House of Commons

Transport Committee

# Plug-in vehicles, plugged in policy?

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### *Volume II*

*Additional written evidence*

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## The Transport Committee

The Transport Committee is appointed by the House of Commons to examine the expenditure, administration, and policy of the Department for Transport and its Associate Public Bodies.

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The following were also members of the committee during the Parliament.

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The Committee is one of the departmental select committees, the powers of which are set out in House of Commons Standing Orders, principally in SO No 152. These are available on the internet via www.parliament.uk.

### Publication

The Reports and evidence of the Committee are published by The Stationery Office by Order of the House. All publications of the Committee (including press notices) are on the internet at http://www.parliament.uk/transcom. A list of Reports of the Committee in the present Parliament is at the back of this volume.

The Reports of the Committee, the formal minutes relating to that report, oral evidence taken and some or all written evidence are available in a printed volume. Additional written evidence may be published on the internet only.

### Committee staff

The current staff of the Committee are Mark Egan (Clerk), Farrah Bhatti (Second Clerk), David G Davies (Senior Committee Specialist), Tony Catinella (Senior Committee Assistant), Adrian Hitchins (Committee Assistant), Stewart McIlvenna (Committee Support Assistant) and Hannah Pearce (Media Officer).

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# List of additional written evidence

(published in Volume II on the Committee's website www.parliament.uk/transcom)

# Written evidence

**Written evidence from Guide Dogs**

## 1. About Guide Dogs

1.1 Guide Dogs provides a range of mobility and other rehabilitation services and campaigns to increase the independence, well-being and dignity of blind and partially sighted people throughout the UK. Services are delivered through district teams working with other local voluntary and statutory agencies to identify individuals whose mobility would be enhanced by the provision of a guide dog or other mobility services. Guide Dogs currently provides guide dogs to over 4,500 blind and partially sighted people.

1.2 Additional mobility services are offered to those who apply for a guide dog and who need some initial mobility training prior to taking on a dog or to those for whom a guide dog is not really a suitable aid to independence. This includes both teaching people how to use a cane and sighted guide training for family members so they can lead their loved ones safely and confidently both indoors and out.

1.3 We also campaign passionately to break down barriers—both physical and legal—to enable blind and partially sighted people to get around on their own.

## 2. Executive Summary

2.1 Guide Dogs supports the introduction of more environmentally sustainable forms of transport, but would like to raise attention to the potential safety implications of increased numbers of low carbon vehicles on the road.

2.2 As low carbon vehicles (also known as quiet vehicles) tend to be very quiet, Guide Dogs are concerned about the safety implications for blind and partially sighted people and other vulnerable road users. The sound of a vehicle is used as a cue for blind and partially sighted people to help them navigate safely.

2.3 Research is being carried out to ascertain how quiet vehicles can be made audible and consequently safer for blind and partially sighted people and others who rely on hearing vehicle noise. There is also work currently taking place at international level to implement regulations stating minimum noise levels for these vehicles.

2.4 Guide Dogs recommends that artificial sounds be installed on quiet low carbon vehicles. These sounds should be discernable, recognisable as the sound of a vehicle and indicate the speed, direction and distance from the listener.

2.5 With regard to the installation of charging points for low carbon vehicles, Guide Dogs would like to see local authorities taking steps to ensure that charging cables do not present a trip hazard for blind and partially sighted people.

## 3. Guide Dogs' Concerns about Low Carbon Vehicles

3.1 In the last few years, there has been a rise in the interest in vehicles with low carbon emissions, including quiet internal combustion engines, electric and hybrid vehicles, with an increasing number coming onto the market. Guide Dogs recognises the environmental benefits of these vehicles and their role in improving fuel economy and reducing carbon emissions. However, electric, hybrid and low noise internal combustion engine vehicles, some of which operate on electric power at low speed, are virtually silent, particularly at speeds under 20 mph. Thus there are serious implications for the independent mobility and safety of blind and partially sighted people and a wider range of other vulnerable pedestrians and road users.

3.2 Guide Dogs also believes that low carbon vehicles will also have implications for other groups of pedestrians and road users including older people and young children and also cyclists. A report by the USA National Highway Traffic Safety Administration stated that hybrid and electric vehicles are nearly twice as likely to be involved in accidents with pedestrians as vehicles with internal combustion engines.[1]

3.3 Blind and partially sighted people, like other vulnerable pedestrians and road users, are reliant on audible environmental cues to assist with their mobility and orientation. The sound of a vehicle's engine is used as a primary cue and clear indicator to establish its movement, speed and proximity. This is particularly important when crossing roads, especially when there are no controlled pedestrian crossings with audible and tactile indicators. The sound of oncoming traffic, or absence of this sound, is used as a cue to assess when it is safe to cross the road.

3.4 Most vehicles with an internal combustion engine have a distinct sound and range of noises to indicate their actions and movement. These are familiar to most blind and partially sighted people, who can detect a vehicle's presence and estimate its type and size by what it sounds like.

[1] Incidence of Pedestrian and Bicyclist Crashes by Hybrid Electric Passenger Vehicles: Technical Report. U.S. Department of Transportation, National Highway Traffic Safety Administration, September 2009. http://www-nrd.nhtsa.dot.gov/Pubs/811204.PDF

3.5 Guide Dogs believes that low carbon vehicles need to have a way of indicating their presence, direction of travel towards or away from the listener, speed and rate of acceleration or deceleration. Vehicles should also emit a sound when reversing along with other less predictable elements of manoeuvring, like for example, being parked up but the drive train is engaged and ready to move off.

## 4. Political Response

4.1 Research in Japan, the US, UK and Europe has aimed to determine the cause for blind and partially-sighted peoples' concern, looking at technological and legislative ways to make quiet vehicles audible and safer for pedestrians and other vulnerable pedestrians and road users.

4.2 Work has been done to understand the concerns of blind and partially-sighted people, regarding their ability to hear vehicles at differing speeds, and whilst the vehicles are performing different manoeuvres. Research has also been undertaken to look at possible alternative sounds to replace the noise generated by a conventional combustion engine on electric and hybrid vehicles.

4.3 Regulations have been implemented in the US and Japan to protect the interests of pedestrians in relation to quiet and hybrid vehicles, as well as international regulations being developed by the United Nations Economic Commission for Europe (UNECE), through the Working Party on Noise (GRB) and its informal sub-group Quiet Road Transport Vehicles (QRTV). An announcement is expected to be made later this year.

## 5. Recommendations for the Safety Implications of Low Carbon Vehicles

5.1 Guide Dogs believes that any sound generated by a quiet internal combustion engine, hybrid or electric vehicle needs to be distinct so as to be recognised as a vehicle, and indicate its distance from the listener, direction and speed of travel. The sound must also be discernible in a wide range of environmental conditions—from quiet country lanes to busy town centres. It should also indicate the type and size of the vehicle to differentiate between different–sized cars.

5.2 Consideration must also be given to the safety of people with hearing impairments. Older people often have reduced sight and hearing. Any sound used for electric and hybrid vehicles should be at least as discernible to people with impaired hearing as the majority of petrol and diesel vehicles.

5.3 Consideration should also be given to the requirement for sound to be generated within a vehicle to indicate its movement. Many blind and partially sighted people can determine information about the movement of a vehicle when travelling in it from the engine sound.

## 6. Charging Points

6.1 With regard to charging points for low carbon vehicles, local authorities must consider the design and location of public charging points, to ensure they are located away from pedestrian routes and cables do not present a hazard to pedestrians. The issue of charging vehicles at private residences where there is no off-street parking must also be considered, as this may potentially involve running cables across footways.

*April 2012*

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### Written evidence from WWF-UK

1. This written submission is on behalf of WWF-UK in response to the Transport Committee's Call for Evidence on Low Carbon Vehicles, announced on 16 March 2012.

2. WWF is the world's largest independent conservation organisation. Low carbon transport is an important issue for WWF because it is urgently needed to reduce emissions from conventional petrol/diesel cars and decrease our reliance on oil. As the biggest consumer of petroleum products, transport is a significant source of emissions leading to climate change, which is a major threat to people and nature.

## Summary of Main Points

3. WWF believes that plug-in vehicles (defined here as EVs) have a significant role to play in decarbonising transport but only if powered by decarbonised electricity and if they do not lead to increased driving.

4. The current uptake of plug-in vehicles is proceeding too slowly to make a significant impact on decarbonising transport. A variety of policy measures are urgently needed, including more infrastructure, alternative ownership models, financial incentives and consumer education, to ensure a rapid uptake of EVs over the next 20 years.

5. A focus on low carbon vehicles must not be at the expense of greater support for public transportation and active modes of travel, such as cycling and walking.

6. The UK compares favourably to other countries in terms of providing financial incentives for purchasing EVs but not in terms of providing charging infrastructure.

## The Contribution of Plug-in Vehicles to Decarbonising Transport

7. WWF-UK recently published a report[2] showing that electric vehicles (EVs) have an important role to play in decarbonising road transport and reducing the UK's dependency on oil. They will also be essential in delivering the level of reduction in emissions from cars necessary to achieve the 80% reduction target by 2050 required under the UK Climate Change Act.

8. The Committee on Climate Change's (CCC) figures suggest that car emissions need to fall by 26% to be in line with the UK carbon reduction target of 34% by 2020. If the CCC's "intended" carbon reduction target of 42% by 2020 is used, car emissions would need to be cut by 32% by 2020 and 51% by 2030 to be in line with this higher target.[3]

9. WWF-UK supports the rapid introduction of EVs to replace petrol/diesel vehicles. However, our analysis shows that EVs will not contribute significantly to transport decarbonisation until after 2020. Until then, reducing average emissions from conventional cars and limiting (or eliminating) increases in demand for car travel, are the most important factors in decarbonising transport. By 2030, the full value of EVs to a low-carbon economy will depend on decarbonising the power sector, by increasing our use of renewable energy, and reducing the amount we drive.

10. The scale of the contribution that EVs can make to a low-carbon transport sector depends on the carbon intensity of the electricity that powers them. Our report shows that, at high levels of EV uptake, decarbonisation of the grid reduces car emissions by approximately 70% more than if the grid is powered by fossil fuels as it is currently.[4]

11. Driving EVs less, not more, than conventional cars will be a challenge as they cost less to operate. If EVs contribute to a rise in car kilometres, we'll need far more of them to achieve the same result as driving less in terms of reducing fuel demand and car emissions.

12. A combination of high EV uptake, improvements in the efficiency of internal combustion engine vehicles (ICEVs), and demand management measures to reduce the amount people drive could potentially deliver a 75% reduction in car emissions by 2030, well in excess of the CCC's recommendations. Under these circumstances, EVs alone could provide nearly a third of the total reduction in car emissions.

13. This same combination of factors could also reduce UK fuel demand for cars by nearly 80% by 2030. EVs alone could account for nearly a third of this potential reduction in UK fuel demand, representing over £5 billion a year in avoided oil imports by 2030.

## Uptake of Plug-in Vehicles and how this can be Improved

14. The current uptake of electric vehicles (EVs) and plug in hybrid electric vehicles (PHEVs) is progressing too slowly to make the necessary impact on the greenhouse gas emissions from the transport sector. In 2011 only 2,500 out of 28 million cars in the UK were electric. By 2020 we need to have a minimum of 1.7 million electric vehicles on the roads of the UK. The barriers to greater EV up take are well understood[5] but they now need to be the focus of concerted policy effort to reduce them and accelerate the market. Current efforts to support EV uptake are driven by the combination of the Plug in car grant and the Plugged in Places programme and while both are welcome they are not on their own sufficient to trigger the change in EV sales.

15. A range of policy measures are available to the UK Government covering:

- Infrastructure provision;
- Alternative ownership models;
- Fiscal measures to reduce relative purchase price;
- Fiscal measures to reduce running costs; and
- Awareness, information and training measures.

16. Work commissioned by WWF Scotland from Atkins consultants identified over 35 possible interventions designed to overcome the barriers to EV sales. These measures range from; identifying the preferred market model for EV infrastructure, incentives for workplace charging, scrappage schemes for EVs, introducing an EV feebate scheme and introducing road charging & low emissions zones. An obvious and important place for the public sector to show leadership is in the replacement of their current petrol/diesel car fleets to all electric fleets. If this is matched by steps to secure similar replacement rates in appropriate corporate fleets public awareness and support for EVs could increase significantly.

17. Some example measures are described below; these are not necessarily priority measures but are highlighted to illustrate the range of available options. Full details of each of these suggested measures and many more are given in the report *Electric Vehicles: Driving the change*. The full report assesses the relative impact of each measure against the most significant barriers and ranks them accordingly:

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[2] WWF-UK, *Electric avenues: driving home the case for electric vehicles in the UK* (March 2011)

[3] Committee on Climate Change, *Meeting Carbon Budgets*, p 240 (October 2009); WWF-UK *Electric Avenues*, Section 1.2 (March 2011)

[4] WWF-UK *Electric avenues* full report, Appendix B (sensitivity analysis: the impact of grid decarbonisation)

[5] WWF Electric Vehicles: Driving the change. Atkins April 2001

*Eg Government action to agree a market model for recharging infrastructure*

18. *Potential measure: UK Government commissions a review of the possible market models for recharging infrastructure and implements the recommendations of the review. This would involve working with relevant stakeholders to identify key roles and responsibilities for energy providers, electricity retailers, EV manufacturers, private infrastructure providers and the public sector; specify pricing and payment approaches; and agree customer interface requirements (single or multiple points of contact).*

Eurelectric identify four possible market models for consideration:

- an integrated infrastructure model—This involves integrating the recharging infrastructure into the national asset base with current electricity providers offering tariff systems common to the whole system, with different rates for slow and fast recharging;
- a separated infrastructure model—A new role of recharging infrastructure operator is created to own and operate recharging infrastructure, purchasing electricity from suppliers before selling it onto the customer;
- independent e-mobility provider—A new role of e-mobility provider is created to install a proprietary network of EV recharging sockets, conforming to agreed standards, and providing electricity bundled with other services, including recharging; and
- spot operators—Recharging points and the selling of electricity are conducted by the parking spot owner or operator.

*Eg Car club schemes*

19. *Potential measure: Local authorities work with existing car club operators to introduce EVs into fleets and introduce EV-based car clubs in other cities. This would involve local authorities:*

(a) *using car clubs instead of purchasing their own fleet cars*—to strengthen the business case for car clubs to purchase EVs;

(b) *procuring vehicles directly for car clubs using their considerable purchasing power to lever favourable purchase prices or lease contracts*; and

(c) *working with manufacturers to set up a publicly funded electric car share scheme*, similar to the Paris Autolib project.

20. Usage patterns of car club vehicles, consisting of predominantly short trips, make EVs a practical option for car clubs. Car clubs can also involve partnerships with medium to long distance mass transit providers (coach rail operators) to enable public transport to be used for the main leg of the journey, and an EV to be used for the first or last few kilometres which are generally unreachable by public transport. For example, the Swiss Railways' partnership with Mobility Car Sharing, called "Click and Drive" gives members access to 800 vehicles located at 350 railway stations around Switzerland. This approach addresses range limitation concerns associated with EV ownership and also tackles the limitations associated with public transport use.

21. An EV-based car club would have positive wider sustainable transport impacts, by encouraging the right mode for the right journey; and positive social inclusion impacts by making EVs accessible to all.

*Eg Scrappage schemes designed to increase sales of EVs*

22. *Potential measure: UK Government introduces a scrappage scheme to encourage consumers to purchase EVs, with subsidies reducing as EV uptake increases.*

23. Scrappage schemes currently exist in Italy and Czech Republic to encourage consumers to purchase low carbon vehicles; while the UK Government ran a vehicle discount or "scrappage" scheme for all types of car from May 2009 to March 2010, to provide a boost to demand and immediate support on a short-term basis to the car industry and its supply chain in the wake of falling sales.

24. The scheme would involve offering drivers a subsidy if they trade in a conventional car or van which is at least 10 years old, and purchase an EV instead. A scrappage scheme would encourage consumers to exchange a conventional vehicle for an EV; rather than encouraging consumers to consider purchasing a second or third vehicle (which is a risk with purchase grants).

*Eg Registration tax feebate scheme*

25. *Potential measure: UK Government introduces a feebate scheme for the UK which involves increasing the tax levied on the purchase of relatively high-emitting vehicles and providing rebates for lower-emitting vehicles.*

26. Feebates are a particular type of purchase tax incentive which involves levying fees (in the form of car registration tax and value added tax, for example) on relatively high-emitting vehicles and providing rebates for lower-emitting vehicles. Revenues from fees can be used to fund rebates, creating a revenue-neutral incentive programme.

27. This measure would involve applying the "first year rates" for Vehicle Excise Duty (VED) as a feebate scheme, and increasing the range of rates/rebate to give EV buyers a financial benefit of £2,000 to £5,000. This allows some of the price premium associated with EVs to be offset.

28. Lane (2011)[6] suggests that there strong evidence pointing to the success of feebates in encouraging EV uptake, citing examples from various countries. For example, in the Netherlands the market share of Band A and B cars increased from 9.8% to 19.3% following the introduction of purchase incentives in 2001 (Gartner, 2005);[7] in France the average $CO_2$ emissions of the new car fleet fell by 6%—almost twice the comparable figure for the EU—in the year following the introduction of a new feebate[8] in 2008 (German and Meszler, 2010).[9]

*Eg Public sector procurement of low carbon vehicles for own fleet*

29. *Potential measure: The UK Government, local authorities and other public sector organisations support an earlier than average switch to low carbon emissions vehicles for public sector fleet vehicles (cars and vans) through procurement policies, etc. This would involve:*

30. the UK Government setting a target for 100% of public sector fleets to be electric, where appropriate;

31. the UK Government and local authorities ensuring that procurement policies require public sector organisations to purchase electric rather than convention vehicles, where practical to do so.

32. National and local governments wield significant purchasing power since they procure and operate large fleets of vehicles. Local authorities and other public sector organisations can support an earlier than average switch to low carbon emissions vehicles for public sector fleet vehicles (cars and vans) through use of financial incentives, procurement policies, etc. This approach provides a clear sign of Government support and belief in battery powered technology, and can provide much needed investment certainty for the private sector (and particularly manufacturers), who may.

33. In 2010, the French government announced that it will purchase 50,000 EVs for government fleet use over the next five years, significantly more than most governments have committed to. It has assembled a group of 20 corporations, utility companies and other large fleet owners to purchase all the EVs, most of which will come from Renault and Peugeot-Citroen.

*Eg Increase the EU target for the emissions-intensity of new cars and vans*

34. *Potential measure: UK Government encourages the EU to increase the target for the emissions-intensity of new cars and vans produced by manufacturers.*

35. This would encourage the major manufacturers to increase the volume of EVs produced. An emissions target was initially set in 1995 and was intended to reduce average new car emissions to 120 g/km by 2005. However, before it became legally-binding, the target was postponed or weakened four times (T&E, 2010). Manufacturers are well on their way to meeting the new target of 130 $gCO_2$/km by 2015, and 95 $gCO_2$/km by 2020, suggesting that a more stringent target would readily achievable. The current target is not sufficiently low enough to drive significant volume EV production, at the moment the target is predominantly incentivising efficiency improvements in petrol and diesel cars.

*The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport*

36. Electrification of road transport will be the dominant transport system of the future; however it must be complemented by attractive alternatives to travel and greater support for demand management and walking and cycling. A reduction in the total car km driven each year in the UK is critical if the transport sector is to play its required role in contributing to our carbon budgets. Analysis by Element Energy for WWF Scotland showed the same emissions reduction would be achieved if Scotland either stabilised traffic levels at those of 2001 and replaced 300, 000 cars with EVs by 2020 or replaced 1.5 million cars and allow traffic kms to grow as predicted. Demand management is the forgotten component of a sustainable transport future and must be integral to any future EV strategy.

*Action taken by other countries to encourage the uptake of plug-in vehicles*

37. The UK's policies and incentives for purchasing EVs are broadly comparable to those in many other countries.[10] There are numerous approaches to stimulating EV uptake, however most have one element in

[6] Lane (2011). Market Delivery of Ultra- Low Carbon Vehicles in the UK: An evidence review. Report for the RAC Foundation, January 2011.

[7] Gärtner, A (2005). Study on the effectiveness of Directive 1999/94/EC relating to the availability of consumer information on fuel economy and CO2 emissions in respect of the marketing of new passenger cars. ADAC Report to the European Commission.

[8] The French scheme offers rebates of €5,000 for <=60 gCO2 /km, €1,000 for <=95 gCO2 /km, €500 for <=115 gCO2 /km, €100 for <=125 gCO2 /km; has a zero-rating for 126–155 gCO2 /km; and charges fees of €200 for <=160 gCO2 /km, €750 for <=195 gCO2 /km, €1,600 for <=245 gCO2 /km and €2,600 for >245 gCO2 /km.

[9] German and Meszler (2010). Best Practices for Feebate Program Design and Implementation. The International Council on Clean Transportation Report (ICCT). Washington DC: ICCT

[10] WWF-UK *Electric avenues*, Section 6 of research report (Electric Vehicles in the UK and Republic of Ireland)

common: the subsidy of the upfront capital cost of the vehicle. These subsidies can be through tax breaks (as in Denmark) or through a capital grant (as in the UK, France and the Netherlands). Germany is one exception, as the government has refused to subsidise the capital cost of EVs and is instead focusing funding on EV manufacturing, where it has allocated up to €500 million for R&D. A summary of electric vehicle subsidy and support policies for a selection of countries is shown below.

SUMMARY OF INTERNATIONAL SUPPORT POLICIES TO ENCOURAGE THE UPTAKE OF EVS

| *Country* | *Support polices* |
|---|---|
| Belgium | Income tax reduction of 30% up to €8,990. |
| The Netherlands | Amsterdam city council provide a subsidy of up to €15,000 for electric cars (total programme cost of €3 million).<br>Free parking in Amsterdam. |
| Denmark[11] | EVs exempt from vehicle registration tax (currently at either 108% or 180%). |
| France [12] | €5,000 subsidy (grant) on EVs (until 2012).<br>Currently ordering a public/private fleet of up to 50,000 EVs with the possibility of expansion to 100,000. |
| US | Tax credit of $2,500–$7,500 depending on battery capacity. |
| US—California[13] | Grant of up to $5,000.<br>Discounted electricity for EV charging, reduced insurance, free parking.<br>Allowed use of the high occupancy lane.<br>Emission reduction counts towards employers' emissions target. |
| Canada [14] | CA$5,000–$8,500 government incentive (battery size dependent), Ontario up to CA$10,000, (up to 10,000 vehicles).<br>Provincial sales tax (PVT) reduction of up to 50% on clean vehicles.<br>Provincial rebates of up to CA$2,000.<br>20% reduction in insurance rates. |
| Japan[15] | Acquisition tax exemption up to 2.7% ~300,000Y ($3,300).<br>Price wars between manufacturers.<br>50–75% reduction on tonnage tax. |
| China[16] | Trial programme in five cities subsidizing EVs at 60,000 Yuan ($8,800) and hybrids at up to 50,000 Yuan. |

38. The policies outlined above relate only to subsidies and incentives to stimulate EV sales. This is only part of the stimulus for electric vehicles. In addition to incentivising EV sales, government-led programmes are also needed to increase EV charging infrastructure. The UK is still without a national charging infrastructure plan and is lagging behind other nations in encouraging infrastructure development. For example Japan has allocated government funding to deliver public charging points, whereas France is changing its planning policy to make the installation of EV charging points mandatory in all new buildings.

*April 2012*

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**Written evidence from the Renewable Energy Association**

SUMMARY

— The enquiry should include a consideration of the role of low carbon liquid and gaseous fuels as contributing to low carbon vehicles.

— Reducing carbon in the transport sector is urgent and should start with carbon reduction in internal combustion engine (ICE) vehicles as a transition to electrification.

— The mandatory sustainability rules, including minimum required carbon saving levels for biofuels, in the Renewable Energy Directive (June 2009) were only transposed into UK law in December 2011 in the Renewable Transport Fuels Obligation Order 2011.

— UK-produced biofuels deliver c. 70% carbon saving compared with fossil fuels.

— Concerns about indirect land use change should spur Governments to improve global agricultural practices and encourage the production of good biofuels rather than abandoning biofuels altogether when they can deliver carbon saving in liquid transport fuels.

[11] http://www.autoevolution.com/news/amsterdam-introduces-ev-subsidies-think-says-thank-you-16987.html.

[12] http://www.usinenouvelle.com/article/edf-un-vehicule-electrique-est-indissociable-de-son-systeme-de-recharge.142268 , http://www.gouvernement.fr/gouvernement/vehicules-propres-un-plan-de-developpement-pour-creer-une-filiere-francaise-offensive.

[13] http://www.afdc.energy.gov/afdc/progs/ind_state_laws.php/CA/HEV.

[14] http://www.emc-mec.ca/webfm_send/60.

[15] http://jama.org/library/pdf/FactSheet10–2009–09–24.pdf. http://www.geni.org/globalenergy/library/technical-articles/generation/plug-in-hybrid-electric-vehicle/energy-central/electric-vehicle-price-war-erupts-in-japan/index.shtml.

[16] http://online.wsj.com/article/SB10001424052748703961204575280473851819084.html?.

— More Government support is needed to develop and commercialise advanced "second generation" biofuels made from non-food plant material.

— The Committee on Climate Change has said that there will be a continuing need for sustainable biofuels in the road transport sector until at least 2030. The Government should therefore urgently set out a clear trajectory to the Renewable Energy Directive 10% renewable transport target to 2020 and beyond.

— Electrification in the road transport sector should take place gradually as market demand and the availability of low carbon electricity increases. It should proceed at a pace that can be serviced by the electricity industry.

