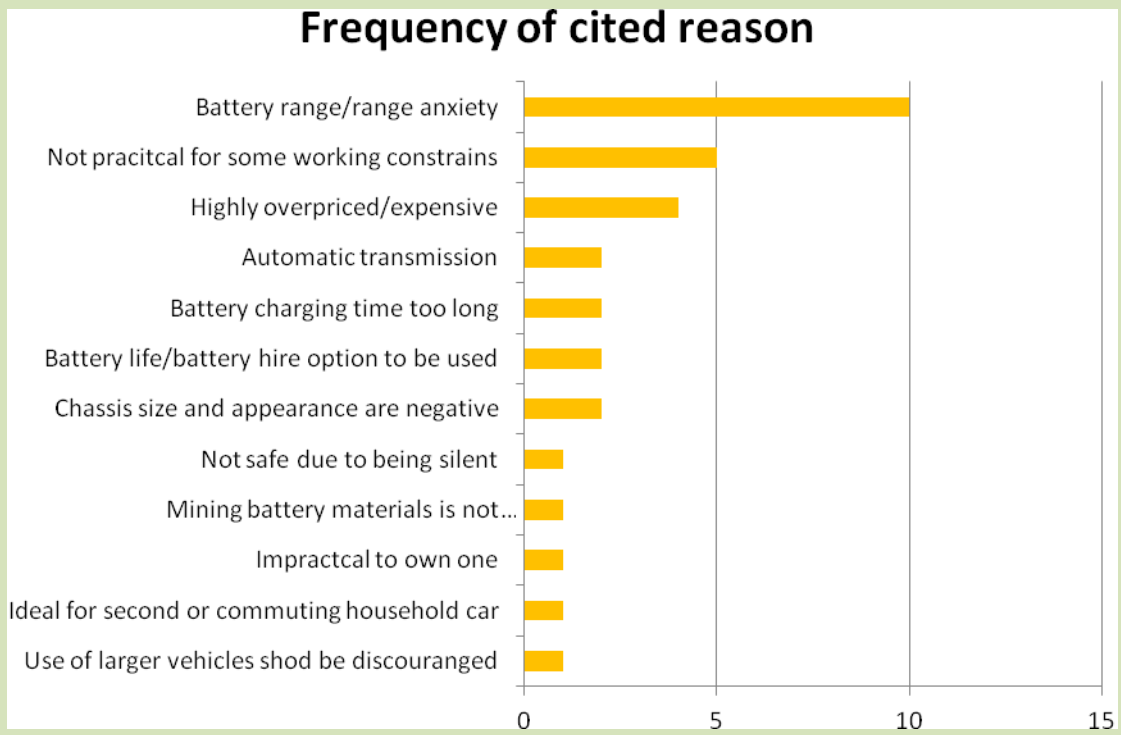
Source: Neal Thomas (CCC) and own work

Instead, interviews were conducted with several employees – eligible drivers – with the aim of identifying the main perceived barriers to the adoption of EVs. The main reason against the use of EVs is range anxiety, which is a known issue in this topic.

One important point, which however cannot be presently confirmed, is whether the range anxiety of the interviewees was justifiable or not. In other words, whether their anxiety was grounded on the length of trips (approaching the battery limits) or whether this was just an irrational fear, based on false premises. This would have been easily identified by examining the travel profile of employees, which would have provided a more detailed picture of their ordinary travel; as well as whether their usual trips could be covered by the battery range. However, as explained above, this analysis was not possible.



Perceived barriers for adoption of EVs



Source: Neal Thomas (CCC) and own work

Other important reasons appear to be the practicality - or not - of using EVs for certain roles or trip profiles (e.g. carrying equipment), and the high acquisition costs involved; the latter emerged as interviewees were asked to contemplate on acquiring an EV for personal use. Several other reasons against the adoption of EVs emerged from this exercise, and are summarised in the above figure. However, the frequency of most reasons is very small, and almost certainly not representative of the vast majority of the EV users in this pilot, who reported a positive attitude and experience.



Conclusions

Overall, the project of expanding the Council car pool with the addition of electric vehicles has been progressing well. Within only two years, electric vehicles have taken over a substantial part of Council staff mileage, and corresponding reduction in costs and local greenhouse gas emissions.

The Council aimed at doubling their electric fleet in the duration of eBRIDGE, as well as increasing their utilisation. Carmarthenshire is making very good progress towards both of these targets, and there is potential for further improvement.

Importantly, the diesel vehicle utilisation has reduced while the electric vehicle utilisation has been stable or improved. The year 2012-2013 has seen the overall expansion of the carpool size, which would inevitably upset the travel patterns of Council employees and might take a while to settle-and subsequently impact on the project's metrics. However, the hitherto progress is satisfactory. There are some issues relevant to the maintenance of the off-site charging points, which have often been out of order for several months. Although the impact of this issue is uncertain, had the off-site charging points been functioning, they are likely to have contributed to further increase in EV mileage.

On the other hand, drivers generally report confidence in driving the EVs for everyday use, and fleet managers report diminishing numbers of issues after the initial familiarisation period elapsed.

