



Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

Analysing the take up of battery electric vehicles: An investigation of barriers amongst drivers in the UK



Nigel Berkeley*, David Jarvis, Andrew Jones

Centre for Business in Society, Coventry Business School, Coventry University, Priory Street, Coventry CV1 5FB, United Kingdom

ARTICLE INFO

Keywords:

Battery electric vehicles
Barriers
Economic uncertainty
Socio-technical issues
EV ecosystem

ABSTRACT

The stream of announcements in 2017, effectively banning the production and sales of internal combustion engine vehicles within the next fifteen–twenty years, indicate how governments are seeking to regulate a mass market transition to electric vehicles. Yet despite significant policy initiatives to stimulate their uptake, EV market share remains far short of the level required to push them into the mainstream. This paper identifies a multitude of potential barriers to uptake and investigates these from the largely ignored perspective of mass market drivers of ICE vehicles in a European context. In addition it assesses the extent to which barriers are inter-related, and can be reduced down to larger explanatory ‘factors’. Findings, drawn from an original survey of 26,000 motorists suggest that resistance to EV adoption is characterised by twelve barriers that can be reduced and conceptualised as ‘economic uncertainty’ and ‘socio-technical’ factors. In turn, economic uncertainty was found to be significantly associated with age and geography, whilst socio-technical issues are related to gender. Problems of EV adoption are shown to be complex and multi-faceted, not easily solved by tackling individual issues, but requiring a more holistic ecosystem approach, the key policy components of which are posited in this paper. Such analysis is significant in enriching academic discourse and informing effective strategy and policy that will facilitate the transition to EVs.

1. Introduction

Threats arising from climate change and the depletion of natural resources have brought governments together through international treaties to set targets for carbon reduction and the use of alternative sources of energy. Given its significant contribution to carbon emissions globally, as well as utilisation of increasingly scarce resources, the transport sector has in the last decade become a major focus of attention for governments across the world. Significant investment in policy instruments to stimulate the design, production and adoption of electric vehicles (EVs)¹ has been put in place to support a transition to greener, more sustainable automobilities. Manufacturers have responded to the challenge, producing an increasing range of EVs within their fleets (Berkeley et al, 2017). However, to date in the overwhelming majority of countries, take-up has been far short of the level required to propel EVs into the mainstream. Data for the first quarter of 2017 shows EV sales in Europe at 0.84% share of the market, compared to

* Corresponding author.

E-mail addresses: n.berkeley@coventry.ac.uk (N. Berkeley), d.jarvis@coventry.ac.uk (D. Jarvis), andrew.jones3@coventry.ac.uk (A. Jones).

¹ For the purpose of this study EVs are defined as vehicles with an all-electric drivetrain powered from a battery which is charged from the electricity grid. In this case, EVs do not refer to hybrid (HEV) or range-extended (REEV) vehicles.

0.68% in 2016 and 0.49% in 2014. Only in two countries, Netherlands (2.1%) and Norway (21.1%) has market share reached more than 2% (Automotive Industry Data Newsletter, 2017, p4). Whilst Norway is clearly bucking the trend, and is the global EV success story,² the overall picture is a key concern given that alternatively fuelled non-internal combustion engine (ICE) vehicles are a critical component of the future transport mix needed to meet internationally agreed carbon reduction targets (Rezvani et al., 2015; Steinhilber et al., 2013; Gunther et al., 2015). Moreover, as battery electric vehicles have now been available to consumers for more than five years, yet remain the only viable mainstream alternative to the internal combustion engine, it is both timely and important to focus on this segment of the market and interrogate the factors underlying the problem of their low market penetration. This issue has gained even more importance in 2017 given the announcements by manufacturers and several national governments pledging to end production and sales of internal combustion engine vehicles within the next fifteen–twenty years.