— Plug-in hybrids vehicles are a useful transition between ICE vehicles and full electrification.

— Consumers should retain choice in their low carbon mobility.

## Introduction

1. The REA represents a wide variety of organisations across the power, heat and transport sectors, including generators, project developers, fuel and power suppliers, investors, equipment producers and service providers. Members range in size from major multinationals to sole traders. There are over 950 corporate members of the REA, making it the largest renewable energy trade association in the UK. The REA's main objective is to secure the best legislative and regulatory framework for expanding renewable energy deployment in the UK, enabling the UK to meet both the UK's own targets under the Climate Change Act and our commitments under the EU Renewable Energy Directive.

## The Terms of Reference for the Enquiry

2. For this enquiry the Transport Committee has expressed a specific interest in the contribution that low carbon vehicles, in particular plug-in vehicles, can make to decarbonising road transport. However, the road transport sector, in terms of both vehicles and re-fuelling infrastructure, is currently almost 100% based on the internal combustion engine (ICE) and liquid fuels. While plug-in vehicles, in both their hybrid and battery only forms, will have a role to play over time and in particular circumstances (such as urban mobility), there is unlikely to be an overnight shift to electric vehicles. Much more likely is a gradual transition to low carbon vehicles, starting with the use of low carbon renewable liquid fuels in ICE vehicles. The Committee's enquiry should therefore include a consideration of the role that these fuels could play in decarbonising the road transport sector. By the same token, the Committee should look at the role that biomethane powered vehicles could play, once appropriate Government policy is put in place.

## Carbon Emissions in the Road Transport Sector

3. The Committee rightly points out that 90% of the UK's domestic transport emissions come from road transport. In addition, the transport sector accounts for nearly a quarter of the UK's overall carbon emissions. In contrast to the power and heat sectors, emissions from transport continued to rise between 1990 and 2007 and have only fallen in recent years as a consequence of recession and rising fuel prices.[17] While fuel consumption has fallen as a result of improving efficiency in ICE vehicles, the transport sector still bears a particular responsibility to make additional efforts to decarbonise.

4. Furthermore, as has been pointed out by the Oxford Institute for Energy Studies[18] the sooner carbon emissions can be made to fall, the greater the overall effect will be on avoiding dangerous climate change in the future. A policy of waiting until the "right" decarbonising technology is discovered and implemented is a policy which will make decarbonisation much harder to achieve in the long run. It is highly unlikely that there will be such a "silver bullet" and policy makers should accept that decarbonising the transport sector will require a range of low carbon solutions to make a real impact.

## The Transition from Liquid Fuels to Electricity in Road Transport

### Phase 1—*Low carbon renewable liquid fuels*

5. At present, with a largely liquid fuels road transport sector, the only way to decarbonise in the short to medium term is to use low carbon renewable fuels. These can only rarely be a full substitute for fossil fuels, but when blended into standard petrol and diesel, they can make a significant contribution to reducing carbon emissions. The Renewable Transport Fuels Obligation Order 2011 (RTFO) lays down mandatory carbon savings and sustainability rules that biofuel producers and suppliers must abide by. These set minimum carbon saving levels of 35% rising to 50% by 2017 and all figures have to be independently verified. According to the latest verified figures from the Department for Transport, these fuels reduced carbon emissions in 2010–11 by 57% compared to their fossil fuel equivalent. For UK produced biofuels the figure is nearer 70%, reflecting the considerable efforts that the UK industry has put into delivering sustainable fuel. In absolute terms biofuels

[17] DfT factsheets: UK transport greenhouse gas emissions

[18] The Oxford Institute for Energy Studies, *"Cumulative Carbon Emissions and Climate Change: Has the Economics of Climate policies Lost Contact with the Physics?" July 2011*

reduced emissions from road transport in the UK by c. 3 million tonnes $CO_2$ e in 2009 as shown by DfT analysis.[19]

6. It is important to note that there is a fully functional liquid fuel distribution infrastructure already in place so decarbonisation with sustainable biofuels can proceed without further costly investment from either Government or industry. The RTFO imposes an obligation on fuel suppliers to supply renewable transport fuels which gives the necessary market demand to make investment in sustainable biofuels viable. Beyond this there are no subsidies for biofuels.

7. Concern has been expressed that the true carbon effects of biofuels has been under-estimated because indirect land use change has not been taken into account. The science of this potential indirect effect is immature, but the UK and EU have led the way in demonstrating that low carbon biofuels can be produced. In the future, these rules and the good agricultural practices that go with them, should be transferred to all end products from the land—be they food, fuel, fibre, pharmaceuticals or forestry. Concerns about indirect land use change effects should spur Governments to transfer good practice globally and not to abandon valuable low carbon liquid fuel options. It should also be noted that the production of a number of biofuels (for example wheat-based bioethanol) delivers a high protein animal feed which can contribute to food security and provide a substitute for imported soybean meal.

8. The development of a market for sustainable biofuels through the RTFO should bring on investment in so-called "second generation" biofuels, which will be made from non-food plant material such as agricultural and forestry residues and municipal waste, using advanced biological or thermo-chemical technologies. However, the RTFO is currently capped at a target of 3.5% with no clarity as to how the UK will reach the 10% renewable transport target by 2020 that it is committed to in the Renewable Energy Directive. In these circumstances, there is little or no investment in the UK into these promising technologies and very little Government support is available. UK companies are investing overseas in countries like the USA and Brazil where there is a clear policy to decarbonise road transport fuels alongside the development of electric vehicles.

9. In their "Bioenergy Review"[20] of December 2011, the Committee on Climate Change has indicated (page 78) that there will be an increasing need for sustainable biofuels in the road transport sector until at least 2030. Thereafter, if transition to electrification proceeds as envisaged, there will still be a requirement for sustainable biofuels in the aviation and shipping sectors. Therefore, in order to make progress in decarbonising the road transport sector, the Government should set out a clear trajectory to the 2020 10% target and beyond. This would give investors the confidence that there will be a return for investing in low carbon transport fuels which will be required for at least the next 25 years.

10. As noted above, the role of biomethane could be much greater than it is at present, but this technology option is currently used more in the power and heat sectors and specific policy would have to be introduced to make it attractive for the transport sector.

Phase 2—*The use of plug-in hybrid vehicles*

11. The REA is concerned that the process of electrification must keep pace with:

- The availability of low carbon electricity. Currently, only 9.5%[21] is renewable.
- The capacity of the electricity industry, in terms of generation, transmission and distribution, to service the transport sector as well as the power and heat sectors.
- The availability of an adequate re-charging infrastructure to give consumers confidence to invest in electric vehicles.

12. We believe that, if sufficient low carbon electricity is available without threatening other sectors of the economy, there could be a gradual transition to electrification via the use of plug-in hybrid vehicles. These vehicles should be able to depend not only on a low carbon electricity supply but also on the availability of low carbon liquid fuels. In this way consumers will be able to retain choice in their mode of low carbon mobility while technologies continue to be developed in the low carbon power and liquid fuel markets as well as in the manufacture of electric vehicles and batteries.

Phase 3—*Full electrification*

13. With today's technologies a transition to full electrification cannot be taken for granted. For example, from the point of view of low carbon electricity, the "Bioenergy Review" of the Climate Change Committee suggests that a wholesale shift to electric vehicles would require fully operational nuclear and Carbon Capture Storage programmes. Neither of these is a foregone conclusion in today's economic climate. There also remain significant uncertainties around support available to renewable power generation. In addition, little attention appears to have been paid to the embedded carbon and resource availability (in particular rare earths) effects of electric vehicles and their associated battery technology. With so many unknowns, the REA would

[19] DfT factsheets: UK transport greenhouse gas emissions
[20] Committee on Climate Change: Bioenergy review, December 2011
[21] Energy Trends, published 29 March 2012, quoted by Office for Renewable Energy Deployment. 10 April 2012

recommend that policy supports all forms of low carbon mobility so that consumers retain choice and the market, rather than Government, picks the winners.

### Conclusion

14. There is a pressing need to decarbonise the UK's road transport sector which is such a significant emitter of carbon. However, this cannot be achieved by moving overnight to electric vehicles which would be prohibitively expensive in terms of both vehicle and infrastructure.

15. The REA would like to make the following recommendations:

- As the road transport market is a liquid fuels market and will be for many years, greater effort should be made to decarbonise liquid fuels.
- The Government has been unnecessarily paralysed by adverse publicity directed at some very bad examples of biofuels. It should concentrate on policy that promotes good biofuels, such as those produced in the UK, and set a clear trajectory for renewable transport fuels under the RTFO to 2020 and beyond.
- Government should give further support for advanced biofuels, particularly for R&D and commercialisation.
- Plug-in vehicles have a role to play, provided there is sufficient low carbon electricity to service this new market demand.
- Consumers should continue to have choice in their low carbon mobility.

*April 2012*

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## Written evidence from pteg

### 1. Introduction

1.1 *pteg* represents the six Passenger Transport Executives (PTEs) which between them serve more than eleven million people in Greater Manchester (Transport for Greater Manchester), Merseyside (Merseytravel), South Yorkshire (SYPTE), Tyne and Wear (Nexus), the West Midlands (Centro) and West Yorkshire (Metro). Bristol and the West of England, Leicester and Nottingham City Councils, Transport for London and Strathclyde Partnership for Transport are associate members of *pteg* though this response does not represent their views.

1.2 The PTEs plan, procure, provide and promote public transport in some of Britain's largest city regions, with the aim of delivering integrated public transport networks accessible to all.

### 2. The Contribution of Plug-in Vehicles to Decarbonising Transport

2.1 The transport sector continues to depend strongly on fossil fuel energy sources. Oil, the main energy source for transport, supplies nearly 100% of road transport fuels. With the movement of people, goods and services, the reliance on road-based transport will continue.

2.2 Decarbonisation of transport is dependent on the substitution of fossil fuel sources by $CO_2$-free alternative fuels. Substitution of oil in transport for low carbon alternatives, such as plug-in vehicles, supports the decarbonisation of transport, but only if the energy system itself is decarbonised. Currently much of our electricity is generated by fossil fuelled power stations. Decarbonisation of transport and decarbonisation of the source of energy need to be addressed as two complementary strategic lines.

2.3 Research conducted for *pteg*[22] found that support for the take up of low carbon vehicles was among the strongest transport $CO_2$ abatement measures alongside:

- Stricter enforcement of speed limits.
- Eco-driving.
- Improved cycling infrastructure.
- Targeted roll-out of Smarter Choices initiatives.
- Improvements in bus fleet efficiency.
- Introduction of workplace parking levy or equivalent demand management schemes.

The report finds that city regions can achieve significant reductions in transport emissions by implementing a comprehensive package of interventions.

2.4 Plug-in vehicles have a significant contribution to make as part of such a package. They emit zero emissions at the tail pipe, reducing pollution and improving air quality, especially in inner-city areas where

[22] *pteg*/Atkins (2010) Carbon Pathways for transport in the city regions, available from http://www.pteg.net/PolicyCentre/Sustainability/Research

people on lower incomes are disproportionately affected by poor air quality. Most electric vehicles also use regenerative braking technology, helping to reduce levels of harmful particulate matter from brake wear.

2.5 However, plug-in cars and vans still come with many of the same problems of their conventional counterparts. Roads will still be congested, streets will still be filled with parked cars and electricity will still need to be generated from somewhere (mostly from fossil fuelled power stations). Also there are the public health impacts of continuing to choose cars over walking, cycling and public transport, modes which help people to become more active, even if this is just a walk to the bus stop.

2.6 There is, therefore, a need to ensure a wider shift from the car to walking, cycling and public transport and to reduce the need to travel in the first place. Converting the car and van fleet to low and zero carbon technologies is important, but a green traffic jam is still a traffic jam. The decarbonisation of vehicles needs to go hand-in-hand with strategies for restraining traffic growth and encouraging a shift to more sustainable modes. Furthermore, if undue weight is given to supporting the greening of the car fleet, there is a risk of encouraging a shift away from under-resourced public transport networks, increasing the problem of congestion.

## 3. Uptake of Plug-in Vehicles and how this can be Improved

*Affordability*

3.1 Whilst we welcome the continuation of the Government's Plug-in Car Grant and the introduction of the Plug-in Van grant, plug-in vehicles remain unaffordable for many consumers and businesses. According to research by Transport for London, the typical plug-in vehicle owner already has several other cars and has a high household income (£79k on average).

3.2 For consumers and businesses, the high upfront costs could be offset with clearly communicated, impartial advice on the extent of savings likely to be achieved by switching to plug-in vehicles. For example, electric vehicles typically cost around 2 pence per mile for fuel, compared to 14 pence per mile for petrol or diesel vehicles. If we assume vehicles will typically travel 8,000 miles a year, this results in a saving of £960 per year.

3.3 It is believed that Total Cost of Ownership (TCO) will become the dominant metric for private consumers for deciding whether to purchase a vehicle, as it is already for fleet managers.

3.4 However, regardless of Government incentives and the potential for long term savings, the high upfront cost of a plug-in vehicle will continue to pose an insurmountable barrier for many people.

3.5 According to Department for Transport statistics, a quarter of all households—rising to half of all households on the lowest incomes—do not have access to a car. It is important that we continue to invest in walking, cycling and public transport infrastructure to ensure that everybody is able to access opportunity whether or not they are able—or choose—to run a car.

3.6 One option to improve the affordability and accessibility of plug-in vehicles for more people would be to move away from an ownership model towards a car club or combined mobility model.

3.7 Owning a car makes it more likely that people will use it for the majority of their journeys. City Car Club report that their members drive less miles each year than an average motorist because they think more carefully about each trip they make in a car and make greater use of alternative travel options such as walking, cycling and public transport.

3.8 Ultimately, plug-in pooled vehicles could form part of a package of transport options designed to keep people moving. This "combined mobility" package would also include other transport services—bike hire, buses, trains, trams and taxis. A single smartcard could be used to access them all, leaving the individual to decide the best mode for the journeys they are making that day.

*Seeing is believing*

3.9 There are real and perceived barriers to the use of plug-in vehicles, including the concept of "range anxiety" where the perceived inability to recharge a plug-in vehicle creates concern. In this respect, seeing is believing—the more opportunities for people to get hands-on experience of plug-in vehicles, the better the chance of wider uptake. According to Cenex, after a six month test period 72% of drivers would switch their full-time car to an electric vehicle, compared to 47% before the trial.

3.10 Encouraging the use of plug-in vehicles in company and public sector vehicle fleets as well as via car clubs, may be a good way to build up a critical mass of users and infrastructure as well as offer a wider range of people the experience of using a plug-in vehicle. Leeds City Council, for example, is trialling electric and hybrid transit vans for their fleet.

3.11 Visible infrastructure at destinations (like railway stations, workplaces and supermarkets) and en-route (rapid pathway charging) for longer distance journeys may also be helpful. Consideration should also be given to convenient charging options for the 35% of car owners in the UK who have no off-road parking to enable charging at home.

3.12 Good land-use planning has an important role to play in supporting residential and commercial developments that include charging points and facilitate access to car clubs as well as encourage walking, cycling and use of public transport. Travel plans for homes and workplaces help to bring all of these elements together.

3.13 In line with the combined mobility model, there are significant opportunities for integrating electric cars with public transport to allow people to make longer journeys with confidence (eg charging points at stations to allow people to continue their journey by rail).

## 4. The Effectiveness of the Plugged-in Places Scheme

4.1 The Plugged-In Places scheme is focused on supporting the installation of recharging infrastructure for plug-in vehicles in order to build consumer confidence.

4.2 As noted above, visible recharging infrastructure is an important part of normalising plug-in vehicles. Drivers will not find plug-in vehicles attractive without ready access to charging infrastructure, parts and repair services. On the other hand, energy suppliers and car manufacturers will not invest in plug-in technology without the prospect of a large market. Government pump-priming of the market through schemes such as Plugged-In Places is therefore to be welcomed.

4.3 However, installing charging points alone will not act as a catalyst for increasing the uptake of plug-in vehicles. As set out in the previous section, there are further barriers to overcome around affordability and opportunities for people to try out the technology for themselves.

### *The West Midlands experience*

4.4 We have received feedback from one of our members, Centro, on the effectiveness of the Plugged-In Places scheme in the West Midlands as part of the wider Plugged-In Midlands scheme.

4.5 Within the West Midlands, the effectiveness of the scheme is largely unknown. It is a new initiative and during the first year of Plugged-In Midlands, no charging points were installed. This may have been the result of early delays caused by the abolishment of the Regional Development Agencies, which previously managed the programme. Plugged-In Midlands is now jointly managed by Cenex and Central Technology Belt and, now in its second year, is starting to gain momentum.

4.6 Centro is keen to be part of the programme and is installing recharging points at strategic rail park and ride sites within the West Midlands and at its office in Birmingham City Centre. Centro has taken a cautious approach to the installation of charging infrastructure due to the small number of electric vehicles and the unknown uptake in the region. Most of Centro's rail park and ride sites are oversubscribed and it is felt that charging bays would not be utilised in the short-term. However, Centro is mindful of the fact that without the infrastructure, consumers are unlikely to buy electric vehicles and is therefore keen to install recharging points at carefully targeted sites.

## 5. The Role of Plug-in Vehicles Alongside other Technologies to Reduce Carbon Emissions from Road Transport

5.1 Plug-in vehicles are not the only answer. As mentioned previously, they need to form part of a wider, integrated package of transport options including walking, cycling and public transport.

5.2 Furthermore, relying too heavily on one new technology is not practical, particularly as plug-in technology is not suitable for all types of vehicles—HGVs and larger buses, for example. Factors such as distance to travel, weight to carry and size of vehicle will have a bearing on the type of solution chosen. Hybrid, biofuels and hydrogen and fuel cell could all have a part to play and some of these technologies could prove to be more effective at reducing carbon emissions than plug-in vehicles, depending on the circumstances.

5.3 These alternative technologies must be explored and tested and the findings communicated. A report commissioned by *pteg*, for example, examined the costs and benefits of different fuels and technologies with the potential to reduce pollution and carbon emissions from urban bus fleets.[23] There is considerable expertise within the city regions regarding green vehicle technologies.

5.4 Merseytravel, for example, have over fifteen years of experience in testing alternative fuels, whilst Leeds City Council organised a major low emissions vehicle exhibition and conference in October 2010, featuring a showcase of 29 different low emission vehicles (ranging from 44 tonne articulated lorries to scooters). The aim of the event was to demonstrate to fleet managers across the North of England how these technologies work and their potential for saving money and reducing emissions.

5.5 In addition, Leeds City Council count biomethane powered vehicles amongst their fleet and were the first UK local authority to purchase their own permanent gas refuelling station. Elsewhere, Sheffield City Council uses compressed natural gas to fuel some of their recycling collection vehicles across the city.

[23] *pteg*/TTR (2009) Scenarios and opportunities for reducing greenhouse gases and pollutant emissions from bus fleets in PTE areas, available from: http://www.pteg.net/PolicyCentre/Sustainability/Research

5.6 The city regions have also achieved success in all three rounds of the Green Bus Fund, resulting in increasing numbers of low carbon buses on our city streets. In total, PTE areas are set to receive over 400 green buses through the fund.

## 6. Action taken by other Countries to Encourage the Uptake of Plug-in Vehicles

6.1 In European cities, much of the focus appears to be on plug-in vehicles, with widespread installation of recharging points (for example, the Autolib car hire scheme in Paris). To meet carbon targets, much greater emphasis needs to be put on investigating other alternative vehicle technologies and the infrastructure required.

6.2 The European Union needs to take a leading role by working with Member States at all levels to build-up the charging and refuelling infrastructure to ensure they are as comprehensive as today's network of petrol stations. In doing so, however, Member States should not ignore the vital role that walking, cycling and public transport have to play in decarbonising our transport systems as well as in reducing congestion and improving public health.

*April 2012*

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## Written evidence from the Engineering the Future

*Engineering the Future is a broad alliance of engineering institutions and bodies which represent the UK's 450,000 professional engineers.*

*We provide independent expert advice and promote understanding of the contribution that engineering makes to the economy, society and to the development and delivery of national policy.*

This response to the House of Commons Transport Select Committee inquiry on low carbon vehicles is from the following organisations in the *Engineering the Future* alliance:

- The British Institute of Non-Destructive Testing.
- The Institution of Railway Signal Engineers.
- The Engineering Council.
- Engineering UK.
- The Royal Academy of Engineering.

### Introduction

The House of Commons Transport Select Committee has invited evidence on the following five questions:

1. The contribution of plug-in vehicles to decarbonising transport.
2. Uptake of plug-in vehicles and how this can be improved.
3. The effectiveness of the Plugged-In Places scheme.
4. The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport.
5. Action taken by other countries to encourage the uptake of plug-in vehicles.

The *Engineering the Future* alliance is not in a position to respond to Q2, Q3 and Q5 but this paper addresses questions Q1 and Q4.

The committee is referred to the Royal Academy of Engineering report *Electric Vehicles: charged with potential*,[24] published in May 2010, that discusses many of these issues.

### Q1—*The contribution of plug-in vehicles to decarbonising transport*

1. Previous work by the Royal Academy of Engineering[25] has identified that about a third of energy delivered to end users in the UK is for transport. This results in about a quarter of the UK's carbon emissions.

2. Changing from petrol and diesel vehicles to plug-in electric vehicles (EV) will, by itself, make only a limited difference to emissions. In 1997, the average $CO_2$ emissions of the UK car fleet was 190 g/km and while it had been much the same for several years,[26] this is now down to under 150 g/km. EU targets are that the average emissions of new cars should not exceed 130 g/km by 2015 and 95 g/km by 2020.

3. In the preparation of the *Electric Vehicles: charged with potential*[24] report, the authors received evidence from engineers working in the automotive sector who said that, until the last 10 years, car designers had little incentive to save energy. Oil prices had been around $20/barrel for more than a decade, petrol prices were dropping in real terms and customer priorities were for performance and comfort. However, since high fuel

[24] www.raeng.org.uk/news/publications/list/reports/Electric_Vehicles.pdf

[25] Generating the Future, March 2010

[26] There is some variation in the figures depending on exactly what classes of vehicle are defined as "cars" and whether the average takes account of the different annual mileage of small and larger cars.

prices changed customers' perceptions, more effort has been put into reducing emissions. Whereas, a few years ago, low emissions internal combustion engine vehicles were not available across the range, it is now possible to buy models of the Mercedes B-Class, Volkswagen Touran and BMW 5 Series, all with emissions below 125 g/km. Engineers working in the industry have said that they see it entirely practicable to reduce emissions of a medium size four or five seat car to below 80 g/km.[27]

4. How the emissions of a plug-in vehicle compares with those of a car with a low-emission internal combustion engine car depends on two factors: the electrical energy consumed and what fuels are used to produce the electricity.

5. Results from electric vehicle trials show that EVs equivalent to a small petrol or diesel 4-seat car use around 0.2 kWh/km in normal city traffic.[28]

6. The $CO_2$ emissions per unit of electricity (referred to as "the carbon intensity of electricity") depends on how it is generated. Most gas-fired power stations use combined-cycle turbines and produce $CO_2$ emissions of around 360 g/kWh. Coal-fired power stations produce 900 g/kWh and wind turbines and nuclear power produce very low emissions (almost zero).

7. Which power stations are in use at any particular time depends on a market mechanism that prioritises low cost. In 2009, the average carbon intensity of electricity was 544 g/kWh, the following year the average was reduced, as gas was cheap, relative to coal. In the 2011–12 winter, coal has become cheaper, relative to gas, and has provided half of all grid electricity produced, thus increasing the average $CO_2$ per kWh.

8. There are also variations between summer and winter and between night and day. The zero-carbon producers (wind and nuclear) tend to run whenever they can produce energy. This means that, during the peaks at 6pm in the winter, the proportion of zero-carbon electricity is lower than during a windy night in summer. Taking these factors into account, the carbon intensity of UK electricity can be more than 600 g/kWh or less than 300 g/kWh.

9. If we take an average carbon intensity of 500 g/kWh, it can be seen that an EV consuming 0.2 kWh/km is responsible for emissions of 100 g/km. This is not much different to a similar small diesel vehicle. It is likely that there will be improvements to this figure but, because an electric drive system is already efficient, in comparison with internal combustion engines, we are not likely to see dramatic improvements.

10. On this basis, it is difficult to see how EVs fed from the present UK electricity generation mix are significantly better than petrol or diesel vehicles.[29] To make a reduction in emissions commensurate with the 2050 target, the introduction of EVs must be accompanied by almost total "decarbonisation" of the electricity supply—at least at the times when they are charged (discussed below). Without low-carbon electricity, there is little point in promoting electric vehicles on environmental grounds except where the concerns are predominantly local air quality rather than purely $CO_2$ emissions.

Q4—*The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport*

Low-carbon energy

11. An important technology that has to be developed in parallel with electric vehicles is low-carbon electricity generation. Whether this is provided by nuclear power, wind farms, tidal barrages or solar panels is of second order importance. Unlike some other uses of electricity, charging EVs has a degree of flexibility about when it is needed. But this interacts with other uses of electricity (discussed later).

12. The sources and end users of electricity in the UK are shown in Figure 1, taken from the *Generating the Future*[30] report. On the left are the various sources of energy—fossil fuels, nuclear power, intermittent renewables (such as wind and solar energy) and biomass. On the right of the diagram are the users—transport, high-grade heat (HGH, which includes furnaces and other industrial processes), electrical appliances, and low-grade heat (LGH, mainly space and water heating).

[27] This emission level is approximate and does not account for factors such as refinery losses and transportation which can add another 10% or so onto the figure.

