Unconsidered futures: Limits of economic assumptions in forecasts for electric vehicles

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Abstract

Great hopes are vested in electric vehicle uptake at a scale which will eventually overtake fossil fuelled vehicles. The substantial questions of the plausibility of these ambitions are tied up with questions of what impacts could be expected if there was major expansion of electric vehicles. Examination of some of these questions is occurring through a range of studies and forecasts. As with any investigation, these studies and forecasts involve theoretical assumptions and implicit and explicit priorities. Attention has tended to focus on understanding supply side development and provision of vehicles and infrastructure, and demand-side changes in relative costs of electric and conventional vehicles and vehicle fuel. This paper analyses the assumptions and priorities contained in forecasts for electric vehicles and asks whether they mean that potential scenarios, and impacts which could significantly affect the lives of some groups of people, go unconsidered.

We identify a number of broad areas of concern. First is that the demand side emphasis on economic factors, especially parity between the combined vehicle and fuel costs of electric and conventional vehicles, does not adequately take account of matters of affordability. That is, the assessments of costs of electric vehicles give too great a weight to considerations of whether overall costs of electric vehicles are economically worthwhile for people and households. There is little consideration of which households would be excluded, or face hardship, in covering the upfront costs of an electric vehicle. Yet unless they can access an electric vehicle, relatively cheaper running costs are an unobtainable economic benefit. Second, while some demand side study has considered implications of electric vehicles for domestic energy prices, these tend again to focus on impacts and overall costs for those using electric vehicles. Third, and most significantly, there is a lack of consideration of whether a society increasingly organised around widespread use of electric vehicles, risks creating forms of exclusion for those without access. Drawing on this analysis we develop recommendations for refining and expanding both the scope and priorities, importantly, the assumptions within forecasts on electric vehicles. We recognise and explore the uncertainty surrounding any forecasts, but argue that we might just improve prospects for understanding distributional impacts if consideration is given to reassessing priorities and assumptions

1. Introduction

Of the several forms of low emission mobility, it is electric cars which are by far the most favoured in British policy. The policy is an ambitious one which aims that all cars and light vehicles will be zero emission by 2050 (DfT et al. 2015). Other low emission modes, including walking, cycling and low emission public transport all feature, but take a more marginal role in policy discourse and action (Marsden et al. 2014; see also CCC 2015). Any change which effectively reduces the current enormous burden of transport related pollution

will involve major changes, and is it implausible to think that such a change would not affect people's everyday activities as well as financial and other resources involving or supporting mobility.[1] However that is very different to saying that we understand what those impacts might be, and how impacts might be distributed. The first objective of this paper is to understand what explicit and implicit assumptions are made in assessments and forecasts about travel demand and the anticipated transition to electric cars. A key focus is on exploring whether or how these assessments consider affordability and availability of mobility, and on broader impacts electric cars might have on costs of living. Our second objective, drawing on the analysis of existing assessments, is to suggest how assessments and forecasts might alter or change both what, and how, factors taken into account in order to improve consideration of the distributional impacts of change.

We begin by outlining broad factors which might be expected to change, or to have significant influence on, the distribution impacts of an electric car based mobility system. Recognising that there are uncertainties surrounding change, we assume that there are some broad matters concerning distributive fairness related to the mobility system which matter now and will continue to matter. These factors, we suggest, could involve availability and affordability of vehicles, fuel and domestic energy, changes in mobility affordability and accessibility for people with or without vehicles, and potentially changes in household income and disposable income. Following this we take on our first objective to analyse current policy thinking on the impacts of electric cars, using data from policy documents and forecasts by government, private sector and non-governmental organisations, along with early findings from expert interviews with governmental, industry and NGO actors. Finally we use this analysis to inform our second objective of developing recommendations for forecasting and assessment which better considers potential distributional impacts of policy on electric cars.