A growing body of literature has identified a multitude of barriers to EV adoption (i.e. Steinhilber et al., 2013; Browne et al., 2012; Wikstrom et al., 2016). However, the currency of this discourse in helping to better understand and conceptualise these barriers, and to inform effective policy solutions to EV take-up is limited. In Europe, the majority of empirical studies report on the results of small metropolitan based demonstrator trials which tend to attract drivers already disposed towards green technologies (i.e. Graham-Rowe et al., 2012; Bunce et al., 2014; Burgess et al., 2013; Jensen et al., 2013; Franke et al., 2012; Wikstrom et al., 2016). Many other studies consider the North American setting (i.e. Carley et al., 2013; Egbue and Long, 2012; Krause et al., 2013; Hidrué et al., 2011; Krupa et al., 2014) focusing on the utility of alternatively fuelled vehicles in a context where driving conditions and the ‘everyday’ realities of required mileage are very different from those in Europe. There is, therefore, a gap in knowledge, a demand for original research that investigates the reality and importance of identified barriers to EV adoption from the perspective of a large sample of mainstream car market consumers in Europe. Moreover, within this context there is a need to explore the extent to which the multitude of individual barriers are connected and inter-related, part of larger explanatory ‘factors’. This would help considerably in reducing the complexity of the barrier problem thereby better informing both academic and policy discourses. In addition, access to a large consumer dataset provides the opportunity to explore the extent to which barriers are influenced by driver characteristics. This is important as academic discourse suggests that to facilitate the breaking down of barriers in the long-term, a short-term solution would be to strategically target EV policy intervention on segments of the market where EV penetration might be easier to achieve. These might include: specific locations where there is likely to be the greatest interest or impact, e.g. core cities; higher-earners, not dissuaded by price and attracted by the pull of new technology; and younger people, less attached to the established ICE ecosystem, more likely to have an interest in technology and the convenience afforded by EVs (Serra, 2012; Krause et al., 2013; Carley et al., 2013; Skerlos and Winebrake, 2010).

This paper addresses these gaps through research which has generated data from over 26,000 drivers of internal combustion engine vehicles in the UK. As the second largest vehicle market in Europe with a national fleet of 31.6 million licenced cars,³ the UK provides an interesting context in which to explore EV adoption issues. The apparent failure⁴ of multiple UK government policy instruments and investment to stimulate EV adoption over a seven-year period, reinforces the richness of the context. Analysis and exploration of the data provides a model for interrogating the ‘EV market share problem’, and at the same time has considerable potential to inform and underpin more effective manufacturer and government-led strategy and policy.

The paper makes several important contributions. First, it draws on UK, European and North American literature to synthesise the various obstacles to EV adoption that have been identified. Second, a large scale survey of drivers in the mass ICE market provides a unique dataset that allows the importance of these barriers to be evidenced and, through exploratory factor analysis enables a robust conceptualisation of barriers to be presented. Third, multivariate regression analysis allows us to uniquely test the extent to which conceptualised barriers are mitigated (or indeed aggravated) by driver characteristics such as age, socio-economic status, place of residence and gender. In doing so, the paper enriches the debate on barriers to EV adoption as well as providing practical, empirically-informed ‘pointers’ for stakeholders engaged in addressing the EV uptake problem.

2. Barriers to electric vehicle take-up: a systematised review of the literature

An increasingly wide body of literature from a multitude of disciplinary perspectives considers ‘barriers’ influencing consumer attitudes towards new transport technologies. These include researchers publishing in the fields such as energy (e.g. Krause et al., 2013), technology (e.g. Serra, 2012), innovation studies (e.g. Noppers et al., 2014), behavioural studies (e.g. Caparello and Kurani, 2012) and transport studies (e.g. Graham-Rowe et al., 2012). In reviewing this breadth of literature, a core of 95 papers, which drew on surveys of drivers, or consumers more broadly, to evidence and analyse barriers to the adoption of EVs, were identified. The wide range of barriers to emerge from this evidence base are discussed here.

It is interesting to note that despite advancements in EV technology over recent years negative perceptions around limited driving range and lengthy charging times (Schuitema et al., 2013; Lane and Potter, 2007; Daziano and Chiew, 2013) appear to be enduring. This suggests that consumer concerns about the ‘inferiority’ or ‘unproven’ nature of EV technology are still prevalent (i.e. Greene et al., 2014; Egbue and Long, 2012; Steinhilber et al., 2013; Graham-Rowe et al., 2012; Axsen and Kurani, 2013; Wan et al., 2015).

² Norway’s drivers enjoying high living standards, cheap electricity and favourable environmental policies, have benefited from a holistic package of incentives that put EVs on a par with internal combustion engine (ICE) cars in terms of their price. On the supply side, Norway has also seen significant investment in charging infrastructure, especially in cities such as Oslo (Berkeley et al., 2017)

³ See Department for Transport Vehicle Licencing Statistics Table VEH0128, Available from <https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#table-veh0150>.

⁴ Market share of EVs in the UK remains below 0.6% for the first 3 months of 2017, AID Newsletter, 1708.

Download English Version:

<https://daneshyari.com/en/article/7498486>

Download Persian Version:

<https://daneshyari.com/article/7498486>

[Daneshyari.com](https://daneshyari.com)