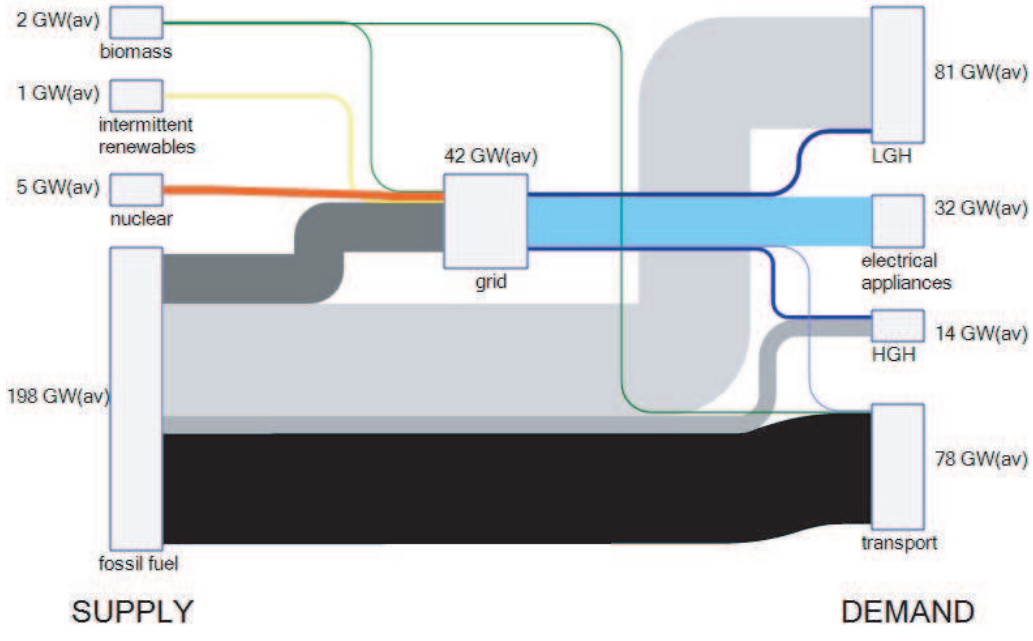
[28] This figure can only be approximate and depends on factors like the extent to which lights or air-conditioning are used.

[29] It is important to ensure that comparisons between EVs and internal combustion engine vehicles compare "like with like". Some publicity compares the emissions of a basic 50 mph EV with a petrol car having air-conditioning, power steering and a top speed of 100+ mph.

[30] Generating the Future, March 2010

**Figure 1**

ENERGY FLOW CHART FOR 2008




13. The lowest black bar represents petrol and diesel used for road transport. This illustrates the challenge that has to be met to decarbonise transport. However, it is also important to bear in mind the grey bar providing low-grade heat from fossil fuels, predominantly natural gas, used for heating. The diagram shows the average power throughout the year but, in summer, this shrinks to a low value, dominated by cooking and water heating, and in winter low-grade heat represents the highest demand on the UK's energy system—far outweighing transport.

Electricity storage

14. Electricity cannot currently readily be stored, but there is increasing research activity into possible technological solutions at all levels from batteries to grid level solutions. It can be used to pump water up hill at off-peak times so the energy can be used later in peak-lopping hydro-electric generation; surplus electricity can be used to charge a battery that is later discharged back into the mains (via an inverter), or it can be used to pressurise air in an underground cavity that can be used to drive a turbo/generator when electricity is needed. However all these technologies are expensive and have losses, so the amount of energy recovered is significantly less than the amount originally stored.

15. Storing energy in the form of coal in a stockpile in a power station yard is easy, cheap and the coal doesn't deteriorate. It is possible to store several months of fuel for a large power station in this way. At the other end of the scale, storing electricity in batteries is very expensive; with currently available technology, a battery pack capable of storing a month's output of a 2GW power station with current technology would weight 20 million tonnes and cost many billions of pounds—which is not a viable option. Energy storage will be crucial to using intermittent renewables efficiently and research funding has been identified, but there are no easy solutions. It may be that technologies, such as hydrogen-powered HGVs, that considered in isolation do not seem to be particularly relevant, may provide a useful balancing mechanism to absorb excess renewable energy during the summer and provide transport during periods of shortage in winter.

16. The objective of DECC is to increase the proportion of electricity generated from low-carbon sources so that the system is largely decarbonised by about 2030. However, there are serious challenges for the UK in meeting these targets. The two major components of a low-carbon electricity supply will be nuclear power and renewables. In much of Europe, "renewables" consist largely of hydroelectric generation, which can be turned on or off in a matter of minutes to respond to changes in demand. In the UK, the amount of hydroelectric power is limited, partly owing to geography, and "renewables" generally means solar, tidal or wind energy. All of these sources of energy are unschedulable; either you use them when the sun is shining, the tide is flowing or the wind is blowing or you lose them.

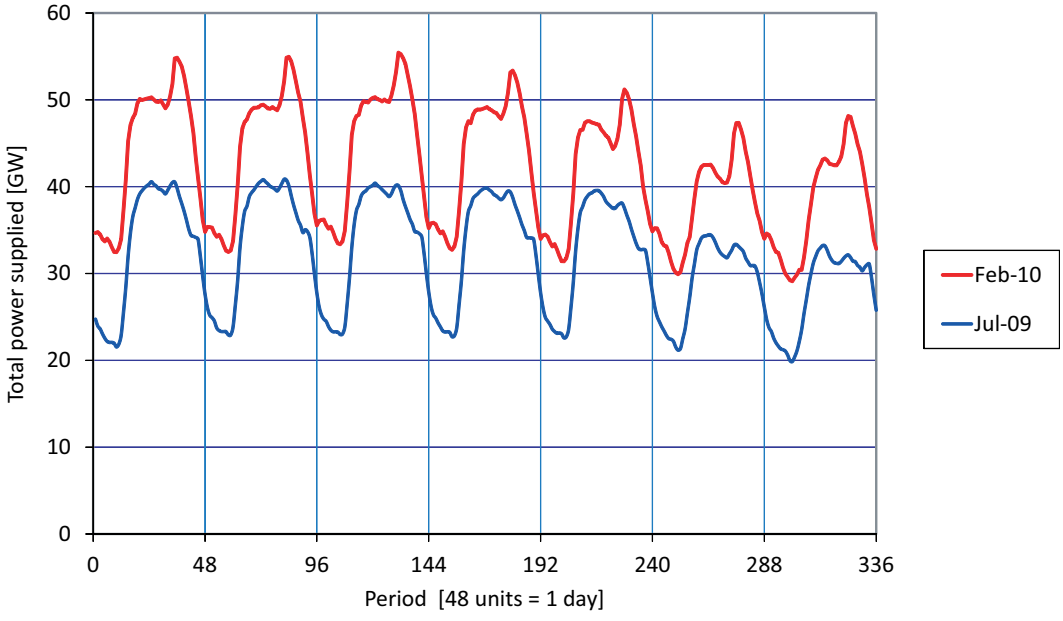
17. The economics of renewable energy are quite different from the use of oil or gas, where fuel cost is an important, sometimes the dominant, component. For renewables, the capital costs dominate the equation and

the operating costs are approaching zero. This means that the financial case for capital investment is more susceptible than fossil-fuelled stations to an intermittent market for generated electricity.

18. Figure 2 shows the load on the National Grid for two weeks—the first week of July 2009 and first week of February 2010.

**Figure 2**

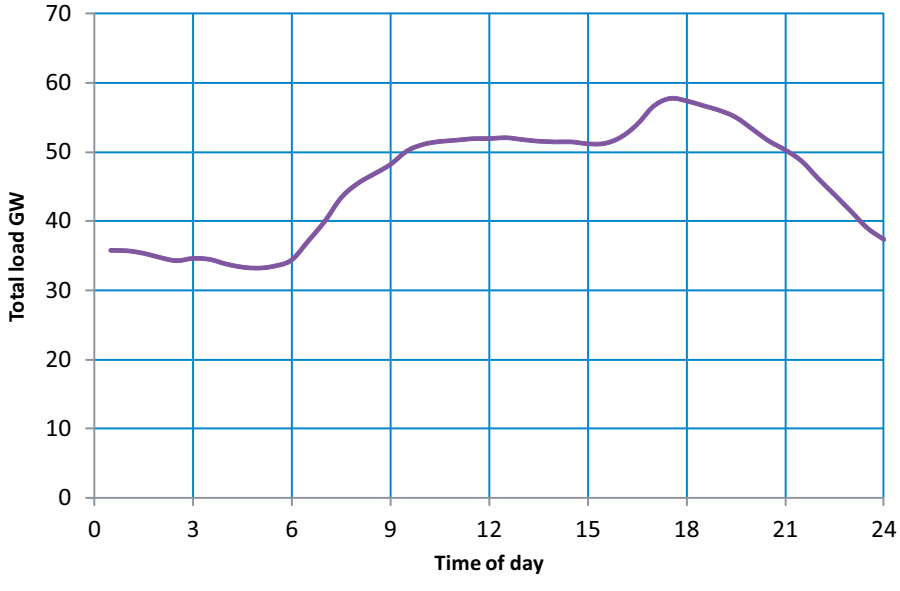
LOAD ON NATIONAL GRID IN SUMMER AND WINTER




19. It can be seen that the load varies from 20GW early on a Saturday morning in July to 55GW at 5:30pm on a weekday evening in February (during December 2010, the peak load was 60GW). Apart from the annual variation, there is both a weekly variation (with higher loads during the working week than at weekends) and a daily variation. The daily variation for 4 January 2010 is shown in Figure 3.

**Figure 3**

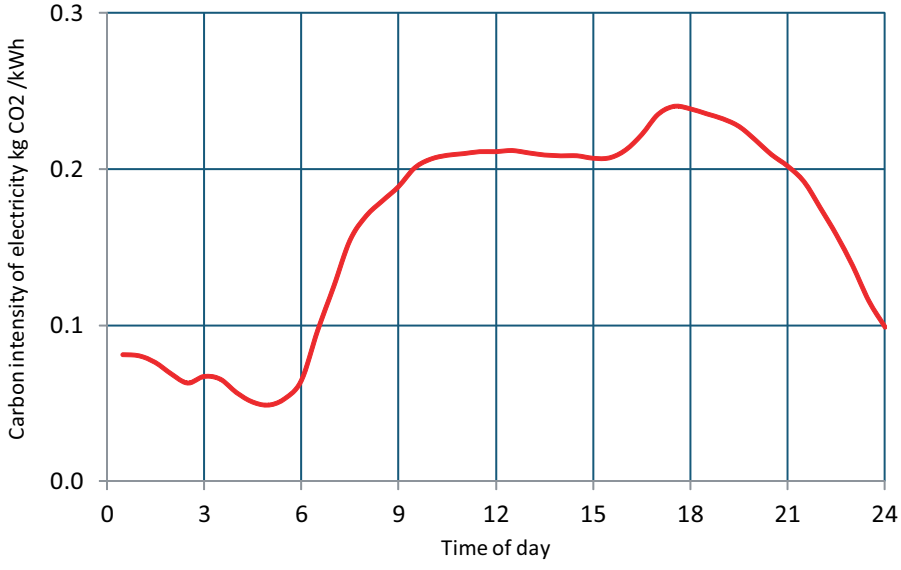
DEMAND ON NATIONAL GRID, 4 JANUARY 2010




20. By the mid-2020s, we expect there to be 10 new nuclear power stations, each capable of producing around 2.5 GW in addition to 30+ GW installed capacity of renewables. It is thus likely that much of the off-peak load will be met by zero-carbon generation. This will accentuate the differences in carbon intensity between day and night.

**Figure 4**

CARBON INTENSITY OF ELECTRICITY WITH HIGH RENEWABLES COMPONENT




21. Figure 4 shows the carbon intensity of electricity assuming the load is the same as on 4 January 2010 and there is zero-carbon generation of 30 GW (nuclear plus wind).[31] It can be seen that the carbon intensity varies from 50 g/kWh in the early hours of the morning to 250 g/kWh in the late afternoon. In windier conditions, the Grid could supply zero-carbon electricity from 10:00pm to 7:00am the following morning. The challenge for plug-in vehicles is to take electricity during the low-carbon period; otherwise there is little benefit in comparison with an advanced internal combustion engine vehicle.

Other uses of low-carbon electricity

22. Transport is not the only sector planning to be reliant on low-carbon electricity to meet the 2008 Climate Change Act. The CCC plans[32] for decarbonising domestic heating, accepted by government in May 2011, envisage the widespread use of electrically-powered heat pumps to replace gas boilers in millions of homes. These are likely to be supplemented by direct electrical heating, which will emphasise the peaks, and, to a lesser extent, by storage heaters which will tend to fill-in the night-time troughs.

23. The overall effect of these additional loads will be to accentuate the difference between summer and winter demand, to flatten the diurnal load cycle during the summer and to increase the "peakiness" of the diurnal cycle in the winter. We are thus likely to see a situation where the night time load can be supplied by nuclear and renewables throughout the year while the morning and evening peak load for at least six months of the year will be largely provided by gas turbine generation. During the winter, gas-fired plant is likely to be used for most of the daytime, particularly during anticyclones.

24. The significance of this is that it will no longer be possible to talk about a single figure for the carbon intensity of electricity. It will vary according to the seasons, the time of day, the weather and (if tidal energy is widely developed) the phases of the moon. It is also likely that the carbon intensity will be almost zero during much of the summer and high during the winter peaks. The marginal cost of generation will also vary. If the targets for renewable capacity are met, one could argue for electricity bills to be based only on the amount of energy drawn at peak times in winter and for summer time electricity being "too cheap to meter". Although such extreme commercial arrangements are improbable, it is likely that a pricing system reflecting the true costs would show dramatically different prices at different times of the day and year.

A new paradigm for energy use

25. Apart from the technical and financial challenges of constructing thousands of off-shore wind turbines and tidal barrages and installing photo-voltaic panels on millions of roofs to provide low-carbon electrical energy, adopting low-carbon technologies will require a fundamental shift in how we use energy.

26. Since the power station building boom in the 1950s, the UK's electricity system has been based on the principle that the consumer is "king" and demand has always been met by supply. In the interval of a cup final, millions of households switch on their electric kettles and, in power stations up and down the country, automatic control systems feed more coal into the boilers to provide more electricity.

[31] Fossil fuelled generation is assumed to be mainly gas-fired with average emissions of 0.5 kg/kWh, a figure higher than the usually stated emissions of a CCGT station but that allows for the intermittent operation that would be required.

[32] http://www.decc.gov.uk/en/content/cms/emissions/carbon_budgets/carbon_budgets.aspx

27. The same principle does not work for renewables—the consumer has no control over the flow of the tides, the strength of the wind or the amount of sunlight. The supply of energy will be determined by the natural world and we will have to manage our use to match what is available.

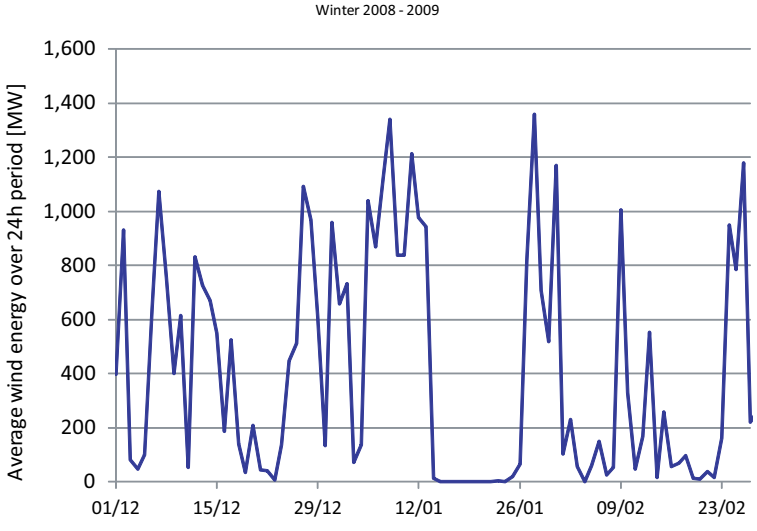
28. This need not be as draconian as it sounds as, for many applications, it is unimportant when the energy is supplied. If a commuter arrives home in the early evening and plugs in her electric car, she is unlikely to be interested whether it is charged between 10:00pm and 11:00pm or between 3:30am and 4:30am, as long as it is ready for use by 7.30am the next morning. To a lesser extent, the same is true of the space heating load. A solicitors' partnership is not concerned whether the heating has been on at a low power level since midnight or whether it has been on full-power for the previous half hour, as long as the office is warm when staff arrive at 9:00am.

The effect of climate variability

29. The UK's major source of renewable energy is wind. Present plans are for around 15 GW of on-shore capacity by 2020 and a total of 18 GW of off-shore capacity.[33] However, this could make the electricity system vulnerable to a widespread anticyclone, as occurred across much of Northern Europe in January 2009. The output of UK grid-connected wind energy between 1 December 2008 and 31 February 2009 is shown in Figure 5. It can be seen that, in the second half of January, wind energy dropped almost to zero for 10 days. None of the storage technologies discussed earlier would have been able to fill this gap.

**Figure 5**

DAILY WIND ENERGY OUTPUT, WINTER 2008–09




The smart grid

30. It can be seen from the above that the use of plug-in vehicles to reduce transport emissions faces several challenges:

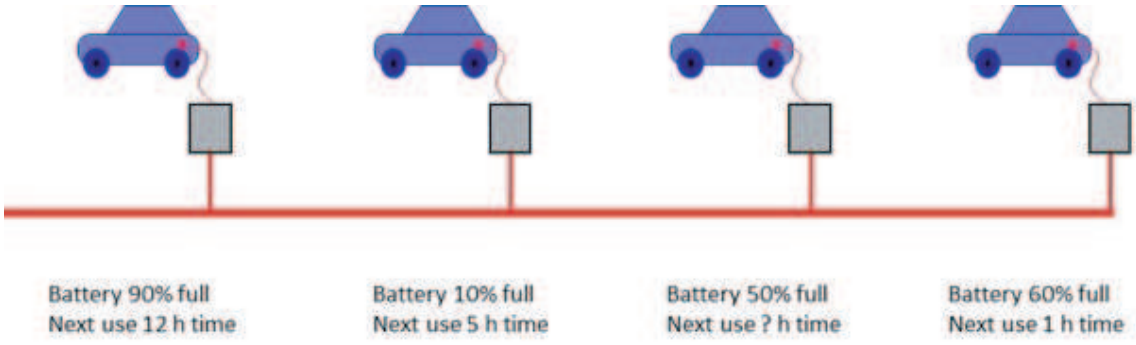
- If vehicles are charged at random throughout the day, the overall emissions per kilometre are unlikely to be significantly better than advanced petrol or diesel vehicles, which would be not allow the sector to meet the targets for emissions reduction.
- During the winter, the load from plug-in vehicles will be less than the load taken by heat pumps and other new heating appliances. The electricity generating and supply system will have to accommodate these loads, as well as electric vehicle charging.
- There will be occasional periods—possibly lasting for more than a week—when weather conditions will drastically limit the amount of renewable energy. The costs of maintaining standby fossil-fuel generating capacity for this "one week a year" duty cycle would be very expensive so an alternative strategy is needed.

31. Apart from the need to manage the overall UK load to match available generating capacity, the smart grid may also be needed to "negotiate" between different users in the same local area. Figure 6 is a greatly simplified diagram to illustrate the problem.

[33] Data from Renewables UK

**Figure 6**

ELECTRIC VEHICLES ON CHARGE




32. In the above diagram, there are four vehicles all put on charge in the evening. The charging computers can identify the state of charge of the batteries, and it is assumed that at least some of the owners have clicked on buttons to say when they next want to use their vehicles.

33. The challenge for the local smart grid, working with intelligent battery chargers, is to ensure that:

- All vehicles are adequately charged when needed.
- The load on national generating capacity is within the available limits.
- When energy is scarce, those vehicles in greatest need are given priority.
- The load on the cables in the street is limited to what they can carry.

34. This is not an easy compromise to broker, particularly when it has to be overlaid with a mixture of different commercial contracts between electricity retailers and customers, and encouragement for consumers to search out better deals and switch suppliers within the electricity market.

V2G (vehicle-to-grid recuperation)

35. Several groups have advocated not only varying the charging power to suit the availability of low-carbon electricity but also using plug-in vehicle batteries to support the grid in times of high load. The principle is that the battery charger is "put into reverse" to allow the batteries in a fleet of plug-in vehicles to provide short term back-up to allow the electricity grid to cope with demand peaks of a few hours duration or the failure of a power station or part of the transmission network.

36. However, such a scheme, although useful in supporting the grid in extreme conditions would need to be very carefully integrated with a high integrity "smart grid" to ensure the energy was only fed back when needed. Faulty software that called for vehicle-to-grid energy transfers over a wide area when not required could wreak havoc with the protection systems on the electricity grid.

Road pricing?

37. At present energy prices, there is a strong incentive for motorists owning a plug-in hybrid vehicle to use electricity in preference to petrol or diesel. For a motorist driving a car that uses 5 litres/100 km (57 mpg) on diesel or 0.2 kWh/km on electric power with energy prices of 150 p/litre for diesel and 10 p/kWh for electricity, the relative costs are 7.5 p/km for diesel or 2 p/km for electricity.

38. Government policy is to rely on the market to optimise allocation of resources. If the market is to dissuade people from using electricity to charge a plug-in hybrid at periods of low renewable energy availability, this differential will have to be reversed, implying an increase of at least five times in the price of electricity during periods of scarcity.

39. For families in fuel poverty, energy bills fluctuating by a factor of five, depending on weather patterns, is likely to be deeply unsettling and politically challenging to implement, which suggests it would be difficult to rely on the market to allocate energy resources. This points to the need for a more sophisticated taxation scheme than the traditional combination of vehicle and road fuel tax. The details of such a system that could incorporate elements of carbon pricing plus congestion charging are outside the scope of this submission. However, it should be noted that the widespread adoption of plug-in vehicles will require a different taxation model from that with which we are familiar.

Conclusions

40. Work undertaken by the Royal Academy of Engineering and professional engineering institutions over the last few years has shown that large number of plug-in vehicles, by themselves, would not necessarily result in a significant reduction in $CO_2$ emissions.

41. For plug-in vehicles to make a difference, they have to be introduced in parallel with low-carbon sources of energy and a "smart grid" that optimises the charging of plug-in vehicles as well as the many other new loads (including replacements for domestic heating boilers) that will be operating from the electricity grid. A smart grid with these characteristics, interfacing with home energy management computers and with the control systems for renewable energy supplies is a hugely complex system that has never been attempted before and is far removed from the "smart meters" that are about to be rolled-out across the country.

42. Key to the successful introduction of large numbers of plug-in vehicles and a consequent reduction in $CO_2$ from the transport sector is a new mindset that takes a systems view of the supply and use of all forms of energy. This should cover not only the transport sector but the energy used by the built environment and industry, as well as all potential supplies.

**Annex 1**

ENGINEERING THE FUTURE ALLIANCE MEMBERS

British Computer Society

British Institute of Non-Destructive Testing

Chartered Institution of Building Services Engineers

Chartered Institution of Highways & Transportation

Chartered Institute of Plumbing and Heating Engineering

Chartered Institution of Water and Environmental Management

Energy Institute

Engineering Council

Institution of Agricultural Engineers

Institution of Civil Engineers

Institution of Chemical Engineers

Institute of Cast Metals Engineers

The Institution of Diesel and Gas Turbine Engineers

Institution of Engineering Designers

Institution of Engineering and Technology

Institution of Fire Engineers

Institution of Gas Engineers and Managers

Institute of Highway Engineers

Institute of Healthcare Engineering & Estate Management

Institution of Lighting Professionals

Institute of Marine Engineering, Science and Technology

Institute of Measurement and Control

Institution of Mechanical Engineers

Institution of Royal Engineers

Institute of Acoustics

Institute of Materials, Minerals and Mining

Institute of Physics

Institute of Physics & Engineering in Medicine

Institution of Railway Signal Engineers

Institution of Structural Engineers

Institute of Water

Nuclear Institute

Royal Aeronautical Society

Royal Institution of Naval Architects

The Welding Institute

Society of Operations Engineers

Society of Environmental Engineers

*April 2012*

## Joint written evidence from the RAC Foundation and RAC

This is a joint response from the Royal Automobile Club Foundation for Motoring ("RAC Foundation") and RAC.

The RAC Foundation is a transport policy and research organisation which explores the economic, mobility, safety and environmental issues relating to roads and their users. The Foundation publishes independent and authoritative research with which it promotes informed debate and advocates policy in the interest of the responsible motorist.

RAC is one of the UK's oldest and most progressive motoring organisations with over seven million members. The business delivers motoring services, including roadside assistance, insurance, vehicle inspections, legal services and traffic and travel information, to both individual members and on behalf of corporate partners. RAC endeavours to champion the interests of responsible motorists and regularly surveys their views to inform policy. RAC is wholly owned by the Carlyle Group, one of the world's largest private equity asset managers.

Although sharing a common heritage, the RAC Foundation and RAC are separate entities. However, both organisations share a common interest in low-carbon vehicles and both are sponsors of the RAC Future Car Challenge, an eco-rally that showcases the latest low-carbon vehicles in a competition to use the least amount of energy for the route from Brighton to London.