2. Mobility and distributive fairness: what factors matter and how can we tell?

Anticipating the future is fraught with epistemological and ontological problems. This is an immediate question for this paper as we need to think about how, or on what basis, we can judge how assessments and forecasts are considering factors which are relevant to understanding distributional impacts of changes in mobility systems. There are two related aspects to this problem, one on normative theory and one on empirical uncertainty.

i. Normative theory

It would be probably impossible to give a purely descriptive account of existing and possible future distribution of impacts associated with mobility. Especially for a subject this extensive,

[1] In addition to the problem of carbon emissions, 29,000 deaths per year in Britain are attributed to other transport related pollution including particulates and NOx (see COMEAP 2010). COMEAP) (2010

data collection and assessment of potential future impacts will be partial, and without a broad theoretical approach to guide description there are greater risks of partial descriptions being arbitrary. Further a purely descriptive exercise would by itself, provide little insight into the fairness of existing or future mobility systems. Distributions may be unequal but are not necessarily unfair (for instance, is it unfair if not everyone owns a car?), and it is not always apparent that equal distributions are either fair or desirable (for instance, imagine a society which withdrew the vote from everyone).

The aim in this paper is not to level a case against any specific normative theory.[2] Instead we begin with a broad normative theoretical basis capable of responding to the questions 'what is the point of concern about distribution', or 'why does distribution matter in relation to the mobility system?' The theoretical basis we propose is one that is compatible with a range of theories of distributive justice, and recognises that people matter equally simply in virtue of being people (cf. Harris 1988). This is not an abstract sense of mattering, but one which involves concern that social and economic arrangements enable people to live a good life. This implies as society we should have concern about the ways in which the mobility system impacts on lives and welfare (through aspects such as pollution, severance, safety), and enables participation in social, economic and other activities (see for instance, Mullen et al. 2014).

ii. Empirical uncertainty

Forecasts relevant to an envisaged future mobility system based on electric cars face a significant difficulty due to the step change in uptake, and probably in technology, planning and cost, required to get from where we are now to that future. Currently, even with a government grant for new electric vehicles (plug in electric vehicles or hybrids), there are only around 50,000 private electric vehicles in Britain, compared to the over 26 million private cars of all types in the country (DfT 2014a). There is a large gap between this situation and the one that the government intend for 2050, in which all light vehicles will be zero emission (DfT et al. 2015). As we discuss in the next section, technological developments and cost reductions are considered important factors underpinning prospects of a substantial increase in uptake of electric vehicles (Anable et al. 2013; Hill et al 2012). There are at best uncertainties about the likelihood or feasibility of technological change required to move towards the sort of mobility system hoped in the policy on carbon reduction (Mardsen et. al. 2014). Further, there are uncertainties around how people, social, economic

[2] If we were to begin with a full theory of justice and investigate its application we would face a question of why one rather than another theory is adopted. Moreover we would have to address the possibility that in its application, the theory becomes implausible of absurd. In fact in some cases, authors' show that a theory is not a plausible one by discussing its problems in application see e.g. Harris 1998; Railton 1985). However this is not the purpose of this paper.

and spatial arrangements would respond to changing technologies and availability of electric cars, and shape the way in which those technologies are used (cf. Rip 1997).

These uncertainties limit possibilities of judgements about forecasts and assessments of distributional impacts of future mobility. With respect to questions or doubts about whether the necessary technologies and changes will occur, we restrict our concern to the questions of whether this uncertainty influences the treatment of distributional questions. Given uncertainties about responses to, and influences on, the use of electric vehicles, we will attempt only to tackle broad questions about consideration of distributional fairness and impacts. In doing this we assume that there are some types of factors and impacts which have mattered, do matter, and which will continue to matter over the timescale of less than a century which we are interested in. One area of concern is what mobility-involving activities people are able do, and how easily they are able to engage in them. A second area is how mobility can create problems, such as pollution and inequalities in health impacts of pollution. To retain a manageable scope, in this paper, we focus on the first question.[3]

It can be tempting to frame this type of question in terms just of whether people have available and affordable transport to enable them to carry out their everyday activities. However, while affordability and availability both matter, this framing can miss some significant aspects. These include well rehearsed questions about whether activities can be undertaken using different sorts of mobility (for instance, Pooley et al. 2013). However there are also questions about how the activities at issue form part of people's lives. That is, how are people restricted or supported by the mobility system in creating and realising ambitions, or in achieving a good quality of life living (Jeekel 2013; Lucas 2006; Preston and Raje 2007; SEU 2003)? Conversely there are considerations of whether or when certain mobility-related activities are reasonable or fair if they place burdens on other people (Mullen et al. 2014). So thinking about distributive fairness, costs and availability of transport should take account of the wider context of people's lives and of how things might be different.

