ELECTRIC VEHICLE CENTRE OF EXCELLENCE

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https://www.cardiff.ac.uk/research/explore/research-units/electric-vehicle-centre-of-excellence

Economy, Infrastructure and Skills Committee
National Assembly for Wales
Pierhead Street
Cardiff
CF99 1NA

Cardiff, 31 October 2018

Dear Economy, Infrastructure and Skills Committee,

Respected National Assembly for Wales members,

We are writing in our capacity as co-directors of the Electric Vehicle Centre for Excellence (EVCE) at Cardiff University, in response to your recent consultation on Electric Vehicle Charging in Wales (http://senedd.assembly.wales/mgConsultationDisplay.aspx?ID=318).

The EVCE (https://www.cardiff.ac.uk/research/explore/research-units/electric-vehicle-centre-of-excellence) combines staff from engineering, business, psychology, geography, transport studies, and more in a unique breadth and depth of skills and experience focussed on electric vehicles.

We bring together experts from Cardiff University School of Engineering, Cardiff Business School's Centre for Automotive Industry Research (CAIR) , School of Computer Science and Informatics, School of Geography and Planning, and the School of Psychology to investigate and help address the remaining barriers to the widespread introduction of electric vehicles.
The EVCE is a core component of the Cardiff University Transport Futures Network (https://www.cardiff.ac.uk/research/explore/research-units/transport-futures-research-network)
This network brings in expertise in key transformative technologies such as vehicle autonomous control, user and traveller behaviours, and the modelling of transport systems.

The automotive industry is undergoing a fundamental transition. A phase of rapid technological innovation is contributing to a dissolution of traditional boundaries Emergent technologies in electric traction, charging networks, connectivity, autonomous control, big data, and the Internet of Things is enabling the realisation of novel automobility services. The implications for vehicle manufacturers, their supply structures, and their attendant business models are profound, but uncertain. The EVCE offers a multi-disciplinary collective approach to understanding the impact of electrification on the future of mobility and the future of the industry.

Examples of previous work on themes such as electric vehicles and low carbon policy include studies for the OECD (Wells and Nieuwenhuis, 2012), the European Commission (Wells et al., 2013), and the

LCVP (Chase et al., 2016). Professor Wells is currently engaged on two relevant studies. STARS is an EU H2020 project on car sharing (typically 10% of car share fleets are electric), and ReLib funded by the EPSRC Faraday Institution to investigate EV battery recycling.

With this letter, we will briefly address the following points of your consultation.

(1) **To understand the current charging infrastructure in Wales, and to what extent it is fit for purpose;**
The current charging infrastructure in Wales is not yet fit for purpose. The current funding round recognises this weakness. The coverage is sporadic, the number of available points is too few. In addition, the actual number of points available is lower than first imagined due to some being technically incompatible, proprietary, or out of service. It is notable how few public destinations like museums, hospitals, schools, and courts have charge points. Major cross-country routes such as the A470 require drivers to carefully plan ahead, with insufficient security that plans will be accomplished. A case study of Cardiff urban network with EVs was presented in the paper below.

Oliyide, R., Marmaras C., Fasina E., Cipcigan L., 2017. Low carbon technologies integration in smart low voltage network. IEEE 15th International Conference on Industrial Informatics (INDIN), Emden, Germany, 24 - 26 July 2017.

(2) **How the infrastructure needs to develop to support an increase in EVs on our roads. How the Welsh Government, private sector and third sector can work together to develop EV charging infrastructure**;

The development of EV market is completely dependent on the parallel development of the recharging infrastructure which will result in an increase in the electricity demand.

EV drivers need a seamless system of fast-charge points to achieve 80% charge in 30 minutes to enable in-transit charging along the major road network. In addition, many more destination charge points are needed in shopping areas and supermarkets, hotels, public service venues, airports, tourism spots and related locations. Workplace destination charging would accelerate the uptake, especially fleet uses of EVs. The ratio of EVs to (valid) charge points should be taken as a guide.

Domestic charging, including that for households lacking off-road parking, is important to ensure equality of access. Innovations in this area include the use of lampposts. Mobile charging capacity is needed for rescue and recovery, and to support major events such as the Hay Book Festival. The spatial distribution of charge points needs to ensure inclusion for disadvantaged communities, and to enable rural uses of EVs.

The Welsh Government need to decide upon a viable balance between commercial and social considerations to establish and maintain a charging infrastructure. Calculation of external benefits (clean air; improved health outcomes) would assist in justifying such decisions. It is vital that future-proofing is designed into the system. A single system for access and payment would be advantageous. A good example is the Manchester GMEV network (https://cleanairgm.com/electric-vehicles).

(3) **Whether the electricity grid in Wales is able to deal with a significant increase in EV infrastructure, particularly in rural areas;**

We do not have a comment on this point.

(4) **To explore the potential for electric vehicles to promote behaviour change, for example in terms of vehicle ownership and car sharing initiatives**;

Individual perceptions of mobility needs can constrain their use of alternative transport modes. Experience from car sharing found that the perceived fit of a shared car to their lifestyle was a predictor of individuals' usage of car sharing (Kim et al., 2016; see Section 2.3.2).

Burdens of ownership include (a) the risks (obsolescence, incorrect product selection, depreciation of value) and (b) responsibilities (maintenance, repair, the full cost) associated with owning an item (Belk, 2007; Moeller & Wittkowski, 2010; Schaefers et al., 2016). For some, a desire to avoid these burdens of ownership encourages use of sharing (access-based) services as an alternative to ownership. For example, in a German population sample, a greater desire to avoid responsibility for repair, maintenance, and storage of products (Moeller and Wittkowski, 2010) was positively associated with participants' desire to rent products. These factors are even more important in the case of EVs and therefore EVs are more likely to be accepted if shared rather than owned outright. Lack of charging infrastructure has repeatedly been singled out as a key barrier to EV adoption.