### Summary of Main Points

- The RAC Foundation and RAC fully support efforts to decarbonise road transport through the promotion of low-carbon vehicles, in order to meet the government's greenhouse gas (GHG) reduction targets set out in the Climate Change Act 2008 and subsequent Carbon Budgets.
- There is no single solution to the challenge of decarbonising road transport. Different power train technologies (eg pure-electric, plug-in hybrid, hybrid, biofuel, highly optimised internal-combustion engines) will be used in different applications, where they are most suited. Plug-in vehicles will be part of the solution.
- The government should "set the rules of the game" through a long-term policy framework and leave it up to the market to decide which technology to choose in each application. It should not put all its eggs into one basket, eg plug-in vehicles only.
- In the short to medium term, (highly optimised) internal-combustion engine vehicles are likely to remain the dominant form of power train because barriers to plug-in vehicles (most notably battery costs and range) will limit these vehicles to niche markets.
- Surveys carried out by the RAC indicate that the current generation of plug-in vehicles is unattractive to financially stretched motorists, mainly due to limited performance characteristics (range) and high purchase costs.
- The gradual electrification of vehicles will increase the need to move towards a life cycle emissions metric to account for and compare the real environmental impact of vehicles.
- The improvement of local air quality is an often ignored benefit of plug-in vehicles.

### 1. *The contribution of plug-in vehicles to decarbonising transport*

1.1 In the short to medium term (up to *c*.2030), plug-in vehicles (currently several thousand) are unlikely to make a substantial contribution to GHG reductions because their numbers relative to the entire car park (currently 28.5 million) are likely to remain low, mainly due to high battery costs and performance limitations.

1.2 The limited contribution is also due the fact that the applications in which plug-in vehicles are likely to be used (ie the type of trips they will make/replace) are shorter ones (eg urban or suburban), which means that the vast majority of vehicle miles travelled will be made by conventional combustion engine vehicles.

1.3 The Committee on Climate Change estimates that 1.7 million plug-in vehicles will be needed by 2020 to meet the Carbon Budget. This is extremely ambitious, as it would require sales of over 200,000 plug-in vehicles every year until 2020—*c*.10% of new car sales. This would require a technological breakthrough in battery technology or huge financial incentives for consumers, neither of which are guaranteed or indeed (politically) acceptable.

1.4 In the longer term (from *c*.2030s), as battery costs and performance limitations are expected to decrease, plug-in vehicles will increase in number and make a greater contribution to GHG reductions. To meet the 2050

GHG reduction target, all vehicles from the early 2040s (because of vehicles' lifespan) will have to be virtually zero carbon, which, in effect, limits the options to plug-in or hydrogen vehicles.

1.5 Much depends on the "grid carbon intensity", ie the emissions associated with producing a unit of electricity, which currently fluctuate between 450 and 550 $gCO_2e/kWh$. In order to maximise plug-in vehicles' contribution to GHG reductions, the grid will have to be decarbonised to virtually zero, which requires significant investment into low-carbon sources (ie renewables and/or nuclear).[34] As other sectors of the economy are electrified (eg rail and heating homes), there will be increased competition for finite, low-carbon electricity.

1.6 There is a strong need to move away from the "tailpipe" (ie exhaust emissions) metric, which currently serves as the basis for policy and regulation, towards a life cycle metric to make better informed decisions which reflect the true environmental impact of vehicles.

2. *Uptake of plug-in vehicles and how this can be improved*

2.1 When compared to the overall car park and new car sales, the market take-up of plug-in vehicles is slow. This is mainly because of: (1) high vehicle purchase prices and concerns over residual value due to uncertainties associated with battery technology; (2) limited range/range anxiety; (3) difficulty/inconvenience of recharging; (4) limited choice of models; (5) supply constraints; and other concerns, eg regarding safety and reliability.

2.2 Overcoming these barriers will require a mix of long-term government policies and technological advances:

(1) *High vehicle purchase prices and residual value:* in its first progress report to Parliament, the Committee on Climate Change stated that stronger incentives might be needed in the early years, eg £10,000 for the first 25,000 vehicles sold, and that cumulative support will have to be significantly higher than the £230 million already committed by the government. While the evidence would support this, even stronger financial incentives would be difficult to justify politically. Technological advances and increasing economies of scale will bring down the price of plug-in vehicles, although the extent and speed of this is unclear. A more promising way to overcome this barrier is for vehicle manufacturers to offer battery leasing models which decreases the purchase price significantly and removes concerns over residual value.

(2) *Limited range/range anxiety:* this will mainly be achieved through technological advances in battery technology, and the roll-out of appropriate charging infrastructure (eg on-street rapid charging, off-street slow charging in residential areas). In theory, battery swapping is also an option, but the need for battery system and mounting standardisation and logistical issues are unlikely to make this a viable option in the UK for the foreseeable future. Evidence from the Technology Strategy Board's ultra-low-carbon vehicle trials suggests, however, that once users experience plug-in vehicles, range anxiety decreases markedly.

(3) *Difficulty/inconvenience of recharging:* charging must be made as easy as possible, and will require the roll-out of charging infrastructure for people without off-street parking facilities.

(4) *Limited choice of models:* this barrier will slowly be overcome as new models enter the market place in the next couple of years.

(5) *Supply constraints:* these will be overcome, as demand gradually increases and vehicle manufacturers increase low-volume production.

2.3 Incentives for and investment in plug-in vehicles must not come at the expense of other low-carbon power train technologies, many of which are available now, such as non-plug-in hybrids and other alternative fuels such as natural gas, which are well suited for certain applications (eg heavy goods vehicles). The ultimate aim must be for the plug-in vehicle market to carry and sustain itself, as the government cannot and should not provide incentives indefinitely.

2.4 It is important to stress that introducing disruptive technologies to the mass market is a long-term and gradual process.

3. *The effectiveness of the Plugged-in Places scheme*

3.1 The main achievement of the Plugged-in Places (PiP) scheme was to stimulate and encourage activity to promote plug-in vehicles at the local level by bringing together a range of actors: local authorities, energy and utility companies, transport operators, and so on. The scheme has set in motion the roll-out of charging infrastructure in key potential markets across the UK.

3.2 As noted above, installing charging points is an important way to overcome slow uptake of plug-in vehicles, mainly because they enable people without (easy) access to charging facilities to recharge their vehicles, but also because they give people psychological reassurance.

[34] The impact of the grid carbon intensity on vehicle GHG emissions is illustrated in www.racfoundation.org/assets/rac_foundation/content/downloadables/shades_of_green-lytton-050511.pdf and www.racfoundation.org/assets/rac_foundation/content/downloadables/the_green_charge-lorf_lytton-270312.pdf

3.3 However, installing charging points, even for PiP regions, is not a straightforward process: it is expensive and potentially a lengthy process due to planning laws.

3.4 There is a need to incentivise night-time (ie off-peak) charging at home to spread the load on the electricity network and maximise $CO_2$ reductions; this will also be advantageous to consumers who can benefit from cheaper electricity at night.

3.5 On-street rapid and/or quick charging points are likely to be needed to make charging in public spaces a realistic option for plug-in vehicle users; these are, however, expensive to install and in many cases will require reinforcements to the local grid.

3.6 Local authorities can make use of a host of policies to encourage plug-in (and other low-carbon) vehicles, other than merely installing charging points: parking policy, Low Emission Zones, road pricing, access to bus only lanes—the RAC Foundation has published a report outlining these powers, including a survey showing the "appetite" among local authorities for using them.[35] The report showed that more of these powers could be used in practice.

4. *The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport*

4.1 Plug-in vehicles are not the panacea to the decarbonisation challenge in transport, certainly in the short to medium term; they are one part of the solution.

4.2 As noted above, however, in the long term, there are only few options as vehicles will have to have zero emissions, from the tailpipe at the very least. This leaves all-electric vehicles, hydrogen fuel cell vehicles (or hydrogen internal-combustion engine vehicles) or internal-combustion engine vehicles fuelled by second or third generation biofuels.

4.3 The RAC Foundation has published a report which maps out the pros and cons of the different options to decarbonise power trains:[36]

(1) *Internal-combustion engine (ICE) vehicles:* ICE vehicles will remain the dominant form of power train for the foreseeable future. European legislation will force vehicle emissions per kilometre to come down. The main options for decarbonisation include downsizing and turbo-charging, and weight reduction. Many vehicles are becoming/have become heavier, however, mainly due to people's preferences (and to a lesser extent safety requirements).

(2) *Hybrids:* micro/stop-start, mild and full hybrids are all readily available and proven technologies which can achieve significant fuel and GHG savings. By the 2020s, almost all vehicles are likely to feature some form of electrification/hybridisation.

(3) *Biofuels:* European legislation requires that by 2020, 10% of transport energy demand comes from renewable energy and 6% of fossil fuels to be effectively biofuel. There are, however, sustainability (indirect land-use change) and social concerns ("food vs fuel"), especially in relation to first generation biofuels, which need to be fully addressed. Furthermore, there will be competition for limited biofuel supplies from other sectors, particularly aviation, where there are fewer or no alternatives to the use of liquid fuels.

(4) *Natural gas:* this is an often ignored fuel, but one that is well suited for certain applications, eg heavy vehicles with central refuelling possibilities, at depots for example.

(5) *Hydrogen:* although hydrogen is a potentially zero-carbon fuel at the tailpipe, hydrogen fuel cell vehicles are likely to be only a longer term mass market solution because vehicle costs are still high, it is very expensive to roll out the necessary refuelling infrastructure, and it is energy-intensive to produce hydrogen in mass market volumes.

4.4 It is important to note that there are many cross-benefits that will apply to all power trains: weight reduction, engine downsizing (for all vehicles that use an ICE), advances in battery technology (hybrids, plug-in hybrids and all-electric vehicles), low rolling resistance tyres, and improved aerodynamics.

5. *Action taken by other countries to encourage the uptake of plug-in vehicles*

5.1 Most countries in the EU have engaged in a programme to encourage the take-up of plug-in vehicles: for example, Spain and France have invested heavily in rolling out charging infrastructure. The French government has also procured a large number of electric vehicles with a view to stimulating market demand.

5.2 An RAC Foundation summarises what EU member states are doing to encourage low-carbon and plug-in vehicles.[37] One interesting example is the French "feebate" system: feebate schemes combine an integrated system of registration fees for the most polluting vehicles with rebates for cars with the lowest emissions. Such systems are financially self-sustaining for the government because the fees collected from the most polluting vehicles pay for the rebates for the least polluting vehicles. The evidence suggests that this system has enabled emissions reductions in France of twice the European average.

[35] www.racfoundation.org/assets/rac_foundation/content/downloadables/going_green-hanley-121011.pdf

[36] www.racfoundation.org/assets/rac_foundation/content/downloadables/low_carbon_vehicle_technology-lytton-report.pdf

[37] www.racfoundation.org/assets/rac_foundation/content/downloadables/market_delivery_of_ulcvs_in_the_uk-ben_lane.pdf, pp. 40–42.

5.3 Countries such as Israel, Denmark, Japan and Australia are working with "Better Place", a company that has developed a battery swapping system designed to make recharging faster and easier for plug-in vehicle users. The advantages of such a system are that it removes range anxiety and the inconvenience of long recharging times, and that it removes the need for charging points and parking spaces dedicated for charging. The disadvantages are that it is: costly to roll out; requires standardisation of batteries and battery mounting systems, which is difficult to agree as manufacturers will not want to give up their own systems; gives rise to a host of logistical issues, namely having to store large numbers of different types of batteries in different locations.

*April 2012*

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## Written evidence from Jonathan Kershaw

### Submitter Introduction

My name is Jonathan Kershaw and I am a 2nd year PhD research student, based at Coventry University. This submission is my own, and not made on behalf of Coventry University.

### Executive Summary

1. The car is responsible for up to 12% of man-made carbon dioxide emissions. In turn, up to 65% of these carbon dioxide emissions are the tailpipe emissions emanating from the use of the car. Plug-in vehicles are the most immediate and obvious candidates for the decarbonisation of transport as $CO_2$ emissions from the tailpipe are greatly reduced or, in the case of full EVs, eliminated altogether. Also, the necessary plug-in technology is, unlike the hydrogen fuel cell, available now.

2. Electric vehicles have zero tailpipe emissions and plug-in hybrids provide moderate zero-emission motoring while assuaging range anxiety and/or lengthy recharging.

3. The economy and efficiency claims made by manufacturers perhaps stretch credibility and necessitate the establishment an "equivalent" figure.

4. There seems to be a lack of information and/or clarity regarding incentives, infrastructure and efficiencies, as well as a disconnect between EV availability and recharging accessibility in some parts of the country.

5. Plug-in vehicles are part of a mix of technologies which all have their place in decarbonising transport.

6. Though currently providing a suite of fiscal measures to incentivise purchase of low carbon vehicles, the government could do more to decarbonise transport infrastructure on a wider scale and also help investigate, develop and establish low carbon vehicle schemes.

### Factual Information

*The contribution of plug-in vehicles to decarbonising transport*

7. Transport is responsible for 25% of all anthropogenic, or man-made, carbon dioxide ($CO_2$) emissions. Responsible for up to 12% of all anthropogenic $CO_2$ emissions, the car is the dominant source of carbon emissions of the transport sector, accounting for almost half of the $CO_2$ emissions therein (EC, 2011a; Khan Ribeiro *et al*, 2007; Khare & Sharma, 2003). This means, however, that it is within the power of individual motorists to reduce and/or mitigate the emissions associated with the car.

8. Because of the carbon content of fossil fuels—petrol and diesel fuels average 2.4kg and 2.7kg of $CO_2$ per litre respectively (Potter, 2003)—tailpipe $CO_2$ emissions are a corollary of engine efficiency and of distances travelled (*ibid*). It has been estimated that the tailpipe emissions of $CO_2$ account for 60–65% of the lifetime greenhouse gas emissions of the car, whereas non-$CO_2$ emissions such as nitrous oxides ($NO_x$) account for 10%, manufacturing 10%, and fuel extraction processing and delivery the remaining 15–20% (OECD, 1993).

9. There is a proliferation of technologies to facilitate low carbon automobility, from cleaner conventional internal combustion engines to hydrogen fuel cells. There are a variety of plug-in technologies too, including the full electric vehicle (EV) such as the Nissan Leaf, the extended range electric vehicle (ER-EV) such as the Vauxhall Ampera or Chevrolet Volt, or the plug-in hybrid electric vehicle (PHEV) such as the plug-in Toyota Prius PHEV, due on sale in the UK in July 2012.

10. Plug-in vehicles are the most immediate and obvious candidates for the decarbonisation of transport—particularly of the car—as $CO_2$ emissions from the tailpipe are greatly reduced or, in the case of full EVs, eliminated altogether. Crucially, the necessary plug-in technology is, unlike the hydrogen fuel cell, available now. The battery capacity of a given ER-EV or PHEV dictates the amount of carbon subsequently emitted from the tailpipe when the battery's charge is exhausted meaning that, insofar as ER-EVs and PHEVs are concerned, tailpipe emissions are dependent upon their respective technologies and the inherent compromises of the installation of such technologies. Such compromises are illustrated by the technologies installed in the Vauxhall Ampera and the Toyota Prius PHEV, in that while the Ampera has a greater electric-only range—50 miles, compared to 11 miles for the Prius PHEV (Toyota, 2012; Vauxhall, 2012)—it appears to offer worse

fuel economy, and therefore more carbon emissions, than does the Prius PHEV once their respective batteries have been depleted (*ibid*; Walton, 2011).

11. The issue of the decarbonisation of road transport isn't as simple as tailpipe emissions. The source of the power used in recharging the batteries of plug-in vehicles means that the electricity mix of the UK also plays a crucial, if less obvious, part in the decarbonisation of the car, and also need to be borne in mind. As such, momentum behind the development of renewable energy in the UK must be maintained and should not be undermined. Well-to-wheel emission provide a true comparison of the various technologies, especially as the $CO_2$/km figures currently quoted by car manufacturers are achieved using the standardised, yet unrealistic, NEDC cycle (Pelkmans and Debal, 2006) and are perhaps best regarded as comparative.

12. As $CO_2$ emissions are a corollary of a particular engine and distances travelled (Potter, 2003), this presents a strong case for establishing a "miles per gallon equivalent" (or MPGe) metric when making claims for the efficiency of a plug-in technology, as is the case in the USA. Similarly, a case for establishing a carbon dioxide per kilometre equivalent emissions figure (perhaps given as $CO_2$/KMe) can be made too.

*Uptake of plug-in vehicles and how this can be improved*

13. Much has been noted about the costs, technologies and (im)practicalities of plug-in vehicles, especially EVs. The cost issue has been addressed with the £5000 plug-in grant offered by the Department for Transport (DfT) via the Office for Low Emission Vehicles (OLEV), although it is clearly difficult to promote and sell expensive emergent technologies during such straitened times. That said, publicity of the £5,000 grant for low carbon vehicles is perhaps not what it could be. It is has perhaps received less coverage than the recent £2,000 "scrappage" scheme, possibly because the scrappage scheme was one geared more towards supporting an ailing motor industry than promoting an environmental imperative; interested more with fiscal than environmental concerns.

14. The impracticalities of the limited distance or range associated with full EVs are addressed by the nature of ER-EVs, while PHEVs can be seen to provide the potential for more emission-free motoring than is possible with a conventional parallel or series-parallel hybrid car, such as those currently offered by Honda and Toyota respectively.

15. A key obstacle to an uptake of plug-in vehicles seems to be the "chicken-or-egg" nature of establishing a charging infrastructure: while there is little point of an electric car without the means of recharging, there is little appetite for providing an infrastructure without the vehicles to use it. Yet there seems to be some anomalies between plug-in vehicle supply and opportunities to recharge them.

16. For example, in Manchester there are currently four manufacturer-franchised dealerships supplying electric cars: Renault Manchester in Salford (Renault, 2012), West Way Nissan in both Manchester and Stockport (Nissan, 2012), Citroën Manchester (Citroën, 2012) and Peugeot (Peugeot, 2012), together with a Vauxhall franchise selling the Ampera (Vauxhall, 2012). However, there is a dearth of charging points in the city—according to charge-point location website Zap-Map, there are just two (Zap-Map, 2012).

17. Conversely, in Coventry, there are 18 charging points across the city, with another 17 pending, within or around the ring-road circling the city centre (Zap-Map, 2012), and yet there is just one local outlet, a Mitsubishi-franchised dealership, from which to buy an electric car (Mitsubishi, 2012). The nearest Renault, Nissan, Citroën and Peugeot electric vehicle franchises are some 20 miles away in Birmingham (Renault, 2012; Nissan, 2012; Citroën, 2012; Peugeot, 2012), as is the nearest Vauxhall franchise selling the Ampera (Vauxhall, 2012).

18. With respect to low carbon vehicles, the DfT website needs to be more informative, with the work OLEV is doing perhaps reflected in having a more overt, dedicated website. At the moment, finding reference to OLEV necessitates finding the "ultra-low emissions vehicles" page (DfT, 2012), wherein OLEV is rather meekly announced. Furthermore, and staying with Manchester and the Midlands, information about the government's "Plugged-in Places" scheme, administered by OLEV, is hard to come by. It seems that the website for the "Plugged-in Midlands" scheme hasn't been updated for some months (Plugged-in Midlands, 2011) and a hyperlink relating to Manchester's part of the scheme is conspicuous by its absence (DfT 2012). If the government is serious about promoting low carbon vehicles, especially plug-in vehicles, it needs to provide a clear, comprehensive and coherent "one-stop-shop" of information detailing availability, incentives and infrastructure.

19. It is clear that, in comparison to costs, technologies and practicalities, less is known about how socio-cultural regard for the car might impact upon the potential for low carbon motoring. The cultural and semiotic nature of the car means that it has always been more than simply a means of transport and, as such, it is important to assess the responsiveness to, and the appetite for, a greener automobility if we are to ascertain the viability of sustainable personal mobility. Admittedly, there is little that the government can do about the "sociology" of the car, although it is an aspect of consumer behaviour which will play an important role in the uptake of low carbon vehicles of all technologies. It is this aspect which my PhD research hopes to address, and so better inform low carbon vehicle policy.

*The effectiveness of the Plugged-In Places scheme*

20. As alluded to above, it is perhaps too early to assess the effectiveness of the Plugged-In Places scheme, certainly outside of London.

*The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport*

21. It is important to look at the various emergent low carbon vehicle technologies, such as hybrids or electric vehicles, to examine how the day to day practicalities and shortcomings of such technologies may act as barriers—or even opportunities—to a wider acceptance. For example, just as it can be argued that wind power isn't *the* answer, but *an* answer, to reducing carbon emissions from the generation of electricity, it can also be argued that the electric car is merely *an* answer to reducing carbon emissions from transport. Each low carbon technology has a place; the electric car is desirable in urban settings as it has no tailpipe emissions, but there are issues with range and recharge time and infrastructure, whereas the plug-in hybrid strikes a balance between zero-emission motoring and assuaging range anxiety and/or lengthy recharging.

*Action taken by other countries to encourage the uptake of plug-in vehicles*

22. A variety of fiscal incentives are available across the EU to encourage the uptake of low carbon vehicles, ranging from "circulation" or road tax exemptions in Italy and Portugal to purchase subsidies in Spain and the UK (ACEA, 2012) and also in the USA (IRS, 2009). A truly flexible battery-swap scheme, such as that posited by Better Place (Better Place, 2012), is in place in Israel, with a similar trial scheme taking place in the EU (Better Place, 2011). It seems that other countries look beyond providing pecuniary purchase incentives.

23. Aside from what other countries are doing, the UK must concentrate on doing more to develop plug-in vehicle uptake and infrastructure, and yet the government seems intent on doing the opposite. For example, a little-reported policy from the 2012 Budget statement scrapping company car-tax exemption in 2015 will do little to encourage a long-term fleet uptake of electric vehicles, and could do great damage to a fledgling plug-in vehicle market (Saunders, 2012). Similarly, the inclusion of a policy statement on the roll-out of electric vehicle recharging points in the National Planning Policy Framework document amounts to little more than a sentence which makes vague mention of a need to include facilities for the charging of plug-in and low emission vehicles (DfT, 2011; DCLG, 2012), which doesn't seem to provide a vote of confidence for the provision of the infrastructure needed for the uptake of plug-in vehicles.

## Recommendations for Action

24. In the light of the proliferation of technologies available, and of some manufacturer claims of fuel economy and $CO_2$ emissions, it would be useful to consider a "miles-per-gallon equivalent" or "$CO_2$/km equivalent" to better inform consumers of the true efficiencies of low carbon vehicles, both in comparison with conventional internal combustion-engined vehicles and with other low carbon vehicles.

25. There is a need to establish a greater connect between plug-in vehicle supply and plug-in vehicle charging infrastructure.

26. More information about the incentives and infrastructure provisions for plug-in vehicles must be made available and be publicised, as educating consumers will be a key factor in challenging the "lock-in" of the internal combustion engine and pursuing a low carbon automobility, regardless of technology. Such information currently in the public domain is highly unsatisfactory in respect if its quality and its coherence.

27. The need to combat emissions in all sectors requires a collective action, not simply a piecemeal, state-sponsored "for-profit" directive. The environment cares not about a level playing field between the predominately fossil fuelled vehicles of the present and the low carbon vehicles of the future. The UK government should support all low carbon industry and infrastructure and, for our purposes here, follow the examples of other countries regarding the exploration of the possibilities for low carbon vehicles and not undermine the uptake of such vehicles, for example, by means of misguided future tax measures.

28. While beyond the influence of government, the sociology of the car might be borne in mind when considering and establishing future low carbon vehicle policy.

## References

ACEA (European Automobile Manufacturers Association). *Overview of Purchase and Tax Incentives for Electric Vehicles in the EU*. http://www.acea.be/images/uploads/files/Electric_vehicles_overview.pdf. Accessed 15/04/12.

Better Place (2011). *European Commission Backs Project for Battery Switch.* http://www.betterplace.com/the-company-pressroom-pressreleases-detail/index/id/european-commission-backs-first-project-for-battery-switch. Accessed 15/04/12.

Better Place (2012). *Battery Switch Stations*. http://www.betterplace.com/the-solution-switch-stations. Accessed 15/04/12.

Citroën (2012). *Find a dealer.* http://www.citroen.co.uk/new-cars/car-range/citroen-c-zero/#/contact-us/find-a-dealer/results/. Accessed 11/04/2012.

DCLG (Department for Communities and Local Government) (2012). *National Planning Policy Framework*. http://www.communities.gov.uk/documents/planningandbuilding/pdf/2116950.pdf. Accessed 15/04/12.

DfT (Department for Transport) (2011). *Making the Connection; the Plug-In Vehicle Infrastructure Strategy.* http://assets.dft.gov.uk/publications/making-the-connection-the-plug-in-vehicle-infrastructure-strategy/plug-in-vehicle-infrastructure-strategy.pdf. Accessed 15/04/12.

DfT (2012). *Ultra-low emission vehicles*. http://www.dft.gov.uk/topics/sustainable/olev. Accessed 11/04/12.

EC (2011a). *Reducing emissions from transport*. http://ec.europa.eu/clima/policies/transport/index_en.htm. Accessed 10/04/12.

EC (2011b). *Reducing $CO_2$ emissions from passenger cars*. http://ec.europa.eu/clima/policies/transport/vehicles/cars_en.htm. Accessed 10/04/12.

IRS (Internal Revenue Service) (2009). *New Qualified Plug-In Electric Drive Motor Vehicle Credit*. http://www.irs.gov/irb/2009–48_IRB/ar09.html. Accessed 15/04/12.

Khan Ribeiro, S, Kobayashi, S, Beuthe, M, Gasca, J, Green, D, Lee, D S, Muromachi, Y, Newton, P J, Plotkin, S, Sperling, D, Wit, R & Zhou, P J (2007). Transport and its infrastructure. In Metz, B, Davidson, O R, Bosch, P R, Dave, R & Meyer, L A (Eds.). *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. Cambridge.

Khare, M & Sharma, P (2003). Fuel options. In Henscher, D A & Button, K J (Eds.). *Handbook of Transport and the Environment*. Elsevier. Oxford. pp 159–183.