Keeping this wider context in mind, we can set out some overlapping and related categories to guide analysis of the way in which forecasts consider, or do not consider distributional impacts:

- Affordability of buying, running and maintaining private vehicles.
- Affordability of non-car mobility: How, or the extent to which, people can get on with everyday life without access to a private motor vehicle.
- Indirect financial implications of the mobility system for household budgets (such as changes in energy costs).

[3] It could be argued that the second question is already tackled by the ambitions for zero emission vehicles. However that may be over-optimistic in assuming that even if successful, an electric car based mobility system would avoid pollution problems, for instance, in generating electricity.

3. Thinking about future mobility: how is distribution treated in forecasts?

As we might expect, within and beyond Government there is ongoing work and a range of studies on pathways and impacts of low carbon mobility, and especially take up of electric cars at the scale intended by the Government's Carbon Plan. In the following analysis we use available documents, including policy documents, advice to government, transport forecasts, independent (non-governmental) studies, and we supplement this with initial analysis of interviews with nine non-governmental actors some working in areas covering poverty and mobility, energy and urban futures.[4] Here we use the broad categories identified in Section 2 to structure our analysis of the interviews and documents.

i. Affordability of vehicles

The cost of electric cars features prominently in discussion of a mobility future based around electric vehicles, and in policy interventions on electric vehicles. Electric cars remain expensive compared to conventional vehicles, and this has prompted the British government to offer grants currently at £5000 for those buying new hybrids or plug in electric vehicles (DfT et al. 2015; OLEV 2014). Even with the grant, electric vehicles are for the main part not comparable in price to conventional equivalents (with the Mitsubishi hybrid noted by one interviewee as an exception). Focus on cost of electric cars, coupled with government subsidy, might appear an indication that policy discourse is concerned with affordability and distribution. If this were the case then we might suggest that the policy intervention of subsidising electric vehicles are unlikely to contribute to policy goal since the subsidy is only of use to the already relatively wealthy who can afford brand new vehicles. However this analysis does not sit well, and instead we suggest that affordability is not the concern, and instead the focus is on giving support and encouragement to facilitate a flourishing market for electric vehicles. In other words, the policy aim is to encourage more people to buy electric vehicles, without a primary concern about who those people are, or who cannot afford to participate in that market. This focus on developing the market can be seen across policy documents (Anable et al. 2013; CCC 2015; OLEV et al 2015). On this reading, the policy of subsidy has a consistent internal logic given the importance of price within market theory.

There are a number of questions about affordability of private vehicles in an electric vehicle future. The first, which appears to have some overlap with concerns for a flourishing market, involves consideration of whether the cost of a vehicle combined with running costs is likely

[4] These are depth interviews forming part of the Demand Centre Theme 4.2 project Need, mobility poverty and the ethics of the future cost of mobility. The interviews explore possible impacts of future mobility and the interviewees understanding of how changes are currently assessed. The interviews were semi-structured to cover topics identified as relevant in advance, and with different questions for each interviewee as each has different expertise.

to be greater with an electric vehicle. There is significant anticipation of the point at which running and vehicle costs of conventional and electric vehicles are expected to become comparable (Anable et al. 2013; CCC 2015). For the market, at this point the cost of electric vehicles can be considered to cease to be a major barrier to take up. However this may not be the point at which people on lower incomes can begin to be included. One reason is that upfront vehicular costs may continue to be a barrier even if overall costs (vehicle and running costs) are comparable. Some interviewees have identified this as a problem of affordability, and suggested that new forms of leasing might act as mitigation, however these are rather speculate ideas. Another and perhaps more relevant reason is that many people, as private individuals rather than companies, buy second hand cars rather than brand new vehicles (Interview and see DfT 2014b). Questions of affordability then may also depend on whether there is a functioning second hand market in electric vehicles. While some interviewees have considered how this might work, it is not a debate currently developed in policy. There are also less direct implications for vehicle affordability. The Energy Technologies Institute argue that if electricity becomes widespread as fuel for mobility, then there will be a threat to the "the reduced volumes of liquid fuel sales will threaten the market viability of the current "universal coverage" model" coupled with "scarcity premiums" (ETI p.9). Again, while they are recognised, there is not evidence that these considerations are influencing policy.