The Carmarthenshire County Council experience shows that EVs are suitable for Council fleet use. Despite initial acquisition costs, savings from fuel costs quickly accumulate, and pay off in the short to medium term. Indicative costs per mile for EVs are only a fraction (approximately 25%) of that of a diesel car; in addition to this, in United Kingdom EVs are exempt from road tax, and enjoy other financial benefits as well.

There are also a number of second-order effects, including the creation of a local infrastructure for broader public use in the future, and the creation of local expertise on EVs procurement and management which would have been unlikely to achieve without government support. Local employees/drivers also have the opportunity to experience EVs through their employer, which would have otherwise been almost impossible. This contributes to the diffusion of knowledge of and experience with EVs.

Current results from the utilisation of EVs are encouraging and the Council is considering a gradual replacement of some of their diesel cars with electric cars after the end of eBRIDGE. Moreover, the installation of further charging infrastructure is currently discussed. Although these investments and any further fleet expansion would greatly rely on central government funding, with the associated political and financial uncertainties, this pilot has clearly demonstrated the advantages of EV use in a local authority carpool.



The Project

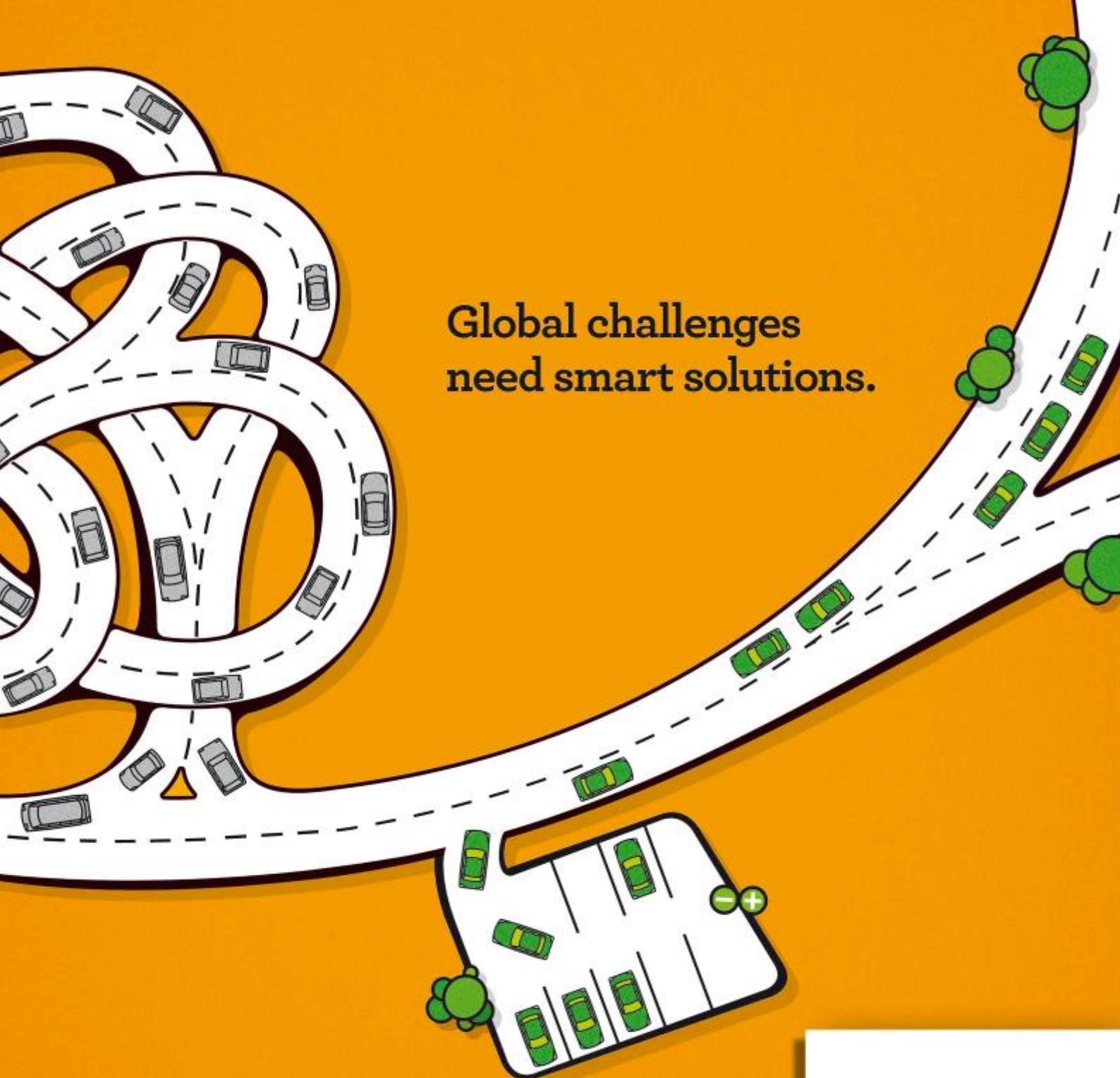


eBRIDGE is a co-funded EU project to promote electric fleets for urban travel in European cities. The project aims to bring innovation and new technologies to make today's mobility cleaner, more efficient and sustainable.

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.



Global challenges need smart solutions.

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