Mitsubishi (2012). *Find your local dealer.* http://www.mitsubishi-cars.co.uk/dealers/. Accessed 11/04/12.

Nissan (2012a). *Locate a dealer.* http://www.nissan.co.uk/#vehicles/electric-vehicles/electric-leaf/leaf/own-it/dealer. Accessed 11/04/2012.

OECD (Organisation for Economic Co-operation and Development) (1993). *Cars and Climate Change*. OECD. Paris.

Pelkmans, L & Debal, P (2006). Comparison of on-road emissions with emissions measured on chassis dynamometer test cycles. *Transportation Research Part D: Transport and Environment* 11(4): 233–241.

Potter, S (2003). Transport energy and emissions: urban public transport. In Henscher, D A & Button, K J (Eds.). *Handbook of Transport and the Environment*. Elsevier. Oxford. pp 247–262.

Peugeot (2012). *Peugeot i0n electric car specialist network*. http://www.peugeot.co.uk/vehicles/peugeot-car-range/peugeot-ion/specialist-network/. Accessed 11/04/12.

Plugged-In Midlands (2011). *Home*. http://pim.pod-point.net/. Accessed 11/04/12.

Renault (2012). *Find a dealer.* http://www.renault.co.uk/contact/dealerlocator.aspx. Accessed 11/04/12.

Saunders, R (2012). *Strangled at Birth?* http://www.auto-retail.co.uk/blog/26–03–2012/strangled-birth. Accessed 15/05/12.

Toyota (2012). *2012 Toyota Prius Plug-in Hybrid Performance and Specs*. http://www.toyota.com/prius-plug-in/specs.html. Accessed 10/04/12.

Vauxhall (2012a). *Reinventing electric propulsion*. http://www.vauxhall.co.uk/vehicles/vauxhall-range/cars/ampera/highlights/technology.html. Accessed 11/04/12.

Vauxhall (2012b). *Locate a retailer.* https://www.vauxhall.co.uk/tools/vauxhall-locate-dealer.extapp.html#. Accessed 11/04/12.

Walton, M (2011). Volt takes on America. *Car* July 2011 588: 110–119.

Zap-Map (2012). *Electric car charge points.* https://www.zap-map.com/indexnissan.php. Accessed 11/04/12.

*April 2012*

**Written evidence from Stephen Harding**

I am acting as an individual eager to see the Committee adopt the bulletted resolutions set out herewith in the public interest.

My primary focus is on simple game-changing positive-displacement engine technology better able to exploit lean combustion. So a brief word on this first.

In reciprocating piston engines (RPE) the pistons move in straight radial paths intersecting the axis of the crankshaft. A circular rotor mounted on the output shaft turned by purely local tangential forces is a more attractive alternative. Applying force to fixed vane extensions is logically and demonstrably far superior to any RPE crank+crankshaft arrangement. Archimedes would concur.

My idea—quite unlike the Wankel—is achievable with a circular rotor rotating inside a concentric housing. A plurality of diametrically-opposite variable-volume chambers are formed for the expansion and expulsion of gases, bounded by the fixed-vane faces, housing, rotor surface and novel partitioning means through which the non-sliding vanes transit without let or hindrance. Concurrent induction+compression strokes are followed by concurrent power+expulsion strokes. All vanes are double-acting. Four (4) power strokes per rotor per rev. is on offer. Extra bolt-on rotor modules open up many other possibilities.

A current focus of the auto industry is on 3-cylinder 4-stroke engines of about 1,000 cc displacement, eg the VW's Up one or Ford's 1 litre "EcoBoost" engine. My ultra-simple compact technology promises *at least double the torque* based on the same quoted displacement and brake mean effective pressure (BMEP) figures. So the same power output is promised at lower revs. or with lower average piston face pressures. Cleaner emissions too.

As the torque-arm is constant, ignition does not *need* to start as in RPEs prior to top dead centre (tdc). Low-cost (solenoid) electronic fuel injection is easily provided for. HCCi (homogenous charge compression ignition) too. The fuel burn is expected to be more complete than with RPEs leading to lower $CO_2$/km output on that score alone.

No reciprocating masses, no balancing needs, no camshaft(s), lighter weight, greater reliability, and lower production costs *should* be very appealing. However getting the auto industry to accept any disruptive technology may come to a David & Goliath spat. Annual losses may though concentrate minds.

I note Professor Rod Smith has recently been appointed Chief Scientific Adviser to the Department of Transport "to provide engineering wisdom to politicians and Whitehall mandarins". He may be unable to make a recommendation to DfT in respect of any particular technology—nor should a technical endorsement of anything not first bench-tested be expected—but I think the Select Committee would certainly benefit from his general opinions. A light grilling rather than a full "Spanish Inquisition" roasting from Louise Ellman should suffice. I have already offered to show him computer animations and may even have a proper physical model to hand sooner rather than later to run on compressed air at BMEP pressures. Of course it's all about materials, tolerances, volumetric efficiency, thermal efficiency, etc. And thinking the unthinkable.

- If the Government wants to increase the number and uptake of energy from plug-in charging points then the plug-in grants should be extended to include vehicle purchases *irrespective of whether the vehicle has an electric battery and electric motor or not.* (Obviously any vehicle will need to comply with E.C. crashworthiness directives.)
- There is little incentive to develop other-technology powertrains if DfT/OLEV can only say that *potentially* they *might* qualify with absolutely no degree of certainty. Energy can be stored on-board in phase-change materials or flywheels, their own energy source being electricity. Steam and heat-direct-to-electricity should not be overlooked either. It's time DfT/OLEV started making connections.
- If the Government wants "zero tailpipe emissions" *at all times* then there should be stronger incentives to encourage this with, say, a minimum achievable range of 200 miles deliverable from one *stop* for electricity rewarded. Again, if OLEV does not try to stifle innovation by, say, suggesting only one anaemic charger can be deployed or a "single-charge range" is specified, then we *will* see such vehicles. But probably not with heavy expensive toxic Li-ion batteries. They make no sense.
- A good way to encourage the development of low carbon vehicles in U.K. would be to offer a £10 million. prize for the best commercially-viable *powertrain* with nobody barred from entering, all entries submitted anonymously, and the result decided on purely technical merit by a lay panel appointed by, say, the Royal Society. Disbursement of the cash prize can still be within the European State Aid Rules—and should be to prevent the "usual suspects" making off with the spoils; the balance going to runners-up. (A winner should have no difficulty raising matching funding if required *after* being proclaimed winner.)
- The money in the EC FP7 fund for "eco-innovations" should be accessible to worthy U.K. applicants, including non-SMEs, and not solely through the DfT/OLEV/Technology Strategy Board route with onerous *application* eligibility conditions to meet, often a complete turn-off.

— Finally let's have a level playing field with say a 2013 target of 60g/km $CO_2$ as a particularly well-rewarded milestone for *any* vehicle including hybrids. What better way to encourage genuine competition and get the volume manufacturers to embrace outside technologies that can deliver when their own heavily-subsidised efforts can't?

P.S. Hydrogen and rotary engines are a match made in heaven as I have long been saying. Thus it should be no surprise that one of the three winners of DOE's "America's Next Top Energy Innovator" Challenge won with a hydrogen-assisted lean burn engine.

*April 2012*

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## Written evidence from the Chartered Institute of Logistics and Transport in the UK

### Introduction

1. The Chartered Institute of Logistics and Transport in the UK ("the Institute") is a professional institution embracing all transport modes whose members are engaged in the provision of transport services for both passengers and freight, the management of logistics and the supply chain, transport planning, government and administration. We have no political affiliations and do not support any particular vested interests. Our principal concerns are that transport policies and procedures should be effective and efficient and based, as far as possible, on objective analysis of the issues and practical experience and that good practice should be widely disseminated and adopted.

2. The Institute has a specialist Roads and Traffic Forum, a Public Policies Committee which considers the broad canvass of transport policy and a nationwide structure of locally based groups. This submission draws on contributions from all these sources.

3. In November 2011, CILT(UK) published a report of a study on the *Transport Use of Carbon*. This study focused on long distance passenger travel by all modes and sought to understand the amount of carbon used by each mode. It considered the way in which carbon is used not just in the fuel consumed, but also in building and scrapping the vehicles and in providing and maintaining the infrastructure.

4. Within the report there are significant conclusions about the use of electric vehicles for long distance journeys, which are set out below. The full report is attached and available at http://bit.ly/HLdmt0

### Carbon in Fuel

5. *Transport Use of Carbon* study showed that substantial progress towards the decarbonisation of electricity generation is critical to meeting targets for the reduction in carbon used by transport (both for road and rail). While total decarbonisation of electricity production is not possible, the most important step is the removal of unabated coal (ie coal without carbon capture and storage) from electricity generation.

6. The study also noted that, if this were achieved, then the amount of carbon produced will be similar whether the assumption is made that the electricity is generated at the margin (eg, by "spare" nuclear capacity at low demand times such as for charging vehicles overnight) or by using the average generating mix (ie, nuclear, renewables, coal with CCS and gas).

7. From the point of view of appraisal, we believe that the emissions trading scheme ensures that increases in carbon from electricity production are offset by reductions in carbon production elsewhere, so that the production of carbon from electricity generation should not be directly taken into account in the appraisal of electric vehicles.

### Carbon Used by Vehicles

8. Paragraphs 3.4–3.13 of our report deal with carbon emissions from cars and buses. We noted that electric vehicles currently use significantly less carbon than petrol or diesel cars, but the latter will continue to improve their performance. Provided that electricity generation is decarbonised, the future use of carbon by electric vehicles would be perhaps only one quarter of that of future petrol/diesel cars, and similar to that of electric trains per passenger-km.

9. Until electricity has been fully decarbonised it is important to avoid charging batteries in the peak which will call for extra generating capacity and might delay the phasing out of unabated coal. Until electricity generation is completely decarbonised electric cars whose batteries are recharged in the peak could emit more carbon than future generations of petrol and diesel vehicles (see figure 3.1 of our report). Pricing regimes should encourage the use of off-peak electricity for battery charging.

10. Irrespective of engine or fuel, the amount of carbon produced is highly sensitive to loadfactor. Cars currently carry around 1.5 passengers on average in a four or five seat vehicle. It is obvious that increasing the average load factor will significantly reduce the carbon use per passenger km. The same is true of local buses which on average have very high carbon emissions per passenger km.

### Carbon Used in Vehicle Production, Maintenance and Scrappage

11. *Transport Use of Carbon* study noted that there was limited evidence of the amount of carbon used in vehicle production, maintenance and scrappage, but that conventional vehicles may consume 15–20% of lifetime carbon use. Currently electric vehicles use around twice the amount of carbon compared with conventional vehicles, probably because of the lower production volume and the inclusion of batteries and electric motors. But more evidence on this is needed, as well as investigation on the degree to which this is already offset by the emissions trading scheme.

*April 2012*

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## Written evidence from Air Products Plc

### About Air Products PLC

Air Products is the world's largest hydrogen manufacturer and the market leader in hydrogen fuelling stations. The company has built more than 130 fuelling stations worldwide and we are proud to be at the forefront of developing a hydrogen infrastructure for the UK.

There are nine Air Products hydrogen fuelling stations in the UK with four more at planning stage. We provide fuelling facilities to the Universities of Loughborough, Birmingham and Coventry as well as for the Isle of Stornoway, Transport for London and the Millbrook Proving Ground. We supply the hydrogen for London's fuel cell buses and are leading the groundbreaking HyTEC project that will bring hydrogen powered taxis and scooters to the Capital.

### Introduction

We welcome the opportunity to give evidence to your inquiry on low carbon vehicles. As a key player in the hydrogen industry our evidence will focus on hydrogen transport. While hydrogen powered vehicles do qualify for the Plug-in Grant we recognise that the large part of this inquiry is to be focussed on electric vehicles.

Our evidence will therefore concentrate on three areas identified by the Committee that are relevant to hydrogen: The contribution of plug-in vehicles to decarbonising transport; the role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport; and the uptake of plug-in vehicles and how this can be improved.

### Summary of Key Points

- While we recognise that battery-electric cars will be part of a low carbon transport mix, we believe that the way to de-carbonise transport is through the use of hydrogen powered transport.
- This is because we see hydrogen fuelled transport as far more efficient and effective than battery-electric transport which cannot offer the same range, performance and refuelling time as a hydrogen car which is on a par with conventional vehicles.
- Government should look to create a market for hydrogen used in transport. In the short to medium term the Government could do this by incentivising the use of hydrogen in transport within the RTFO.
- In the longer term the Government should be looking to supporting the production of renewable hydrogen.

### The Contribution of Plug-in Vehicles to Decarbonising Transport

1. There is little doubt that battery-electric cars will play a part in a future low carbon transport mix. The problem is that they are not practical for the majority of the population and so take-up is always likely to be among a minority. Battery-electric vehicles take too long to recharge and cannot travel for long enough distances to be able to replace conventional vehicles and there is no obvious technology fix to solve this problem.

2. In addition, when hundreds of thousands of electric cars are being charged for several hours at a time during the same period of time, there will be considerable pressure on the grid which could potentially lead to "brown outs". This is likely to occur at the same time as the peak domestic power demand when users arrive home in the evening. Hydrogen would be able to take some of the pressure off of the grid by reducing the amount of cars that are charged. So, while there may be a place for battery-electric vehicles, they cannot be the whole solution.

### The Role of Plug-in Vehicles Alongside other Technologies to Reduce Carbon Emissions from Road Transport

3. A "hydrogen fuel cell—electric hybrid" vehicle has a much broader user-potential than current plug-in electric vehicles. As explained, the batteries used to power electric vehicles cannot offer the same range,

performance and refuelling time of a conventional vehicle and will therefore be attractive only to a niche market. By contrast, electric-hydrogen hybrid vehicles can compete with conventional vehicles in terms of range, performance and refuelling time and like electric vehicles give off no emissions at the point of use.

4. Hydrogen also addresses the further problem of air pollution. The only emissions from a hydrogen vehicle, at the point of use, are water and energy. The UK is subject to the highest levels of dangerous traffic fumes of any country in Europe and most of these fumes are focussed on Britain's cities. Air pollution is linked to respiratory disease, strokes and lower life expectancy as well as more minor ailments like eye and lung irritation.

5. A further benefit of hydrogen is that it addresses problems associated with the intermittent energy generated by renewable energy sources. The UK offers a vast resource in terms of renewable energy sources. In the future, it may be possible to generate large amounts of energy from this island's access to offshore wind and tidal power. There have, however, been problems identified with wind and other renewable forms of energy because of their intermittent nature. The outcome of sourcing energy from most renewables is that the energy supply is subject to uncontrollable conditions, including seasonal variation and is therefore not available on demand.

6. For intermittent renewable energy sources to be effective there needs to be facilities for the energy produced to be stored and large-scale electricity storage is not possible with current technologies. Batteries are not suitable for this purpose because they typically lose energy over time and so would not be effective for long term energy storage. By contrast, hydrogen is a very efficient energy carrier. Excess energy created by a renewable energy source can therefore be used to generate hydrogen, which can be converted back to electricity to feed the grid when required or alternatively used to fuel cars.

### Uptake of Plug-in Vehicles and how this can be Improved

7. The plug-in grant, in spite of the name, is open to all forms of transport with tailpipe emissions of 75g $CO_2$/km. The Department for Transport explicitly names "hydrogen fuel cell vehicles" among those vehicles that qualify for the grant. However, to date (DfT figures December 2011) not one single hydrogen fuel cell vehicle has qualified for the grant. The reason for this is simple, there aren't any hydrogen fuel cell vehicles available commercially available in the UK. But this is soon to change and in the next couple of years (according to most of the major car companies, by 2015) hydrogen cars will become commercially available in the UK.

8. The Government must, therefore, begin preparing for the commercialisation of hydrogen vehicles. It is good that they are already included in the plug-in grant, but this will not be enough to deliver a significant roll-out as we still lack the necessary infrastructure.

9. Government should look to create a market for hydrogen used in transport. In the short to medium term the Government could do this incentivising the use of hydrogen in transport within the RTFO. Most hydrogen is currently produced from natural gas reformation and therefore has some carbon emissions associated. Thus, like a battery-electric vehicle a hydrogen vehicle has no emissions at the point of use but can have some associated carbon emissions. It will be necessary to support "brown hydrogen" in the short term to create a market for it, before it is replaced by renewable "green hydrogen" in the future.

10. In the longer term the Government should be looking to support the production of large-scale, economically viable, renewable hydrogen. Current Government policy designed to support renewables actually discourages some methods of production of hydrogen from renewable sources because it incentivises the generation of renewable electricity at the expense of renewable hydrogen. We believe, Government should review its policy as a matter of urgency in order that it does not stunt the hydrogen industry in the UK.

*April 2012*

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## Written evidence from the eMotor Cycle Industry Association

### THE DEVELOPMENT OF THE ALTERNATIVE POWERED PTW—OR HOW GOVERNMENT MANAGES TO IGNORE THE LARGEST SEGMENT OF THE E-VEHICLE SECTOR

### Introduction

eMCI is a "sister" association to the Motor Cycle Industry Association. It was established in 2011 to bring together the developing ePTW sector and provide both a voice and also a framework for product policy development and support.

eMCI is available to give aural evidence to a session of the Transport Committee. Please contact Craig Carey-Clinch (contact details above) if this is required.

From January 2011, the Government awarded a £5,000 subsidy for the purchase of low carbon vehicles. This grant, named the "Plug In Grant", has survived the Coalition Government's spending review and is widely considered to be of both significant political and practical value; it underlines the Governments recognition of

the embryonic electric transport sector whilst also giving the sector valuable "pump priming" by making the purchase of an electric or hybrid vehicle a viable transport option for the general public.

Also included in the Government's plans has been a £30 million fund for a network of electric vehicle hubs, called Plugged-In Places, to promote charging infrastructure in car parks, major supermarkets, leisure and retail centres, as well as on the street.

However, notably absent from these initiatives has been any support for electric powered two wheeled transport (ePTW). This omission is an important and disturbing oversight.

The Motor Cycle Industry Association (MCI) held meetings with both the Office of Low Emissions Vehicles (OLEV) and with Ministers from the Department of Business Innovation and Skills (BIS) in relation to the new and developing ePTW sector from early 2010.

Ministers indicated in 2010 that they would appreciate a report on the sector which will help them consider policy and proposals for "Stage Two" of the "Plug In Grant". This was provided in January 2011.

Further meetings with OLEV were held in 2011 and during this period, the motorcycle industry launched a new association for the alternative powered motorcycle sector, the eMCI (e Motor Cycle Industry Association). http://www.emcia.co.uk/ . This is a sister body to the Motor Cycle Industry Association (MCI). The launch event was attended by London Mayor, Boris Johnson.

eMCI has considered a number of technical issues in relation to ePTWs in some depth and has also liaised with industry colleagues in Europe, via the ACEM association (European motorcycle industry). OLEV has observer status at the eMCI Board.

As 2011 progressed it appeared clear that it would be difficult to determine criteria for including ePTWs in the Plug In Grant in time for the Government's 2012 review. However, OLEV expressed an interest in including reference to the work that was being done on ePTWs in the Review, indicating that further evaluation would be undertaken in relation to any further review of the availability of the Plug In Grant. This was an important and welcome acknowledgement of the growing importance of the ePTW sector.

However, to the industry's dismay, the 2012 review once again omitted any reference to ePTWs when it was published.

It is fair to say that despite regular dialogue with OLEV, the motorcycle industry is extremely frustrated by the Governments seeming unwillingness to take the ePTW sector seriously. This attitude seems to follow the longstanding pattern that exists with regard to motorcycling and overall transport and business policy.

The situation with the ePTW market draws this omission into sharp focus. In February 2011, Zak Goldsmith MP asked the Secretary of State for Transport how may ultra low emission vehicles were registered for the latest period for which figures were available.

Data from the DVLA suggested that 1,277 electric and plug-in hybrid vehicles were registered in Great Britain during 2010: 268 cars, four quadricycles, 547 motorcycles, mopeds, scooters and tricycles, six buses, coaches and minibuses, and 452 commercial vehicles, including light vans.

This revealed that the ePTW sector was a significantly important component of the e-vehicle sector—indeed the most important sector.

However, 2011 figures revealed a drop in sales due to recessionary factors (to 402) and also (arguably) due to a lack of recognition in Government policy. The sharp increase in eCar sales to over 900 in 2011 provides further evidence of how the Plug In Grant led to what was in effect a suppression of the ePTW market.

### Summary of the ePTW Sector

The electric powered two wheeler (ePTW) sector is expanding rapidly, driven by a genuine enthusiasm for a greener, low emission transport alternative. Entrepreneurial by necessity, the sector has sought out its own solutions to the issues of design, manufacture and sales of a whole new generation of electric powered two wheeled vehicles, creating a route to market that is fresh and new and designed to meet the demands of a new generation of commuters.

Design and technology are an important element of this growing transport sector. The initially slower pace of engagement by the major manufacturers left the door open to smaller design houses and technology companies to seize the initiative and secure valuable market share. As demonstrated by companies like Intelligent Energy, the potential for "UKPLC" to become a global technological "hot house" is enormous.

Over the last twelve months, many traditional major manufacturers have also revealed development of various ePTW products for market and manufacturers are taking a keen interest in technical issues and standardisation of such items as plug in technology and e-safety.

The ePTW has been impacted on negatively by the Plug In Grant, insofar as the grant omits the ePTW, with this inadvertently placing the sector in the shade of their four wheeled counterparts. However, the ePTW is a key component of a fully integrated and sustainable low emission urban transport strategy. It provides an affordable "lifestyle" transport choice that avoids the issues of urban congestion and parking.

The sector has the potential for exponential growth if given the appropriate support.

## The UK ePTW Industry

To stand a chance of fully exploiting the sectors enormous potential, to deliver a genuine ULC transport solution and to help position the UK as a technological centre of excellence for Electric Vehicles, the sector needs harmonisation and focus. This is one of the roles of the eMCI.

The UK Low Carbon Two Wheeled Industry is at a very early stage of development and is currently dominated by *electrically* propelled Powered Two Wheelers (PTW). Alternative power types, such as hydrogen fuel cells, are being developed by universities and researchers from the low energy sector (at least one concept in conjunction with a major motorcycle manufacturer)

The "industry" currently combines a number of small specialist technology firms focusing on battery and control unit technologies and entrepreneurs with business links to Far East Manufacturers who import and retail road ready motorcycles.

The traditional Internal Combustion Engine (ICE) manufacturers, the Japanese (Honda, Kawasaki, Suzuki & Yamaha) and their European counterparts (BMW, KTM, Triumph, Piaggio etc.) are all showing interest in the development of the ePTW sector, but only the larger companies have taken any public steps into the arena (though more manufacturers will be making product announcements during 2012).

## Types of Product

There are three distinct groups of electric PTW's:

— Electric "Superbikes": branded "electric superbikes", these machines generally use a donor chassis and suspension from a current internal combustion engine (ICE) bike and are designed to give power and performance characteristics similar to their ICE equivalent. Mavizen Motorcycles are probably the most prolific in this sector, parent company TTXGP launching their "brand" at an electric motorcycle race around the Isle of Man TT course in 2009. Electric superbikes are designed primarily for recreational purposes where performance is one of the most important factors. These machines are still very niche and most of the design and production is based in the USA.

— Electric Scooters: designed primarily as a short range urban transport solution, the e-Scooter is normally based on a generic ICE design, with an electric motor. The keys to success for escooters are range, recharge speeds, looks and design. Almost all e-scooter production is in China, but much of the design is European, indeed much is UK based. Current products mostly meet the range that commuters need for average daily travel mileages (National Travel Survey).

— Electric Off Road Bikes: Zero and Quantya produce a range of e-motorcycles with off road capabilities. These are often targeted towards fleet users in the forestry/parks sector, or recreational off road parks. Many products have a battery range that is suitable for short range off road competition and motocross.

## The Market and Trends

Currently, it is difficult to identify an existing sales "market" for electric motorcycles, despite many products being within the needs and capacity of many urban commuters. Those operating within the sector have identified a number of reasons for this lack of engagement, the most significant of which is a general lack of publicity/awareness of the ePTW sector as a viable transport option, which seems related to the lack of engagement with all other kinds of PTW within UK public policy.

Where sales are being made, almost without exception these are to short distance commuters in urban environments, with London being the dominant market place. As with ICE scooters, design is a key feature of a successful product and the best-selling ePTWs are following the trends already established. The growth in European designed vehicles supports this and more vehicles are being brought to market with design inspirations being taken from "timeless" designs such as those manufactured by Vespa and Piaggio.

Each of the manufacturers/importers has been working hard to create a market for its products but each has voiced a common concern regarding the lack of publicity around the ePTW alternative. Many of those in the sector believe that the public perception of "low emission vehicles" is overly dominated by electric cars and the car-focused publicity surrounding the "Plug In Grant" has only added to the problem for the ePTW sector.

## The Challenges

### *Design and Manufacture*

Design and technology are an important element of this growing transport sector. technology companies to seize the initiative and secure valuable market share. As with many things, manufacture of electric PTW's is almost all overseas, predominantly in China.

However, vehicle design is very much European and a number of UK based design houses are making their name in creating innovative and exciting "lifestyle" design to attract a new generation of "carbon conscious" customers.

*Technology*

The key to the success of the electric vehicle as a viable replacement to the internal combustion engine lies in the hands of the technologists who are developing new innovative battery and motor designs.

ePTW technology needs to be at the cutting edge of design and performance, but also small and affordable. The UK can, with appropriate support and investment, quickly establish itself as the world leader in ePTW battery and motor technology, delivering ULC transport to the masses.

*Routes to Market*

Many of the key protagonists in the ePTW sector have identified potential for growth will not lie in the traditional motorcycle markets and are seeking out and embracing new and imaginative routes to market for their products.