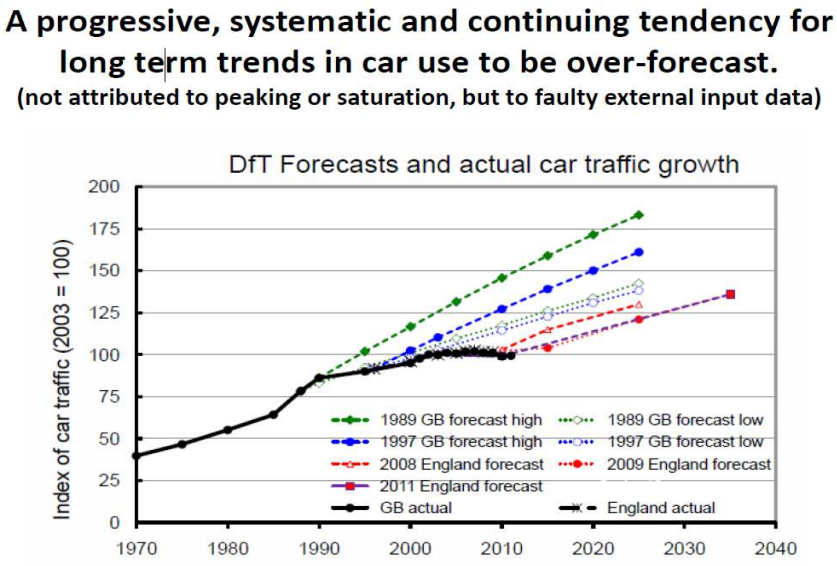
ii. Affordability of non-car mobility

In thinking about distributive fairness in relation to affordability of private vehicles, there is a need to broaden the scope of debate to consider whether and how people do, or may come to, rely on vehicles in order to get on with their lives. In some contexts people can manage well, and happily without owning or having constant access to a car, and with little use of other vehicles (Pooley et al. 2013; 2014). Other people, in different circumstances, appear to make significant financial sacrifices in order to maintain a car (Mattioli et al. 2015; Mattioli and Colleoni 2015). One significant factor in this, is the built environment: where people's lives take place in a location with good public transport, or viable and safe possibilities for walking and cycling, then a car can matter less than for people in places where public transport is poor and distances large. Two factors which might influence whether a move to electric vehicles affect the feasibility of manging without a car, are changes in traffic volumes over time, and changes in affordability and availability of housing. In relation to both factors there is some cause for concern that in an electric vehicle future mobility system, prospects of managing, or managing easily, without a car would be diminished.

First, let us consider changes in traffic volumes over time. The DfT publish traffic forecasts, and while they have moved towards forecasting a range of scenarios rather than just one forecast, they still find that the "range of our forecasts is for 19% to 55% growth between 2010 and 2040" (DfT 2015b p. 6). While the relation is not explicit in the forecasts, if policy hopes for electric vehicle are realised, then increased traffic growth will increasingly involve electric vehicles. Even on the lowest estimate, at 19% growth, these forecasts imply a

continuation of social and economic arrangements based around cars. As such there would be concern about the impacts on accessibility and perceptions of safety for those using non-car modes.[5] It might be suggested that detrimental impacts of increased traffic would or could be mitigated by other measures such as improved investment in cycling and walking (DfT 2015b). However it is at best speculative, and probably optimistic, to suppose that these relatively small investments would offset the impacts of much higher traffic volumes.

Yet it might be that we should not read too much into these traffic forecasts. For years, these forecasts have been subject of criticism for repeatedly and significantly over estimating traffic growth (see Figure 1). This might soothe concerns about the impact on non-car accessibility. However, even if the increased traffic volumes do not materialise, over-estimation of future traffic volumes tends to have an impact on policy and on thinking about mobility futures. In some cases forecasts are used to make the case for policy, so for instance, in current government policy, traffic forecasts are used to justify a huge investment in road infrastructure with over £15 billion capital investment by 2020 (DfT 2015b). In other words, anticipated traffic growth is currently used to support measures which sustain and encourage higher vehicular travel demand. Further some organisations who questions official forecasts, still have are reasons to incorporate them into their own forecasting and assessments because otherwise they believe that they loose an opportunity to influence government by appearing too out of step with government calculations.