Being involved in a form of car sharing is related to greater interest in other car sharing activities, for instance peer-to-peer and station-based car sharing (Prieto et al., 2017) and a greater likelihood of owning an electric or hybrid vehicle (Clewlow, 2016). While causality is unknown, these findings suggest that users of car sharing and alternative fuel vehicles (AFVs) may enter a 'virtuous circle' of alternative travel means.

Belk, R., 2007. Why not share rather than own?. The Annals of the American Academy of Political and Social Science, 611(1), 126–140.

Chase, A.; Wells, P. and Alberts, G. (2016) UK low-carbon automotive investment: the role of policy in the UK automotive sector renaissance, Engineering and Technology Reference, doi: 10.1049/etr.2015.0069: pp1-8.

Clewlow, R.R. (2016). Carsharing and sustainable travel behaviour: Results from the San Francisco Bay Area. Transport Policy, 51, 158–164.

Kim, J., Rasouli, S. and Timmermans, H. (2017). Satisfaction and uncertainty in car-sharing decisions: An integration of hybrid choice and random regret-based models. Transportation Research Part A: Policy and Practice, 95, 13–33

Moeller, S. and Wittkowski, K. (2010). The burdens of ownership: reasons for preferring renting. Managing Service Quality: An International Journal, 20(2), 176–191.

Prieto, M., Baltas, G. and Stan, V. (2017). Car sharing adoption intention in urban areas: What are the key sociodemographic drivers?. Transportation Research Part A: Policy and Practice, 101, 218–227

Wells, P. and Nieuwenhuis, P. (2012) New Business Models for Alternative Fuel and Alternative Powertrain Vehicles: An Infrastructure Perspective, Report for the OECD, Paris.

Wells, P.; Varma, A.; Newman, D.; Kay, D.; Gibson, G.; Beevor, J. and Skinner, I. (2013) Governmental regulation impact on producers and consumers: a longitudinal analysis of the European automotive market, Transportation Research A: Policy and Practice, 47, 28-41. doi: 10.1016/j.tra.2012.10.023

(5) **To what extent the Welsh Government has acted upon the recommendations in the Low Carbon Vehicle Report;**

In 2016 a group of experts completed "Low Carbon Vehicles" (LCV) report which was required by the Minister of Economy Science and Transport at Welsh Government. EVCE participated with three experts in that group. It was reported that sustainable transport through low carbon vehicles in Wales is offering environmental and social benefits for both urban and rural communities, promoting the economic growth and job creation. Our recommendations were based on facts. Some examples of these recommendations are:

- the Welsh Government considers installing LCV infrastructure at all its premises and encourages local authorities to do the same, making the information widely available in location, type and availability.
- the Welsh Government installs LCV infrastructure at all premises when they are undergoing major refurbishment or where new premises are being built. Local Authorities to consider installation of LCV infrastructure in changes or new road infrastructure projects across Wales, in particular transport hubs such as park and ride or major interchanges (road to train).
- any Welsh Government owned vehicle that needs to be changed is replaced with an appropriate LCV vehicle if there are no implications for health and safety; and the Welsh Government encourages local authorities to do the same.
- expert solutions are provided to help organisations across the public and private sectors improve their fleet efficiency through the adoption of LCV technologies
- the Welsh Government considers the use and usefulness of a 'Green Bus Fund' for the bus operators and establishing a fund to support the adoption and use of low carbon vehicle technologies for public transport.

According to recent BBC Wales Freedom of Information request not a single electric or hybrid car has been owned or leased by the Welsh Government in the last five years and all 72 vehicles it owned last year - including 12 ministerial cars - used diesel. Therefore, the facts shows that the recommendations from Low Carbon Vehicles were not implemented.

The WG has announced a £2m investment in EV charging facilities (https://gov.wales/about/cabinet/cabinetstatements/2018/evi/?lang=en). At present, there is no evidence for adoption of smart charging to reduce the peak burden on the electricity distribution system.

(6) **Examples of best practice from Wales and further afield.**

Research into charging applications and systems is underway on a global basis. Key areas of interest include integration of the EV into the domestic electricity system (e.g. Tesla Powerwall), and the use of domestic renewable energy and V2G systems for maximum economic efficiency. In terms of charge point locations the use of lampposts has been taken up by some local authorities (char.gy has just started work in London).

Innovate UK project "Ebbs and Flows Energy Systems" - Propose and demonstrate new balancing services: Demand Side Response from Electric Vehicles and storage (V2G) facilitated by Virtual Power Plant

http://www.cardiff.ac.uk/news/view/757939-installation-of-the-uks-first-domestic-vehicle-to-grid-unit-for-energy-storage

http://www.cenex.co.uk/news/cenex-leading-installation-uks-first-domestic-vehicle-grid-unit/

Our e-Bridge project (http://www.ebridge-project.eu/en/) also explored the potential of introducing EVs in fleets, pioneered in 7 sites across Europe and the UK; one of our findings also supported the need for charging infrastructure and shared ownership as ways forward for electric automobility (a sample video from this project here: https://www.youtube.com/watch?v=ayMhT4f9oiU)

With this short document, we aimed to provide you with an overview of our knowledge base and activity at EVCE, as well as pointers to specific aspects of your consultation.

Please do not hesitate to contact us for further information.