Many of these new routes embrace the internet, with customers buying their machines on line, engaging the internet generation and helping to keep the supply chain costs as low as possible. This is vitally important for those looking to establish start up businesses as, by its very nature, the market for low emission vehicles is small and likely to remain so for the foreseeable future as financial constraints drive commuters to utilise cheaper current solutions.

*Charging Infrastructure*

One of the most significant challenges facing the "electric revolution" is re-fuelling.

Not only are there relatively few EV charging points, the length of time needed to meaningfully refuel a typical EV can be highly impractical.

The issue of recharging is even more significant for those who have no off street parking. They will effectively be prevented from recharging their vehicles at home. Ironically, these are the very individuals—urban dwellers whose daily commute is short and generally congested—who could benefit most from EV's.

ePTW's offer the perfect solution to this problem. More and more ePTW's are being delivered with cartridge type battery units which can be easily removed from the vehicle and taken inside to charge. This has the added benefit of rendering the vehicle immobile and, by virtue of the relative cost of the battery as a percentage of the vehicles overall cost, unattractive to thieves.

## The Role of Government

The ePTW sector has been damaged by the "Plug In Grant" because the press and PR coverage has focused exclusively on the electric car sector. All of the representatives of the ePTW sector were very critical of the "Plug In Grant", not only because it didn't include PTWs, but because it drew attention and public awareness away from the two wheeled option.

ePTWs have an important place within any low emission transport strategy and need to be included in any funding mechanism. In a congested urban environment, like any of the UK's major conurbations, ePTW transport is arguably more relevant in terms of road space taken in relation to the number of people travelling, parking space required, energy used and as a consequence needed to be replaced, and, ultimately, practicality.

An effective transport strategy must be as diverse and multifaceted as the communities and business it seeks to serve. From public and private transport to transport for business and courier/freight sector, a combination of conventional ICE, Hybrid and full EVs can work together to create a truly sustainable and fit for purpose transport strategy.

ePTWs have a key role to play in such a strategy, particularly in the urban commuter sector and also, potentially, in the light weight urban commuter industry. For solo commuters, the ePTW offers an emission free, congestion proof, time saving and more efficient transport option. With an average urban commute of 9 miles, and no requirement to exceed 40mph, 75% of the current crop of ePTWs is capable of matching the needs of the today's urban commuter. Future developments, technological and design will only improve this situation and make the ePTW even more relevant.

## Policies Required from Government

1. Plug In Grant for ePTW's—a scheme similar to the Grant for cars to encourage people to examine ePTW's as well as their four wheeled cousins.
2. Inclusion of the ePTW in all future EV planning and policy—the ePTW is noticeable only by its absence—or at best token mention—in virtually all Govt and non-Governmental policy documents.

3. Recognition of the added benefits of the ePTW in terms of congestion, parking and most importantly CHARGING.
4. Recognition of the benefits of the e-Bike in the overall ULC transport infrastructure.
5. Inclusion of the ePTW in the development of Charging infrastructure across the UK.
6. Government support to Technology start up businesses working on low carbon technology, with a focus on ePTW.

*April 2012*

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**Written evidence from ITS (UK)**

The Intelligent Transport Society for the United Kingdom, known as ITS (UK), is a "not for profit" organisation of 150 organisations in the transport field who are working to promote the use of Intelligent Transport Systems (ITS). These are combinations of sensors, communications and mobile Information Technology designed to assist all modes of transport. ITS (UK) is fortunate in having membership from across the UK and beyond, drawn from the public and private sectors and from academia. ITS (UK) is funded entirely from member subscriptions and can therefore independently represent the interests of the whole membership spectrum in this rapidly developing field.

A complete list of our Members is attached to this Submission.

1.0 Introduction

1.1 The Transport Committee launched its Inquiry on Low Carbon Vehicles on 15 March 2012. The Terms of Reference and Call for Evidence invite organisations to respond to a series of questions regarding Low Carbon Vehicles. The Committee is particularly interested in:

— The contribution of plug-in vehicles to decarbonising transport.
— Uptake of plug-in vehicles and how this can be improved.
— The effectiveness of the Plugged-In Places scheme.
— The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport.
— Action taken by other countries to encourage the uptake of plug-in vehicles.

1.2 ITS United Kingdom, referred to hereafter as ITS (UK), is a "not-for-profit" public/private sector association financed by members' subscriptions providing a forum for all organisations concerned with ITS. The Society works to bring the advantages that ITS can offer in terms of economic efficiency, transport safety, and environmental benefits to the United Kingdom—and at the same time expand the ITS market. Membership, over 150 UK organisations, comprises Government Departments, Local Authorities, Police Forces, consultancies, manufacturing and service companies, and academic and research institutions. ITS United Kingdom encourages discussion on issues such as public/private co-operation, standards, legislation, information provision and new technology. ITS (UK) was a key contributor to the Parliamentary POSTNote 322 "Intelligent Transport Systems" published in Jan 2009.

1.3 Intelligent Transport Systems, "ITS", is the term used to describe combinations of sensors, telecoms, information processing and location referencing to deliver improved transport systems and services including information before and during a trip for travellers by all modes. ITS can also advise and inform travellers of the most appropriate travel choices for a particular trip, including cost, time, route, mode and even the associated carbon footprint of the journey. ITS can improve the efficiency of transport through traffic control and enforcement of traffic regulations and enhance road safety through in-vehicle systems for collision avoidance and better lane keeping. Many commercial organisations use ITS technologies and/or schemes to manage vehicle fleets, both freight and passenger, through the provision of two way communication between manager and driver. Electronic ticketing (by means of Smartcards, for example) enables faster, easier travel by public transport. In addition Intelligent Transport Systems have beneficial effects on the environment by reducing air and noise pollution on highways and by helping to create traffic free zones in cities.

2.0 General Observations

2.1 The Inquiry poses questions regarding the government's vision that the UK's domestic road transport emissions can be minimised by a vast increase in the numbers of Low Carbon Vehicles on the roads by 2015 as part of its "Plugged-In Places" Vehicle Infrastructure Strategy. However the global acceptance and adoption of electric vehicles to date is somewhat contradictory to this expectation and has been slow and sporadic. Individual countries have their own strategies to address this and most will report having had limited success as the concept of electric vehicles is one of short range, limited power with unglamorous model options. However since 2012, well-engineered, production electric and hybrid vehicles is gradually changing this perception Trying to persuade motorists to exchange their hydro-carbon vehicles for electric vehicles has proven difficult to date as the costs of the vehicles themselves is considerably higher—on average electric

vehicle battery packs account for £10K to £15K of the purchase price—than the conventionally powered counter-parts (despite any incentive schemes) with any perceived offset-benefit.

2.2 In the UK the previous government set up the "Office for Low Emission Vehicles" within the DfT to promote the construction, adoption and uptake of electric vehicles focusing on several "Plugged-in Places" centres as strategic centres that would then be supplemented by additional locations until such time as the proliferation of schemes meant that these locations overlapped each other. Most of the previous effort has been directed towards reassuring motorists that the vehicles were fully capable of providing their daily needs. As the vast majority of daily journeys are commuter journeys to/from the workplace they are, by their very nature, of short distance—verified by the Department for Transport statistics that state that approximately 90% of car journeys are under 20 miles in length and 80% under 10 miles. On arrival at work most vehicles remain parked throughout the day offering the opportunity for electric cars to be charged at the workplace. Once the return journey has been completed a further opportunity to recharge occurs as these cars can be "plugged-in" overnight ready for use the following day. Experiments are underway in North-East England, one of the initial "Plugged-In Places" Schemes locations to explore whether drivers can be influenced to select times to re-charge their EV when there are lower levels of $CO_2$ involved in the production of electricity—to reduce the equivalent carbon emissions from EV's—which largely means discouraging charging during the peak times of the day 8am to 7pm. Experience from the "Plugged-In Place" schemes have shown that drivers are intuitive on how to exploit and take advantage of their vehicle's battery range by maximising the range potential by route/time selection—eg pre- or post-"rush hour" and on routes that avoid road obstacles such as roundabouts/traffic lights/hills. Most users have found from experience that they recharge the vehicles in much the same way that they do so when they determine the appropriate time to recharge their mobile phones—ie as the battery strength display bars start to reduce then the need to locate an EVCP becomes increasingly important.

2.3 With the change of government to the Coalition government a certain amount of the "headway" on the uptake of Low Carbon Vehicles was lost and the whole "Plugged-In Places" lost a fair amount of its momentum as a consequence. From a European perspective this has unfortunately relegated the UK from being perceived as a leader and innovator in the field to a more minor role; this will have major implications for the electric vehicle industry as a whole. Recent fuel price increases have begun to alarm motorists who are now paying substantial amounts of their budget merely to get to/from the workplace. Issues of pollution, performance and (in the instance of the London Congestion Charging Zone) avoiding having to pay to drive in specific areas are becoming increasingly secondary to the costs of refuelling as they continue to escalate. With no apparent respite in this inexorable rise this could well be the most appropriate juncture to enhance and promote Low Carbon Vehicles' capabilities and economies in association with other aspects such as helping to reduce pollution and avoidance of certain standing motoring costs associated with hydro-carbon vehicles (ie—fuel duty, vehicle excise duty, congestion charges and parking charges). Recent calculations from many sources, including "real time" data from electric vehicles collated at Newcastle University, suggest that, even with the high cost of purchasing an electric vehicle, the "break-even point" where that purchase and running costs is less than a conventional internal combustion engine is less than three years being driven 8,000 vehicle miles per year. New business models are being considered—such as a) Renault equalising the purchase prices of conventional and electric vehicles and b) vehicles are owned or leased whilst the vehicles' batteries are never owned but rented on an ongoing basis. A major European project "SMART-CEM" is using the North-East of England "Plugged-In Places" scheme as a reference site in examining how the wider issues of ITS are integrated into electric vehicles.

2.4 Acceptance and adoption of electric vehicles has to be based around motorists' confidence in their ability to complete a journey and be able to recharge in anticipation of their next journey. Conventionally powered vehicles can be refuelled at any petrol station however the numbers of electric vehicle charging points (EVCP) are currently minimal. It is critically important therefore that a motorist needs to be assured that an infrastructure is available and this is where ITS (UK) has been directing its efforts by establishing a Working Group that examines how "intelligent transportation systems" can be employed to overcome "range anxiety" by identifying where EVCPs are located and also by confirming that they are currently available. In conjunction with the anticipated increase in the numbers of electric vehicles on the UK's roads ITS (UK)'s role has been to adopt a strategic overview of this and has outlined a 20 year strategy on how the ITS industry can "match" information about the ECVP infrastructure. This strategy has been presented in international fora and has received interest from other nations who recognise similar challenges.

## 3.0 Inquiry Questions

*The contribution of plug-in vehicles to decarbonising transport*

3.1 The introduction of a reasonable number of Low Carbon Vehicles to the global fleet has undoubtedly acknowledged that they are a "serious" form of transport and far more than the common perception that they are merely "milk floats" which is how they had previously been regarded. Evidence from trials such as the "SWITCH EV" trial in North East England suggest most drivers who experience driving electric vehicles rate them very highly with only range, purchase price and uncertainty on the long term performance of the battery pack as inhibitors to wider adoption. The incremental introduction of ECVPs has increased the flexibility in the manner of how these vehicles are used. Additional ECVPs have helped to satisfy the recharging demand and the increased number of points has helped raise the credibility of Low Carbon Vehicles to the extent that

they are now regarded as a substantial modal option. It must also be remembered that electric vehicles generally contribute a level of equivalent $CO_2$ per km travelled that is about half that of an equivalent petrol vehicle (based upon the $CO_2$ generated by UK electricity generation) however the $CO_2$ is not created or emitted in the urban area where high concentrations of pollutants from internal combustion engines may cause harmful effects to humans in the confines of townscapes.

*Uptake of plug-in vehicles and how this can be improved*

3.2 The main incentive relating to the uptake of Low Carbon Vehicles has been the operating costs vis-à-vis those for conventionally powered vehicles. The purchase costs of an electric vehicle are significantly higher than those of a petrol or diesel vehicle and it will take lengthy ownership of that vehicle before an owner reaches a "break-even" point therefore it is important that fiscal incentives are created to offset that imbalance. However in order to achieve the levels of uptake that the government is envisaging then potential customers must be given overwhelming arguments and benefits that there is viability in purchasing an electric vehicle. The only way this can be achieved is by offering a very large subsidy that clearly identifies that electric vehicles are significantly cheaper to purchase and operate. As petrol and diesel prices continue to increase and "bite" into domestic and commercial budgets the provision of "free" electricity has got to be an option that would favour "early-adopters" who are prepared to accept a "gamble" and "take the risk" on being amongst the first to accept the new modal technology. As more and more "adopters" take up the option then they will have pay a gradually higher price until the use of electric vehicles becomes a norm. There is a precedent for this business model—eg mobile phone providers and solar panels. Concerns about the purchase prices need to be diminished and there is evidence that this is now happening as Nissan and Peugeot are reducing list prices following lower than expected sales of their electric vehicles models in 2011. For many people we do not believe range of vehicle is as major concern as originally envisaged. Vehicle usage profiles from the electric vehicle fleet are being demonstrated in the "SWITCH EV" trial—the electric vehicle journey profile mimics the DfT figures, although, some commuters are travelling <70 miles one way, charging up during the day and travelling <70 miles return journey in the evening.

*The effectiveness of the Plugged-In Places scheme*

3.3 The three pilot sites that were selected in Phase 1 of the "Plugged-In Places scheme were London, Milton Keynes and Newcastle upon Tyne. It is fair to say that they have had varying degrees of success most of which is a direct reflection on where the three sites are located. There seems to be a correlation between the size of the city, the related EVCP infrastructure and the populations" willingness to adapt, to what was to them, a novel form of transportation. The London scheme was based on individual sub-sites being established in a non-structured way that was based on which organisations were willing to introduce them. Conversely, in the North-East of England, there has been a far more strategic approach with a diverse range of vehicle types being used in and around the locality. This latter approach has been more successful and has captured the local population's imagination that has brought about a more accepting attitude towards Low Carbon Vehicles. A subscription based scheme, "Charge Your Car", has been introduced in the North-East of England whereby, for £10 per month, electric vehicle users could have "smartcard" access to the 300+ public charging posts in the region. Interestingly this includes eight publically available "fast-chargers" which can re-charge an electric vehicle battery to 80% charge in about 30 minutes. Again, data from the "SWITCH EV" trial suggests that these "fast-chargers" are well used and are enabling electric vehicle drivers to extend their effective driving cycle in an effective way. Many of these lessons have been accepted in the application of Phase 2 of the "Plugged-In Places" scheme.

*The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport*

3.4 There is no doubt that the "well to wheel" output from petrol and diesel vehicles is a major contributor to pollution from road transport however it would also be correct to say that Low Carbon Vehicles are not "carbon-neutral" as vehicle production and energy generation have substantial implications on creating pollution. However there is evidence that confirms that Low Carbon Vehicles can play a significant part in reducing emissions in urban areas. "Stop-start" driving is the most significant area where pollution occurs as opposed to inter-urban driving where this is markedly less prevalent. There is ongoing academic research that can corroborate this hypothesis and also the wider benefits of having vehicles in urban areas that are not contributing to the prevailing levels of road traffic generated pollution that has been linked to many health-related issues.

*Action taken by other countries to encourage the uptake of plug-in vehicles*

3.5 The global approach to Low Carbon Vehicles has been remarkably similar and whilst there have been obvious variances the general response has been that there is a limited uptake on these vehicle types. What is lacking in each of the countries is the impetus to "drive" this forward and whilst petrol and diesel fuels predominate economically it is unlikely that this will change. It is accurate to state that the UK has been a global leader in the adoption of low carbon vehicle technologies and the work ITS (UK) has undertaken to assess the future adoption in conjunction with the "intelligent transportation" means is being watched by other nations as a potential model for them to adopt. However the apparent unwillingness by the UK government to engage in many of the European activities on electric vehicle research, demonstrations, standards and future

policy options may well have compromised our future position and ability to influence policy in this important area of "green" transport.

4.0 Summary

4.1 This submission is intended to highlight how the Low Carbon Vehicle industry is broader than the production of electric vehicles and provision of an EVCP infrastructure. There is a far wider requirement to influence the motorists to change their mode of transport and to acknowledge that the terms and conditions on which they do so will mean that they drive their vehicles in a markedly different to how they currently use hydro-carbon vehicles. The technological restrictions initially sound quite debilitating and potentially seem to "sound a death-knell" for the wider adoption of Low Carbon Vehicles as the prime source of transport. However this need not necessarily be the case. As commented earlier the average daily commuter journey is very short and offers ample time to recharge the vehicle ahead of the return journey where it can be recharged once more. Minor variations to driving patterns will enable motorists to complete journeys with confidence—especially as battery technologies are consistently improving to extend vehicle range. There is a need for greater coordination and standard specs for electric vehicle charging across the UK and a common way of accessing posts. Again the North-East of England is a good exemplar—joining the "Charge Your Car" scheme or driving to a charging-point and then paying by using a mobile phone and without the requirement of being a "Charge Your Car" member. The UK's Institute of Engineering and Technology's "Code of Practice for Electric Vehicle Charging Equipment Installation" published in January 2012 is a crucially important document and outlines essential guidance on safe and secure charging at residential addresses.

4.2 "Plugged-In Places" EVCP infrastructure needs to communicate its "availability status" to expectant motorists and the obvious means to do so is via "Intelligent Transport Systems". The effectiveness of the "Plugged-In Places" initiative is inextricably linked to the ability to relay information regarding EVCP availability to the driver to prevent aimless driving seeking an available point whilst consuming a continually reducing battery capacity. It should be emphasised that a strong relationship and reliance between the vehicles and the EVCP infrastructure via "intelligent transport system" technologies will positively influence how Low Carbon Vehicles will be perceived and will encourage greater adoption commensurate to the increasing difficulties and costs associated with hydro-carbon vehicles. It cannot be over-emphasised that the next stages of the "Plugged-In Places" project are vitally important for the Low Carbon Vehicle industry and that once a "tipping-point" of adoption has been reached then the ongoing conversion to Low Carbon Vehicles will be relatively straight-forward. Additional ITS functions such as pre-booking parking for charging and then informing drivers when the vehicle is charged and ensuring interoperability of EVCPs across the UK are key issues to encourage adoption. New forms of electric vehicle charging, such as inductive and battery exchange schemes, are being actively progressed and need to be encouraged. Both will speed the recharge process and will make the use of electric vehicles much more attractive. This is an important factor as the current infrastructure is based on electric vehicles being recharged on domestic driveways/garages however the widespread lack of such facilities in conurbations is seen to be a major inhibitor to an expanding market and strenuously suggests that innovations re home charging options are needed.

*April 2012*

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## Written evidence from Transport for London

1. Introduction

1.1 Transport for London (TfL) welcomes the opportunity to contribute to the Committee's inquiry into Low Carbon Vehicles.

1.2 The Electric Vehicle (EV) agenda has high level support from the UK Government because the move to EVs is seen not only as an environmental innovation but also as a potential platform to drive investment and job creation in the UK as part of new technology and the vehicle industries. Developing a local market for EVs is considered critical to attaining UK Government goals regarding EV investment and growth.

1.3 In May 2011, TfL launched Source London, a London-wide EV charging network which is being installed by the consortium of public and private partners. EV drivers can join Source London for a £10 annual fee and use any charge point in the scheme with no cost for the electricity (though parking charges may apply).

1.4 Source London and its infrastructure is key to building confidence in and boosting the new EV market and as such it is critical to support the Mayor of London's aspiration that London be the EV capital of Europe with 100,000 EVs as soon as possible.

2. The Contribution of Plug-in Vehicles to Decarbonising Transport

2.1 Electric vehicles have no tailpipe so they do not produce any emissions whilst driving—they are cleaner and quieter than petrol or diesel vehicles on the road. Encouraging the market and uptake of electric vehicles will help improve air quality and reduce carbon dioxide ($CO_2$) emissions and aims to put the UK at the leading edge of this new technology.

2.2 The $CO_2$ produced by an EV is directly related to how the electricity it uses is produced, but even using the current standard UK grid supply, a pure EV is estimated to produce up to 40% less $CO_2$ than an equivalent petrol or diesel vehicle (on a well to wheel basis).

2.3 In central London, road transport accounts for over 80% of particulate matter emissions and for 46% of NOx emissions across Greater London. EVs, therefore, also have significant potential to help address the issue of air quality in London in the future.

2.4 In London around 90% of all car trips are less than six miles, and across the UK over 99% of all car journeys are less than 100 miles. Pure electric cars available now or coming to the market shortly, typically have a range of around 100 miles and are therefore well placed to meet transport needs.

2.5 Electric vehicles form part of a wider package of measures which TfL and the Mayor are undertaking to reduce $CO_2$ emissions from Transport. The Mayor has committed to reduce $CO_2$ emissions by 60% by 2025 (from 1990 levels) and TfL is helping to meet this target by promoting sustainable travel, running vehicles more efficiently, and using greener vehicles and fuels. This includes trialling hydrogen fuel cell buses and bringing hybrid buses into the fleet.

## 3. Uptake of Plug-in Vehicles and how this can be Improved

3.1 London is a key market for EVs. DVLA data indicates that there are currently 2,400 pure electric vehicles in London from a total of £15,300 in Great Britain and 25,700 hybrid vehicles registered in London form a total of 111,400 in GB.

3.2 The key obstacles which TfL perceives to increasing the uptake of electric vehicles include:

- Range anxiety where EV users limit the journeys they undertake to avoid being stranded should the battery in the vehicle run flat. Trials to date, both in the UK and in Japan, indicate that users quickly adapt to charging overnight at home and that public charging infrastructure is not in fact utilised extensively. However, range anxiety remains a key perceptual barrier to EV take up and where charging infrastructure is not in place EV users significantly under utilise their EVs;
- capital costs as EVs typically have a much higher purchase cost that equivalent petrol or diesel vehicles, largely due to the expense of the battery technology;
- residual value (second hand value) which, as EVs are so new, has not yet been established. There is no second-hand market and no track record to establish what the lifespan of an EV—particularly the battery—may actually be. Therefore the battery life and residual value estimates can only be theoretical and in business financial modelling EVs are often accorded a residual value of zero for this reason;
- customer information is limited. Customers have limited information about the actual capabilities and types of EVs available. The majority of customers have no experience of driving or using an EV. Therefore, there is a very poor understanding of the practical realities of EVs; and
- lack of agreed international standards. This creates confusion and an increased perception of risk for consumers. It also means that both private and public sector investors in this sector may waste significant levels of investment should subsequent standardisation render their investment obsolete.

3.3 EV users will predominantly charge overnight at home. Therefore, additional support for home charging, particularly to insist that EV users have the correct checks and a safe EV supply installed into their home, is critical. A standard domestic 13 amp plug is not recommended as safe for charging an EV. Mandatory standards from the Government would increase costs but will address safety concerns raised by the electricity industry arising from unsuitable charging solutions. Charging infrastructure is therefore critical to providing potential purchasers with the confidence to buy and use an EV in London.

3.4 The London Plan requires that all new developments provide 20% of car parking spaces with charging capability, ensuring developments are equipped to manage future demand.

3.5 The Source London public charging network provides a top up charging facility across the capital, which addresses range anxiety. This represents a means to pump-prime and stimulate the early market development for EVs in the UK, paving the way for market driven solutions in the future. The scheme is critical to establish a population of EVs within London and to more broadly support development of the EV market. TfL liaison with UK Government, the SMMT and EV manufacturers indicates that the new charging infrastructure is welcomed by all the major EV manufacturers who are investing hundreds of millions in bringing new EVs to market.

3.6 However, given the uncertainty around how much public charging infrastructure will in fact be utilised in the long term and the lack of any internationally agreed charging standards, TfL would question whether significant investment in very expensive rapid charging infrastructure is necessary or appropriate at this juncture.

3.7 EVs are currently expensive largely due to the costs of battery technology. Although some reduction in costs can be expected as production volumes increase, it is not clear that there is significant scope to reduce battery costs by a large margin due to the expensive inputs required. It may be, therefore, that EVs retain a higher capital cost over time, despite greater market penetration.

3.8 TfL has developed two procurement frameworks (for infrastructure and vehicles) which will help deliver best value to public sector bodies and partner organisations wishing to invest in electric vehicles. There are also incentives available to customers including the 100% discount from the Congestion Charge, zero Vehicle Excise Duty and Government Plug-in Vehicle Grants. However, these only go some way to meet the barrier of higher upfront capital cost typical of EVs.

3.9 Some manufacturers are introducing new purchasing models where the battery—the most expensive element of the vehicle—can be rented rather than purchased. This brings the capital cost down to a level more comparable to a petrol or diesel equivalent and the battery rental costs is on a par with petrol cost if a given level of mileage is undertaken each month. This model goes some way to address the capital cost issue and provides guarantees around battery life and performance which in turn address issues for the residual value of the vehicle.

3.10 EVs are so new that the residual value of vehicles is not known. This is primarily due to uncertainty over the useful life expectancy of the car battery and how expensive they are to replace. A battery will degrade over time and reduce the effective range of the vehicle so reducing its usefulness and therefore value. The new technology, therefore, causes concern because the business model for purchasing an EV without an evidential base for the EV lifespan and second hand value is uncertain.

3.11 Lack of established life span and residual values is a significant barrier particularly in leasing and financing approaches commonly used by many vehicle purchasers, especially fleet managers, which rely on a residual value to drive the financial models. TfL would welcome further action to provide information support for the financial and insurance industries to help address this key issue. TfL is working with the Energy Saving Trust and EDF in a fleet initiative to help understand how EVs can best be utilised in fleet operations and can provide a clear financial benefit. There will be 20 projects funded in total by TfL and the Department for Transport (DfT).