(Figure 1: Goodwin 2012)

[5] Fear of traffic is reported a the major barrier to cycling uptake (Pooley et.al 2013)

There are a number of ways in which housing might impact on distributional fairness in a society that comes to have a large reliance on electric car mobility. Organisations involved in debate on mobility futures have identified questions about possibilities for charging electric vehicles at home. One organisation interviewed has estimated that one third of homes in Britain would not be suitable for plug in vehicles, and so there is a question of whether there would be sufficient alternative provision to avoid exclusion for some living in those houses.

There are additional trends in housing which present complex questions for distributional fairness in relation to mobility, especially in a mobility context where electric cars dominate. One issue is that rents and house prices are increasing in many parts of the country, so for many people any idea of 'choice' about where to live is a shallow idea. Coupled with this, is insecurity in tenancies. For people in private rented housing, tenancies are very insecure,[6] and social housing tenancies are becoming much less common and more insecure (interview). This has implications for people's ability to plan travel from home to work and other activities, and if coupled with decreases in accessibility for non-car modes, this may create hardship and exclusion for those without vehicles. While these trends in housing raise questions about mobility futures, these are not questions which have been recognised, still less considered, in policy thinking on transitions to electric vehicles.

III. Indirect financial implications of the mobility system

If they are charged at home, it is thought that electric vehicles would double a home's domestic energy use (Kelly et al. 2012). There has been attention to the costs for the consumer of charging an electric vehicle, with some consideration of whether this would deter consumers (e.g. LSE et al. no date). Further there is consideration of the distributive impacts and other questions of fairness associated with a transition to electric vehicles. One aspect of this is the likelihood that local substations would need to be upgraded to accommodate the additional burden from electric vehicles. The organisation which raised this point in an interview, also noted that there are complicated regulatory arrangements in the country which mean that it could be difficult to control for any apparently unfair distributions of the costs of upgrading – for instance, the costs may not be evenly distributed just among owners of electric vehicles. The further concern is that the additional electricity demand from electric vehicles would lead to an increase in prices of domestic energy to all households regardless of whether they used, or could afford, and electric vehicle. This concern is recognised by actors seeking to inform government policy, however the complexity and uncertainty involved in estimating what the impact would be has meant that the concern is not factored into assessments (interview).

[6] People can be forced to leave with two months' notice and for no reason, through the 'no fault' Section 21 provision

4. Forecasting for a society concerned with inclusion for all its members?

Policy documents coupled with some interview evidence suggest that policy makers tend to see a transition to electric cars as a straightforward substitution with conventional vehicles. Further, this appears to be understood both as a technical transition where the major concerns are about technological development, and as a transition in which the market is naturally the force powering the change.

Nevertheless, as we have seen, there is a rather wide awareness of distributive concerns, especially in relation to access to charging for electric vehicles and impacts of a transition on costs of domestic energy and conventional fuel for those without electric vehicles. Yet although identified as concerns, there is relatively little detailed assessment of the scale of the problems or their potential mitigation. Moreover there are significant questions about distribution which appear little considered, including questions about the impact of housing trends, or impacts on non-car mobility. Some explanation of these limitations in thinking about distributive fairness may lie in what has long been recognised as problems of silo working.

However, further barriers to consideration of distributional impacts may be found in the framing of transitions to electric vehicles as a matter of substitution driven by technological developments and market processes. First, for those hoping that the market will bring change, what matters is incentives for whoever has the ability to influence the functioning of the market. In this case, that ability appears to be held by consumers with the means to buy electric vehicles. Distributional impacts are simply not a feature of this conception. Second, if the transition to electric vehicles could be a process of consumer substitution of one mode for another, then policy makers might consider that distributional impacts would not be worsened by the transition.[7] However there is also evidence that substitution is unlikely and that transition may create financial and mobility difficulties for those without access to electric vehicles which are greater than problems currently faced by people without cars.

To bring these questions of distributive fairness to the fore of policy thinking, and seek a more robust assessment of their nature and impact, it may be necessary to challenge assumptions that transitions to low carbon mobility are matter of technology and a market concerning vehicular ownership and access. There are different possibilities for mobility systems in low carbon futures, for pathways to those futures, and different ways in which the costs of transitions can be apportioned - some of which create greater issues of fairness than others.

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[7] That does not mean that there would be no distributional impacts – the mobility system we currently have is one with numerous problems (Lucas 2006; Mullen et al. 2014; Preston and Raje 2007).

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