3.12 As EVs are new, there is low public awareness of what vehicles are available and whether they are a suitable replacement for a conventional vehicle.

3.13 TfL is working to share best practice locally and internationally and to disseminate information via the Source London website (www.sourcelondon.net), however, TfL recognises more could be done in this area.

3.14 TfL hosts the London Electric Vehicle Partnership (LEVP) which meets twice a year with a range of stakeholders from the public and private sectors to debate and discuss the future of EVs in London. TfL also provides the secretariat for the Mayor's Electric 20, comprising business members (including Nissan, Sainsbury's, Tesco's, Marks and Spencer, UPS, TNT Express, DHL, Amey, Go Ahead, Speedy, Royal Mail) already using electric vehicles in their fleets on a daily basis. The forum provides experience, knowledge and support for companies looking to follow in their footsteps in adopting EVs.

3.15 New technology is emerging all the time and in 2012, TfL will work in partnership with Qualcomm to trial new inductive (wireless) charging technology in London. This new technology will be fitted to some of TfL's own EV fleet and to private hire vehicles later this year. The trial is expected to last for at least a year and will further the development of this innovative technology which is currently not market ready.

3.16 TfL is also part of "Low Carbon London". Co-ordinated by UK Power Networks, this is an Ofgem funded project that is researching new technology to explore use of smart grid technology to deliver lower carbon electricity in the future. The project includes investigation of smart metering technology in a number of scenarios including for use with EVs. TfL will encourage Source London members and TfL staff to participate in the trial and use a new smart meter to monitor electricity use in the home and, where applicable, for their EV. Source London will also supply information on charge point usage. The trial will provide a wealth of data on use of EVs for TfL, grid impacts of new technology such as EVs and inform future development of the electricity grid.

## 4. The Effectiveness of the Plugged-in Places (PiP) Scheme

4.1 Source London currently has 361 charge points and is on target to install 600 by the end of April 2012. The overall target is 1,300 charge points by 2013. Source London is the largest network of public charge points in the UK. This could not have been achieved without the support provided by the PiP scheme.

4.2 Source London's service is built on the success of a large scale innovative public-private sector partnership, where 31 partners part-fund, own and install charge points and make them available to Source London customers.

4.3 The Source London EV charging point network is the product of a public and private sector collaboration coordinated and managed by TfL. In February 2010, the Source London consortium was awarded £9.3 million over three years to 2013–14 of the £30 million PiP grant available nationally. Consortium partners purchase

and install charge points and the PiP monies are used to reimburse 50% of the cost. Partners continue to own the charge points but these are made available for Londoners to use via the Source London network. Consortium partners pay for the electricity used at their own points so that Source London members pay only an annual fee (of £10) and electricity is then free at the point of use, though parking charges may apply at some points.

4.4 The Source London network replaces the patchwork of charging schemes that previously operated in individual boroughs and for the first time offers genuine pan-London coverage. TfL is also working with our neighboring PiP regions with the express aim of being able to offer customers access to multiple networks, enabling EV owners to roam across existing charging networks easily.

4.5 Siemens are providing the back office, IT infrastructure and call centre support for Source London free of charge (to TfL) under a unique sponsorship arrangement until March 2014. The back office functionality enables all the charging points in the scheme, from various manufacturers, to be operated with a single smart card. This innovative technology allows charging points with different operating models from different manufacturers to work together to provide a seamless customer experience.

4.6 Cards are issued to members for a £10 annual fee with the scheme operating as a seamless whole to the customer, visually tied together by the shared Source London branding that is on the membership card and all charging points.

4.7 Anyone with an EV registered with the DVLA can join (vans, cars and motorcycles and scooters can join but electric bicycles cannot). Registrations are taken online at www.sourcelondon.net and payment can be made using a debit or credit card. Once members receive their membership card, they can use any of the Source London charging points and access electricity free of charge.

4.8 TfL is also working in partnership with British Gas to provide PiP funding to support installation of home and work place charging across London and provide Source London membership as part of the charging package. It is hoped that other suppliers will also be interested in accessing support for this type of initiative.

4.9 TfL is working with the DfT's Office of Low Emission Vehicles (OLEV), other cities, Source London partners, and industry to identify potential options for a self sustaining business model for EV charging. Various options are being considered by TfL in order to secure the continuity of Source London beyond 2014 (when the current Siemens sponsorship and Government PiP funds stop).

4.10 The PiP scheme is successfully delivering its stated aim of installing EV charging infrastructure. The funding has enabled creative commercial thinking to create and operate a city-wide network with minimal burden on the public purse.

4.11 However, the EV market is evolving rapidly with new private sector providers coming into the market. It is unclear that there is a need to pursue investment of public monies in public charge point provision when private sector investors are appearing to fulfil this role. However, what is lacking is a consistent framework within which charge point providers can operate. It is currently unclear how the market can evolve to supply an integrated and easy customer experience nationwide without such a framework. London has worked hard to integrate a number of charge point manufacturers into one seamless network and this issue must be tackled on a national scale if an interoperable national network is to be achieved. TfL would welcome guidance from Government regarding future national policy.

## 5. The Role of Plug-in Vehicles Alongside other Technologies to Reduce Carbon Emissions from Road Transport

5.1 Any measures seeking to reduce emission from road transport should look at the transport network as an integrated whole. There is significant scope to reduce carbon emission from the transport sector via investment in public transport and active travel solutions such as cycling and walking.

5.2 There is significant scope to improve the efficiency and reduce the carbon impact of the petrol/diesel engine and this should not be overlooked. Improved carbon performance from vehicle manufacturers is largely being driven by current European legislation. This is, therefore, a critically important avenue for the Government to support in ongoing development of EU regulation to drive innovation and investment in the future.

5.3 Other technological solutions will also have a role to play in reducing carbon emissions from road transport and EVs are one of a portfolio of technologies, rather than the whole solution.

5.4 In addition, the Mayor has published the London Hydrogen Action Plan and supports the London Hydrogen Partnership, a group of public and private bodies working to establish a hydrogen economy in London.

## 6. Action taken by other Countries to Encourage the Uptake of Plug-in Vehicles

6.1 TfL works regularly with partners in other countries to share knowledge about plug-in vehicles.

6.2 TfL is a partner in CAPIRE (Co-ordination Action on PPP Implementation for Road-transport Electrification), an EC-funded project as part of the European Green Cars Initiative. It includes 14 partners,

led by Renault and including Volvo, CRF, Procter &Gamble, Bosch, Valeo, Iberdrola, TfL and others. CAPIRE is a four-year co-ordination project which commenced Dec 2010, with key outputs due this year to inform EV themes in future EU grant funding allocations. The project's workstreams include developing vehicle electrification roadmaps, as well as research into low carbon freight/urban logistics and PPP models.

6.3 TfL would welcome action from the Government to establish common international charging standards to ensure that ongoing investment in charging infrastructure is not wasted

## 7. Conclusions

7.1 TfL fully recognises the potential of low carbon vehicles to deliver significantly cleaner transport, but would urge the Committee to recognise that this must sit within the context of ongoing investment in public and active travel solutions.

7.2 There is significant potential to reduce the impact of existing petrol or diesel technology which, given the timeframe for implementing mass market roll out of potential low carbon solutions must not be lost.

7.3 Electric vehicles are widely recognised as the best developed low carbon road transport technology at the moment and TfL is actively supporting development of this market. TfL welcomes Government investment via the Plugged in Places scheme which has been critical to delivering a public charging network in the capital.

7.4 TfL would welcome further support to integrate information provision to customers, both individual and business. In particular information support to ancillary financial and insurance sectors to educate providers is critical to enable the development of more realistic business models for purchasing and operating plug in vehicles.

7.5 TfL would welcome further action on creating industry standards and commercial frameworks to secure customer safety, reduce investment risk and to drive an integrated customer proposition from this new industry.

*April 2012*

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### Written evidence from the Campaign to Protect Rural England (CPRE)


## Summary of Key Points

— Government strategy for plugged-in vehicles should ensure that economic, social and environmental gains are pursued simultaneously, despite this it currently only focuses on carbon, which is not the only environmental issue.

— While we agree plugged-in vehicles should have a growing role to play, the current strategy is not likely to deliver the significant reduction in carbon emissions required due to the "rebound effect" from increased traffic.

— The focus of the Plugged-in Places funding on urban and suburban areas effectively disadvantages rural areas, where there are fewer alternatives to driving and where increases in the cost of fuel are felt the most.

— The Plugged-in Car Grant is likely to be socially regressive. It should instead focus on car sharing rather than car purchase, which would also help ensure subsidies are targeted on vehicles that would be used most, rather than those parked in a driveway or office car park for most of the day.

— China and Germany have far greater use of electric bikes (e-bikes) than the UK and there are strong arguments for treating them equally with electric cars, such as by subsidising the cost of buying them.

— Underlying these concerns is a general failure to consider behaviour change—such as people switching to electric car clubs and e-bikes. The focus is on technological change, despite the fact behaviour is likely to change too and this should be encouraged.


## Recommendations

— The strategy for plugged-in vehicles should be grounded in a wider long-term national transport strategy, particularly in order to tackle the "rebound effect" and ensure that it decreases rather than increases social inequality.

— Transport and planning policy, in particular the definition of "sustainable transport mode" in the National Planning Policy Framework (NPPF), need to be amended to ensure that the carbon savings from low emission vehicles are locked in and that other costs, such as increased congestion, do not arise.

— The 2013 revision to the Plugged-in Vehicle strategy should cover behaviour change as well as technological change and be rural-proofed, to ensure rural areas are not left behind.

— A minimum of 25% of the Plugged-in Car Grant should be reserved for car club vehicles and this should be accompanied by charging infrastructure. A proportion of funding should be ring-fenced for rural areas.

— Subsidies for purchasing Plugged-in Vehicles should be extended to e-bikes, which should be fully incorporated into the revised strategy. Government action may be needed to facilitate insurance for e-bike pools.

## Introduction

1. We welcome the opportunity to submit evidence to the Transport Committee's inquiry into Low Carbon Vehicles. As a leading environmental charity, the Campaign to Protect Rural England (CPRE) has worked to promote and protect the beauty, tranquillity and diversity of rural England since 1926.

2. With the recent rise in fuel costs particularly affecting rural areas, where there is greater dependency on cars, and the growing future challenges of decarbonising transport in rural areas,[38] we recognise the need for a rapid increase in penetration of plugged-in vehicles (PIVs) in the vehicle fleet. We believe that this needs to be planned much more carefully, however, if it is to lead to economic, environmental and social benefits.

3. In the Ministerial Foreword to (Office of Low Emission Vehicles, 2011) it was stated that: "it is the carbon that is the problem, not the car. The idea that the only way to achieve our environmental goals is to force people out of their cars is pessimistic, outdated dogma."

4. Besides the fact that many people in the countryside feel that they are being forced into cars due to the lack of affordable, convenient public transport or safe conditions for walking and cycling, these assertions are inaccurate and unnecessarily divisive. PIVs do not address congestion, in fact could make it harder to manage, while in central London over half of transport related particulate pollution comes not from the tail pipe but from tyre and brake wear[39] and this proportion is growing.

## Inquiry Questions

*The contribution of plug-in vehicles to decarbonising transport*

5. The starting point is often the claim that an electric vehicle would emit 15–40% less carbon on today's grid and this advantage will increase as the grid is decarbonised. This focus on emission of individual vehicles fails, however, to consider the likely wider impacts on traffic patterns and modal share (let alone tax take by the Treasury) if there is a significant increase in the penetration of such vehicles.

6. The latest Department for Transport (DfT) Road Traffic Forecasts, derived National Transport Model (NTM) 2011, predict a 9% reduction in greenhouse gas emissions from road transport between 2010 and 2035. This assumes that cars will become 46% more efficient, so reducing the cost of driving by 30%. But the carbon savings from these efficiency gains are eaten up by the "rebound effect" that is predicted to lead to a 44% increase in traffic miles. It is this "rebound effect" which reduces the real world potential of plug-in vehicles to decarbonise transport.

7. The Climate Change Act 2008 requires a reduction of UK emissions by at least 80% from 1990 to 2050 and effectively this will require a 90% reduction in surface transport emissions due to the difficulty in reducing aviation and shipping emissions. Surface transport emissions rose slightly between 1990 and 2010, so were the NTM predictions to turn out to be true, effectively a 90% cut would be required in road traffic emissions between 2035 and 2050.

8. The NTM did not model the impact of wholly electric vehicles or improvements to fuel efficiency[40] after 2020. These could be expected to increase the rebound effect even more. Although the Committee on Climate Change (CCC) has highlighted "the necessity of developing over the long term the policies which ensure that the reduction in supply side emissions is not offset by rebound effects",[41] the DfT does not have any long term strategy[42] and so has been unable to lock in carbon savings from more efficient vehicles. A particularly important but controversial issue will be how to replace fuel duty as use of hydrocarbons per mile travelled decreases and, until this is answered, traffic forecasts will at best be highly speculative.

9. The planning system has played a key role in helping manage traffic levels and their impacts, such as through maximum parking standards, guiding the location and scale of development, and through setting conditions. The National Planning Policy Framework (NPPF) now defines sustainable transport mode as "[a]ny efficient, safe and accessible means of transport with overall low impact on the environment", explicitly including low emission cars.

10. It is not just the simple equation of the environment with low carbon that is so concerning to CPRE, it is the NPPF's fundamental failure to apply all three dimensions of sustainable development (paragraph 7), to its definition of sustainable transport modes. With EU emissions standards set to become more stringent over

[38] For example see Commission for Rural Communities, *Rural Life Without Carbon*, 2009

[39] Although regenerative braking could reduce the impact of this, the greater acceleration offered by Plugged-in Vehicles could make it worse, unless the benefits are locked in through widespread 20 mph speed limits.

[40] Hybrid vehicles could generally be modelled as the same as more efficient conventional vehicles, whereas electric vehicles would be somewhat different.

[41] Page 285 in Building a low-carbon economy—the UK's contribution to tack ling climate change, 2009

[42] A point rightly raised by the Transport Committee in a number of its recent reports on the economy and on High Speed Rail.

the next decade, the definition will effectively be uninterpretable and unworkable over the thirty-plus lifetime of development.

11. The CCC has emphasised the importance of better land use planning to reduce transport emissions in future carbon budgets but CPRE believes the NPPF represents a big step backwards in this regard. The Irish experience, where development sprawl caused by a lax planning system was the major cause of a 170% increase since 1990 in emissions from transport, should sound a note of caution.[43]

Electric bikes

12. Although electric bikes (e-bikes) are not considered in *Making the Connection*, they have enormous potential to improve people's mobility choices. They can take the effort out of cycling for longer journeys, journeys in hilly areas, the carrying of goods and indeed make cycling easy for the elderly and the less able. E-bikes therefore offer significant potential to increase the modal split of cycling even beyond the best performing continental countries. Unlike PIVs, they do not cause issues such as congestion or indeed air pollution from brake and tyre wear, an increasing problem.

13. CPRE launched a trial of e-bikes in a village in Hampshire in 2011, which was highlighted in the 2011 Local Transport White Paper at paragraph 5.7, which was the first mention of e-bikes in a Government White Paper. A study following the end of the trial showed that although very popular and much cheaper than buying a PIV, many of the participants felt that e-bikes were currently "prohibitively expensive".[44]

14. Around 200,000 e-bikes are sold annually in Germany compared to 30,000 in UK, while in China more e-bikes are sold than private cars. Just as with PIVs, the Government needs to help generate a critical mass by helping reduce the initial cost and consumer acceptance of this new technology. If e-bikes were to receive a subsidy equivalent to that of the Plugged-in Car Grant, it would be about £250. Assistance should also be provided to help communities set up e-bike pools and a key barrier identified in the pilot is securing suitable insurance.

*Uptake of plug-in vehicles and how this can be improved*

15. *Making the Connection* proposes focusing investment in charging infrastructure where it will be "most used" (paragraph 1.7) but fails to apply this principle in relation to plugged-in vehicles. It is an inefficient use of public subsidy to pay towards private vehicles that are likely to spend as much as 23 hours per day parked in a drive way or workplace car park. Car clubs or car sharing offers a much better way to increase the proportion of vehicle mileage driven by PIVs, which is more important than penetration of such vehicles. It also helps allow those who cannot afford such vehicles a more equal opportunity to use them.

16. There is a higher degree of transport poverty in rural areas, where a significant proportion of the household budget is spent on transport, often just to keep an older car on the road. In such cases, buying a new car, let alone an expensive PIV is simply not an option. There is a growing social divide between those who have an efficient, cheap-to-run car and those who have an "old banger" that drinks fuel.

17. The Plugged-in Car Grant should be prioritised for car clubs with at least 25% of it being reserved for this purpose and rural areas should be prioritised as up to now most car clubs have focused on cities. In addition, tax advantages should encourage businesses to make their plugged-in vehicles available for car sharing in the local community in the evenings and weekends. As noted above, subsidies should also be extended to e-bikes. Charging infrastructure should be prioritised for car club spaces, as car club operators should not have to shoulder the cost of an emerging technology.

*The effectiveness of the Plugged-in Places scheme*

18. It is too early to judge conclusively the impact of the Plugged-in Places funding as it has been used to fund a variety of different charging infrastructure schemes in different locations, though focused on urban and suburban areas. A particular challenge is that a "critical mass" of charging opportunities and PIVs will be needed to be able to judge properly which approach works best but that this critical mass is unlikely to be achieved while there are a range of different approaches.

19. Although *Making the Connection* aspires to an increasing proportion of rural journeys (paragraph 2.11) undertaken by PIV, it fails to rural-proof its recommendations in any way and rural areas are at risk of being left behind. The lack of focus on rural areas runs the risk that the approaches being piloted in urban areas will not transpose well to the countryside. We believe that a special fund for charging infrastructure should be made available for rural areas, in the same way that the DfT's bus strategy now, following years of lobbying by CPRE, includes a fund to help roll out smart ticketing to smaller bus operators, which operate predominantly in rural areas.

[43] Page 20 in An Taisce—The National Trust for Ireland, *State of the Nation: A Review of Ireland's Planning System 2000–11*, 2012

[44] Report available from CPRE Hampshire at http://www.cprehampshire.org.uk/transport/trial1.html

*The role of plug-in vehicles alongside other technologies to reduce carbon emissions from road transport*

20. PIVs are most effective for shorter trips and, although they can work well for vans, are not appropriate for large goods vehicles. There are growing sustainability concerns around biofuels, which will need to be prioritised for aviation and shipping, for which there are even fewer alternatives. Hydrogen is still a long way off as an energy source and, in any event, its production is not an efficient use of energy.

21. For these reasons, CPRE believes that significant modal shift to electrified rail will be essential for passenger and freight transport. A national transport strategy would be a key opportunity to embed the Government's vision to make rail the longer distance mode of choice.

*April 2012*

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**Written evidence from the Institution of Engineering and Technology**

1.1 The Institution of Engineering and Technology is one of the world's leading professional bodies for the engineering and technology community. The IET has over 150,000 members in 127 countries and has offices in Europe, North America and Asia-Pacific. The Institution provides a global knowledge network to facilitate the exchange of knowledge and to promote the positive role of science, engineering and technology in the world.

1.2 This evidence has been prepared on behalf of the IET Trustees by the Transport Policy Panel. The IET would be pleased to provide further technical assistance and evidence as part of this inquiry.

SUMMARY

1.3 Plug-in vehicles can make potentially a significant contribution to the decarbonising of transport if the fundamental issues of cost can be overcome, alongside the "greening" of electricity generation in the UK. It is pointless to deploy Plug-In vehicles if the new demand created has to be sourced from carbon intensive sources.

1.4 Public fleet procurement can play a crucial role in helping to increase the take up of plug-in vehicles. The key challenge is changing public perception around electric vehicles and having publicly visible fleets, either directly through the Government Car Service or stipulated as part of tender requirements, can play a part in achieving this.

1.5 There is a particular air quality benefit to be gained from the use of EVs in urban areas. As a result increased incentives to assist adoption in cities could be one way to ensure the vehicles are being adopted for the right applications in the right areas.

THE CONTRIBUTION OF PLUG-IN VEHICLES TO DECARBONISING TRANSPORT

1.6 According to the Department of Energy and Climate Change and the Department for Transport, domestic transport (excluding international aviation and shipping) as a sector, is the second largest source of greenhouse gas emissions, accounting for 21% of the UK's emissions in 2008. Of that 21%, road transport accounts for around 90% of transport $CO_2$ emissions (55.2% passenger cars, 12% light duty vehicles, 3.7% buses, HGVs 18%, 0.5% mopeds and motorcycles).[45]

1.7 Plug-in vehicles are therefore an important way to tackle the decarbonisation of transport. The UK needs to meet its climate change targets and plug-in vehicles present a ready technology that can be used, if applied in a sensible way. However, we need to ensure that whole-life costs are used as the basis of measurements of cost/effectiveness so that we get a true picture of the level of "decarbonisation" which is actually being done. By their very nature plug-in vehicles will increase the demand for electricity, which at the moment is not derived from the cleanest of sources.

1.8 In 2009, the European Commission Mobility and Transport Directorate issued a Communication on the Future of Transport, which included a consultation on their findings. The IET responded to that consultation making particular reference to low carbon vehicles. In our response we stated that grid powered electric vehicles will only reduce carbon emissions if they draw their electricity from wholly or largely carbon free sources. A low carbon transport strategy has serious implications for electricity demand and clean electricity, at the moment the average grid $CO_2$/kWhr ranges from a peak of 470g/kWhr to a low of around 360g/kWhr. Our view has not changed since we made this response.

1.9 Any decarbonisation strategy based on plug-in vehicles needs to consider whole life emissions costs, both in manufacture and in operation. If we are not specific about what we add up and measure, we could end up manufacturing vehicles with a high carbon intensity of production (such as battery and motor manufacture) while increasing demand for "dirty" electricity as part of vehicle operation. Whole life costs must be at the heart of a plug-in vehicle decarbonisation strategy.

1.10 The absence of a clear procedure for a whole life cost approach that is common across Government demonstrates the urgent need for joined up planning between Department for Transport ambitions and

[45] 2008 greenhouse gas emissions—final figures, DECC, 2010 & Carbon Pathways Analysis, DfT, July 2008

Department for Energy and Climate Change electricity generation predictions. In particular a clear strategy is needed now on the role of smart grids and smart meters in helping to meet this challenge. The Office of Low Emission Vehicles (OLEV) could play a role in joining up this strategy. The IET has provided significant evidence on the need for a joined up strategy between smart grids, smart meters and plug-in vehicles, combining the input and expertise of our Transport, Energy, IT and Communications Policy Panels.[46]

1.11 The 2008 King Review suggested that the complete decarbonisation of road transport could be possible by 2050, if electric vehicle technology is significantly improved. This has been affirmed by the Committee on Climate Change who state that electric vehicles are the most viable of the potential technologies to be employed to deliver "deep" emissions cuts in car and van emissions through the 2020s.[47]

### Uptake of Plug-in Vehicles and how this can be Improved

1.12 The uptake of electric vehicles has been lower than expected. The Committee on Climate Change (CCC) set a target of 5,000 electric vehicle car registrations for 2010, we understand that only 167 were registered in that year. Alongside this we have had developments around "new car" internal combustion engine $CO_2$ emissions, with a target of 155.5 $gCO_2$/km set by the CCC for 2010, but this figure being better than target at 144.2 $gCO_2$/km.[48] This compares to an average electric vehicle $gCO_2$/km figure of around 80.

1.13 The aims and objectives of policy in the short and long term need to be clearer. Hybrid vehicles could be a good stepping stone in the short term, to overcome "range anxiety" concerns and other transitional fears. This would be a useful but not a total policy solution until the long run when the acceptance of electric vehicles and plug-in technology is more widespread amongst the public.

1.14 Alongside this short term strategy, Pure-EVs could be pursued in areas where they are more suited such as part of fleet procurement. Pure-EV capability is more restricted than conventional vehicles and costs are significantly greater. This limits current rates of adoption in the private vehicle fleet. Pure-EVs may (in the short term) be more suited to fleets with a suitable duty cycle which would allow periods of charging. While this strategy is pursued further steps can then be taken to ensure the electricity fuel mix is decarbonised and that smart meters and smart grids are rolled out effectively.

1.15 History demonstrates that environmentally beneficial technologies (such as unleaded fuel, catalytic converters) will not be adopted if there is a significant extra cost to businesses if the sole justification is environmental benefit; cost neutral subsidy or legislation has been required to promote or force adoption.

1.16 One of the key issues inhibiting take up is the cost of batteries and as a result most research is focused on reducing this cost. No major improvements in range or performance are expected in the next five to ten years, as most vehicles available in this timeframe are already being designed to utilise available technologies.

1.17 If battery energy density can be increased (and this will probably need to double), while charging time and costs are reduced, then pure EVs and plug-in hybrids will be more attractive for mass adoption. New battery/super capacitor technologies may deliver such improvements over the next five years, but these would then need to be included as part of vehicle design and enter service over a longer period. Cost is likely to remain an issue inhibiting uptake.

1.18 We need a better understanding of who benefits the most from adoption of the current technologies and promote uptake in these sectors. There is a particular air quality benefit of EVs in urban areas. As a result increased incentives to assist adoption in cities could be one way to ensure the vehicles are being adopted for the right applications in the right areas.

1.19 Given the issues identified with commercial fleet adoption, large scale adoption should be led by the public sector in fleet purchase, including public transport contracts requiring low or zero emissions on a large scale. Such fleets tend to be focussed in urban areas and private sector procurements may be driven by costs and not social/ethical factors. If the Government wants to trigger a change, it needs to lead by example and either include tender requirements to contain x% EVs or to specify that the average emissions of a fleet must be below a certain figure. This could then encourage adoption of appropriate vehicles.

### The Effectiveness of the Plugged-in Places Scheme

1.20 The ambition behind the Plugged-In Places (PiP) scheme is set out by the Department for Transport on their website:[49]

> 1.20.1 To inform wider roll out of infrastructure as mainstream electric vehicles come to the UK, the Government is supporting the "Plugged-In Places" programme. The scheme offers match-funding to consortia of businesses and public sector partners to support the installation of electric vehicle recharging infrastructure in lead places across the UK.

[46] See for example our Key Topics page on Smart Grids: http://www.theiet.org/policy/key-topics/smart-grid/index.cfm

[47] Committee on Climate Change, Electric cars & vans http://www.theccc.org.uk/sectors/surface-transport/electric-cars

[48] Challenges and opportunities in meeting carbon budgets, Committee on Climate Change Presentation given at Smart Cities 2011 conference

[49] http://www.dft.gov.uk/topics/sustainable/olev/recharging-electric-vehicles

1.20.2 Data derived from the programme about how drivers use and recharge their electric vehicles will provide the necessary evidence base to shape the design of a national system of recharging infrastructure.

1.21 We believe that the PiP scheme does need to be evaluated. Anecdotally it has been suggested that one of the ambitions behind the scheme was to reassure the public around the issue of range anxiety, ie that you will always be able to charge if required. Feedback from EV trials suggests that charging posts create a reassurance that if they did need to be used, they would be there. Charging posts which include "fast charge" as an option are also popular amongst users.

1.22 As discussed earlier, policy should be clearly focussed toward the fleets that can make the greatest difference. This could be initiated in public sector fleets such as the Government Car Service or other areas of large public shareholding such as the Royal Mail. Publicly visible EV fleets such as taxis, buses, mail/shopping delivery, may do more to build the public perception of EVs over time alongside the current approach of PiPs.

1.23 The future of on-street infrastructure will be privately funded but a wider question around redundancies is raised. Some of the current network is based on a low ampage current, to help with assuaging safety fears and as a result charge times are longer. Safety concerns may be alleviated through the development of standards, such as the IET's recently published Code of Practice for Electric Vehicle Charging Equipment Installation.

1.24 Most charging posts will need retrofitting as technology advances to allow fast but safe recharging, while also being interoperable. While obvious, it should also be pointed out that home charging is more difficult for those who do not have a garage/drive.

1.25 In addition if future low carbon vehicles are based on other technologies such as hydrogen fuel cells, there would be a reduced requirement for a national EV recharging network. This latter point raises a wider question about what the government's fuel preference is for road transport. The Plug-In Car grant is applicable to ultra-low emission cars, including hydrogen-fuelled vehicles and has recently been expanded to include Plug-In Vans. Policy in this area needs clarification.

## The Role of Plug-in Vehicles Alongside other Technologies to Reduce Carbon Emissions from Road Transport

1.26 There are many technological challenges which need to be overcome such as battery technology. The challenge is how to kick start this research and get it to a position to be rolled out efficiently. Making the funding follow technology is a good principle but is difficult to implement. Another way around direct funding is to provide taxes and rebates to incentivise research amongst manufacturers to help drive down costs.

1.27 A low carbon transport solution does not have to mean only plug-in vehicles, some other cross-cutting and cross-transport industry technological developments can help to reduce carbon emissions. For example, developments in materials can help to dramatically reduce both body and component weight. For example, Drayson Racing Technologies are experimenting with reducing the need to carry around a EV battery through the use of structural composite batteries, where the shell of their Le Mans Prototype car is the battery itself.

1.28 The announced Transport Systems and Smart Cities Catapult Centres could well play a crucial role in seeking out some of these cross industry technological requirements to help share knowledge on how transport as a whole can be decarbonised, disappointingly however this has not been included in the list of initial challenges to be tackled.

1.29 Some of the challenges which could be driven by tax incentives and rebates include:

- Efficiency improvements in internal combustion engines and the addition of mechanical energy recovery systems still have significant potential to reduce emissions.
- Carbon-free charging from renewable sources such as wind and solar. Linked to an increase in photovoltaic cell installation increase.
- Technology to support contactless recharging.
- Use of hybrid technologies with either bio-fuels, hydrogen (fuel cell) or gas to reduce the emissions of range extenders even further.

*April 2012*

## Written evidence from Thriev

### About Thriev

This evidence is submitted by Thriev, an urban mobility company that will launch a large-scale on-demand chauffeured car service with an entirely electric vehicle ("EV") fleet later this year. Thriev's EV fleet will be largest in the world, with investment in fast charging points across London as well as IT technology to optimise the investment. This approach will allow Thriev to maximise investment in cars as well as the fast charging points.

Thriev seeks to dramatically reduce parking and traffic congestion by providing a chauffeured travel service at lower cost than car ownership for up to 0.7 million registered private vehicle owners in London (of the total vehicle population of 2.5 million). By replicating the "on-demand" convenience of car ownership, but at lower cost for 30% of registered car owners in London, Thriev will enable a substantial and long-term reduction of privately owned parked vehicles in London's streets. This will transform the urban transportation environment and lead to a step change in perceptions of electric cars. It will also have a significant and positive impact on vehicle $CO_2$ emission levels.

The House of Commons Transport Select Committee has put forward five questions on the subject of low-carbon vehicles:

1. Contribution of plug-in vehicles to decarbonising transport.
2. Uptake of plug-in vehicles and how this can be improved.
3. Effectiveness of the Plugged In Places scheme.
4. Role of plug-in vehicles alongside other technology to reduce carbon emissions from road transport.
5. Action from other countries taken to encourage the uptake of plug-in vehicles.

Thriev is pleased to offer evidence on all these points.

### Summary of Thriev's View

Improving the uptake of electric plug-in vehicles and maximising their potential to decarbonise road transport requires overcoming a range of currently existing barriers and obstacles, including:

- The lack of leadership in EV take-up due to the current inability of industry to demonstrate economic viability and practicality of EV use in commercial or domestic settings;
- The upfront capital costs of electric vehicles;
- Range anxiety, confounded by the limited availability of accessible and fit-for-purpose charging infrastructure regarding power capacity and charge speed and the limited interoperability of charging networks within one geographical zone;
- The lack of access to parking near available charge points and the disincentive of parking fees levied to access "public" charging infrastructure.

To address these challenges, Thriev recommends for the Transport Select Committee to consider ways in which central government could:

- Target higher (financial) incentives towards rapid-charge, high-utilisation charging infrastructure, particularly charging factories, put in place by organisations which are able to demonstrate economic viability alongside acquisition of large pure EV fleets;
- Make available publicly controlled sites and spaces for the construction of charging infrastructure;
- Ensure the interoperability of charging points across geographical zones, or even, UK-wide;
- Introduce access to free parking for EVs and increase the number of "EV-only" parking spots across London and other localities;
- Learn lessons from the Norwegian example of subsidising EVs, particularly with a view to introducing tax exemptions and other benefits for EVs.

### 1.0 *Contribution of plug-in vehicles to decarbonising transport*

1.1 The contribution of plug-in vehicles to decarbonising transport will be significant, especially as infrastructure and public confidence grows. Infrastructure and public confidence are two areas where Thriev will have a major impact. Thriev believes perceived limitations, such as range, of pure electric vehicles (EVs) can be overcome by a change in vehicle usage habits and the application of smart technology. According to London Travel Demand Survey 2011, 2% and 4.6% of Londoners changed their travel habits in 2009–10 for environmental or cost factors. Combined with EV technology, vehicle usage habits will have a long-term sustainable impact to decarbonise transportation. The statistics on carbon emissions per mile for electric vehicles vs petrol vehicles speak for themselves.

1.2 The benefit of plug-in vehicles shouldn't be looked at only in terms of carbon, but in terms of noise and air pollution. This is particularly true within London.

1.3 Carbon emitting vehicles create breathing difficulties and are unpleasant for cyclists. These vehicles therefore discourage people from cycling in London. Thriev believes a change from using internal combustion engine (ICE) vehicles to using pure electric vehicles will multiply the effect of decarbonisation since less $CO_2$ emitting vehicles will make cycling more appealing.

1.4 Not least, decarbonisation of transport would have a positive impact on the UK's current account deficit. Thriev alone will save 40 million litres of fuel annually (£50 million at retail) on its fleet of 5,000 vehicles. Those vehicles will be manufactured in the UK adding a further lift to the UK economy.

2.0 *Uptake of plug-in vehicles and how this can be improved*

2.1 In this section, Thriev outlines solutions to these key challenges that impact uptake of plug-in vehicles:

- Utilisation and upfront capital cost of the vehicle.
- Limited available charging infrastructure.
- Infrastructure needs to be fit for purpose: power capacity, charge speed, availability.
- Scheduling and queuing technology.
- Range anxiety.
- Access to parking near a charge point.
- Lack of leadership in EV take-up: industry has yet to demonstrate economic viability and practicality of electric vehicle use in either commercial or domestic applications.

2.2 *Envisaged utilisation of electric vehicles at less than 12,000* miles per annum, coupled with the *high upfront capital cost*, does not provide attractive overall cost savings compared to ICE vehicles.

2.3 Due to a perceived lack of economic attractiveness caused by the high upfront capital costs, and other limiting factors explained in this submission, government incentives have yet to encourage a meaningful uptake of plug-in vehicles.

2.4 Uptake can be improved by increasing incentives targeted at *high utilisation EV users (40,000+ miles/ annum)*. This will encourage a sustainable and substantive (not presentational) uptake of electric vehicles based on sound economic principles.

2.5 A profound *increase in charge point infrastructure* is required in order to facilitate charging of electric vehicles by potential users that do not have guaranteed access to a charge point either at home or at work. The 2013 target of 1,300 public infrastructure charge points in London would need in the region of 20 days of back-to-back charging to "refuel" the London target of 100,000 plug-in vehicles. Thriev proposes that the government offers greater incentives for investment in charging infrastructure to firms that acquire large fleets of pure electric vehicles (EV).

2.6 New *infrastructure needs to be fit for purpose.* A) Many existing London charge points are located in car parks that charge a per hour access rate, in addition to charge scheme membership fees. This acts as a disincentive to vehicle charging. B) Much of the existing London charge infrastructure is "slow-charge" (3.7kw), not practical for high volume usage since it takes six to eight hours to charge a mid-range EV. Thriev proposes that incentives are directed at investment in rapid-charge infrastructure only.

2.7 Infrastructure needs to be installed side-by-side with technology that enables *intelligent allocation of vehicles to charge points, and virtual queuing.*

2.8 *Lack of public confidence* in electric vehicles' range, known as *"range anxiety"*, is a major barrier to uptake of plug-in vehicles. Although some EVs have a range of up to 100 miles, the usage model as different from the internal combustion engine (ICE) vehicle has yet to gain acceptance. Public confidence in electric vehicles' range and speeds needs to grow before this can change. This change would be assisted by the existence of large fleets that demonstrate a viable usage scenario for EVs. This is likely to be achieved only by *electrification of large corporate and public fleets.*

2.9 *Access to charge points* for many Londoners is prohibitive both at home and at work. To overcome this challenge, grants should be provided to encourage development of fast-charging factories (where vehicles can be charged within 20mins to 80% of full charge). These could be located in "off-prime" locations. If widespread enough, these factories would provide comfort to electric vehicles owners of a "guaranteed" charge facility. Moreover, Thriev recommends that the government extend incentives based not merely on financial stimulants, but on access benefits to sites that could be dedicated to vehicle charging. Using publically controlled sites for charging EVs would go a long way to solving the charging challenge, and take-up would be encouraged. Thriev, for example, would invest in industrial, commercial, derelict or other sites to create charging factories for vehicles. Thriev would aim to regenerate areas within boroughs and create employment. Other corporations could be encouraged to follow suit.

2.10 EVs have suffered from a low uptake and many people consider them to be *virtuous as opposed to efficient*. As such, EVs are not yet seen as valid competitors to existing ICE vehicles. This view prevails even among Londoners, whose journeys are less than 15 miles on average and therefore would find all their needs supplied by the average EV. Thriev, and the arrival of other large EV fleets, would change this view since it would demonstrate that electric vehicles can be used cost effectively in a commercial setting and for passenger journey usage. Visibility could jumpstart the lagging electric vehicle revolution. To quote the Institution of Engineering and Technology, "publically visible EV fleets ...may do more to build the public perception of EVs". Further incentives from government can help to secure a higher uptake and therefore help to change public perceptions.

2.11 Infrastructure for cars is not purely based around fuel. Thriev believes that taking into account the particularly poor quality of London air, the difficulty of finding parking in London, and the effect of public confidence in finding free and/or easily available parking spaces, a large increase in the number of free or reserved-for-EVs parking spaces is advisable.

3.0 *Effectiveness of the Plugged In Places scheme*

3.1 In this section Thriev describes the main factors that relate to the effectiveness of the Plugged in Places scheme:

- Interoperability of charging networks within a geographical zone, such as London.
- Impact of parking fees levied to access "public" charge infrastructure.
- Maximising impact of incentives.

3.2 The Plugged-in Places scheme has been fairly effective nationwide, particularly in north-east England. However, Source London's competition from some boroughs (with more expensive memberships) and the *lack of interoperability* on chargers damages this improvement in infrastructure. London-wide interoperability should be enabled across London's various charge infrastructure networks. Incentives should be provided to organisations willing to risk large-scale upfront capital investment to build charging factories.

3.3 Source London is cheap and its chargers are spreading across the city. However, competition from other boroughs means it can't be everywhere a vehicle-owner needs it to be; for instance, Westminster charges £75 a year for membership of its separate scheme. The *lack of interoperability* between different schemes, both public and private, weakens London's charging infrastructure.

3.4 The *general expense* of London parking is exacerbated by the large proportion of Plugged In Places/ Source London charge points located in NCP and other chargeable parking locations. These parking slots should be free to access for pre-defined period, as are on-street locations. The cost of parking by a publically accessible charge point should be taken into account.

3.5 The current level of stimulus does not make investment in charge point infrastructure a commercially viable business since EV uptake is required to generate demand, and there are several factors (discussed in this submission) that combine to prevent large-scale EV uptake. Existing PiP terms can only encourage "presentational" investment by corporations. Higher incentives should be targeted to operations that can demonstrate an *economically viable business model for a charge infrastructure* combined with a robust solution to stimulate EV uptake. The model should guarantee high utilization of charge points, making the business model viable for itself and for other market participants such as utilities companies. This would attract significant attention and demonstrate rational, practical and economically viable EV usage. As such, it will be the catalyst for a step change in perceptions of EV usage by businesses (and also consumers) and kick-start the EV revolution in London.

4.0 *Role of plug-in vehicles alongside other technology to reduce carbon emissions from road transport*

4.1 Thriev would like to note that the green economy has outperformed other sectors. Thriev in itself will be providing approximately 7,500 new jobs in London, with an intention to recruit largely from the 21–24 age range. Supporting the increased uptake of EVs and the installation of infrastructure is important for encouraging job growth, particularly for young Londoners. It will demonstrate that EVs are in fact the start of a new phase of development for the automotive industry as a whole. It will give confidence to the automotive industry to continue R&D spending on more innovative zero emission vehicle technologies.

5.0 *Action from other countries taken to encourage the uptake of plug-in vehicles*

5.1 Government incentives for electric vehicles have revolved around reducing the upfront cost, as with the current £5,000 subsidy. The uptake of that subsidy has been extremely low, and the UK's uptake of electric vehicles in general has been low compared with other nations.

5.2 Over 1,000 Nissan LEAFs have been sold in Norway just six months after the car was released in the country, bringing it up to 2% of the market. The range of incentives in Norway is both strong and wide-ranging: in addition to initial subsidies such as the lack of VAT, electric vehicles in Norway get free parking, can use bus lanes and are exempt from some tolls. Norway has the highest level of subsidies in Europe and this has contributed to the creation of a thriving EV market in Norway.

5.3 Providing governmental support for uptake of electric vehicles throughout the lifetime of the vehicle clearly has an impact. Not having to pay the London congestion charge is an excellent start on this sort of subsidy in the UK. Giving electric vehicles the right to park and charge in more locations, for instance, would likely increase uptake substantially, particularly given electric vehicles' suitability for oft-congested urban spaces. This would be an important step on the road to transformational change and therefore strongly recommended by Thriev.

*May 2012*

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**Written evidence from the British Vehicle Rental and Leasing Association (BVRLA)**

1. Overview of Response

1.1 The British Vehicle Rental and Leasing Association represents the interests of more than two million business car drivers and the millions of people who use a rental vehicle each year. Its members are active supporters in the drive to decarbonise road transport. BVRLA members and their customers, purchase over 45% of new vehicles registered in the UK every year.

1.2 Our rental and leasing members play a vital role in helping to make available the greenest vehicles in a cost effective manner so that UK businesses and consumers can benefit by accessing this green fleet. $CO_2$ emissions from BVRLA members' fleets are on average 12% lower than the UK car fleet. We believe this behavioural change has helped to underpin and support the government's greenhouse gas (GHG) reduction targets as set out in the Climate Change Act 2008.

1.3 We believe that it is vital to set out a long-term direction for policy that has $CO_2$ reduction at its heart and to avoid using one specific method of achieving this goal. Different vehicle powertrains will continue to emerge and it is vital that current and future policy remains technology neutral and equally neutral to the method of acquisitions available to the business vehicle user.

1.4 We remain concerned that the Government is in danger of seriously stifling growth and take up of ultra-green cars as it has announced in the Budget Report 2012.[50]

(a) *First Year Allowance* (FYA)—Only cars with a $CO_2$ rating of 95 g/km or less are eligible.—this represents a *13.6%* reduction against the current threshold This is sharp reduction is applied too soon and does not attempt to reflect the current economic climate facing UK businesses. Instead, we feel it would be far more sensible to remove the cliff edge $CO_2$ drops by looking to gradual reduction in the $CO_2$ eligibility and that this should be carried over a longer period of time to support businesses migrate to a greener car fleet.

(b) *FYA Leased Cars*—From 2015 firms involved in leasing, which may include renting, will be prevented from claiming the FYA from 2013. This will narrow the funding and acquisition options available to businesses. Specifically, this will adversely impact SMEs who rely on leasing cars as a means to help free up their working capital.

1.5 *Company Car Tax*—Moving the 0% rate band for zero emitting cars and 5% band for cars emitting less than 75 g/km to 13% from 2015 not only creates a cliff edge, but this sharp rise in the tax liability will see an equally sharp decline in the take up of ultra-green cars by the fleet sector.

1.6 These changes announced in the Budget will adversely impact the take up of ultra-green cars. The BVRLA believes that it is vital that taxation which is offered as an incentive to encourage take up greener vehicles is purposeful, clear, effective, certain and efficient.

1.7 Sound tax policy should target $CO_2$ reduction in recognition that the most efficient methods are likely to change over time. This creates a stable framework that can withstand the tests of time and gives the best opportunity to find the most efficient and cost-effective methods of reducing $CO_2$. It is essential that taxation is closely linked to market progress in the development of ultra-low carbon vehicles and that HM Treasury regularly review the progress to ensure buying incentives are working and are affordable.

1.8 Plug-in-vehicles will form part of the solution, but will not be the only solution to help decarbonise road transport, as this technology is more expensive (largely due to the high capital costs) when compared to a small highly efficient internal combustion engine vehicles, and is likely to be less practical as the range of miles and size of available vehicle, is extremely is limited.

2. Who we are and what we do

2.1 The BVRLA is the trade body for companies engaged in the leasing and rental of cars and commercial vehicles. Its members provide rental, leasing and fleet management services to corporate users and consumers. They operate a combined fleet of 2.5 million cars, vans and trucks, buying nearly half of all new vehicles sold in the UK.

[50] Budget 2012, Chapter 2 point 2.107

2.2 BVRLA rental members operate vehicles which have $CO_2$ emissions that are 12% lower than the UK car fleet. BVRLA leasing members also operate vehicles that are cleaner, the $CO_2$ emissions in 2011 were on average 138.1g/km which outstrips the average new car emissions for the same year which were 144.2g/km.

2.3 BVRLA members also play a vital role in influencing the second hand buyer, vehicles which our members purchase end up in the second hand market and therefore influence the choices of consumers. The greener the vehicles which are purchased by our members the greener the UK car fleet becomes.

## 3. How Incentives and Clear Policy can Help Change Behaviour

3.1 If the Government is to reach its $CO_2$ targets by 2020, then it is vital for it to develop policy which is both clear and joined up across Whitehall. If the UK is to make substantial progress towards a low carbon economy then it is paramount the market is afforded clarity and certainty. For example, tax incentives should be well signalled and provided for significant period eg five years rolling notice, with any changes to the incentive introduced on an incremental basis to avoid dramatic cliff edges.

3.2 Policy should be developed to help solve problems associated with the poor take up of plugged-in cars or other innovative vehicle and fuel technologies. This is vital, especially if the rate of road transport growth projected by the Eddington Report continues, and road use in the UK approximately doubles by 2050.

3.3 The take up of plugged in vehicles in the UK market has been slow in comparison to all new car sales. Between 1 January 2011 to 31 March 2012, 1276 claims have been made through the Plug-in Car Grant scheme, with Society of Motor Manufacturers and Traders (SMMT) data showing that 1,412 cars eligible for the Grant were registered over the same period.

3.4 We believe the following market barriers may help to explain why plugged in vehicles remain a niche market:

(i) lack of clarity and commitment to national corporate and personal tax incentives and other programmes such as "free or preferential" car parking spaces and London congestion charging scheme exemption;

(ii) high purchase prices and concerns over resale or residual values, largely due to the uncertainties associated with battery technology;

(iii) limited number of miles which is associated to range anxiety and more importantly lack of flexibility;

(iv) impractical operation and inconvenience of recharging;

(v) limited choice of models and size; and

(vi) concerns related to vehicle safety and reliability.

3.5 We note that the Office for Low Emission Vehicles (OLEV) was set up as a cross-Whitehall team to manage this programme of measures. Specifically comprising people and funding from the Departments for Transport; Business, Innovation and Skills; and Energy and Climate Change; and that OLEV is responsible for taking forward a national policy on this shared agenda.

3.6 If these original aims are to be effective then we believe OLEV needs to focus more closely on the market barriers from a customer pull or demand side perspective. Having already identified a low take-up of the vehicles eligible for the Plug-in Car Grant then we believe it would make sense to address the areas highlighted in our response with more support to the purchasers and operators of the product, which would include our members and their customers as well as retail purchases.

3.7 The BVRLA is concerned with the recent changes announced on the company car tax bands for plugged in vehicles. The Government announced in the Budget[51] that from April 2015, the five-year exemption for zero carbon and ultra-low carbon emission vehicles will come to an end. The appropriate percentage for zero emission and low carbon vehicles will be 13%. Therefore, from 2015 unless an employee is based or works in London there is no incentive other than a reduction in fuel costs for running a plugged-in vehicle. In addition, given the high purchase costs of these vehicles an employee is effectively penalised for making a green choice.

3.8 In our EV Guide[52] we researched the total cost of ownership for a plugged-in vehicle and compared it with an ultra-low emission vehicle which showed that a Volkswagen Blue Motion's cost of ownership was £5,078 cheaper than a Nissan Leaf over a period of three years. This figure will increase further in 2015 when the Nissan Leaf moves from a nil benefit in kind charge for company car tax to £4,017. Even the ultra-low emitting vehicles in the company car tax regime which move from the 5% band to 13% band in March 2015 are being unduly penalised and it is likely that employees will move away from these vehicles after the changes take place.

3.9 These changes along with the announcement that the corporation tax bandings are changing do not send reassuring signals to would be purchasers of plugged in vehicles and instead will start to erode confidence.

[51] Budget 2012, Chapter 2 point 2.154
[52] BVRLA Business Guide to Electric Vehicles

3.10 The BVRLA is disappointed at the government's failure to mandate the extended warranties and NCAP 4 safety standards required to give customers real confidence in this emerging technology. Without more assurances and support for vehicle safety, longevity and residual value, a front-end financial incentive may not be sufficient to kick-start the market. Many companies set NCAP-based minimum safety standards for their fleet vehicles, which could preclude many ultra-low carbon vehicles that only meet the basic criteria outlined by the government.

3.11 The association has also had concerns about the lack of guidance on how the grant will work in practice. For example, how the grant will be treated for VAT purposes. The government needs to act on the lessons learnt from the scrappage scheme, which was launched without adequate guidance. This was unfortunately perpetuated when the scheme was extended to vans.

## 4. Role of Leasing and Renting (and Impact on FYA)

### 4.1 *Ultra-low Emission Vehicles*[53]

4.1.1 The majority of our members now make available "ultra-low" emission vehicles on their fleet, of which the most common is the petrol hybrid Toyota Prius. Our rental members have also made plugged-in vehicles and other ultra-low emitting cars available for customers to access and use.

4.1.2 Our members have reported considerable growth in corporate interest in lower emission vehicles, and plugged-in vehicles—and that corporate clients particularly welcomed the opportunity to be able to try vehicles, without having to take on the purchase costs, maintenance and other issues.

4.1.3 In contrast, other corporates state that they like those options to be available, however in practice, people were more likely to want to rent vehicles that were familiar, and that their primary focus was likely to be "hassle-minimisation": "It's like the healthy option on the menu—people want it to be there, but they don't necessarily choose it."

### 4.2 *Current Market Demand*

4.2.1 Whilst our rental members have taken the commercial risk of making these vehicles available on their rental fleet, our members have reported the following concerns:

- Potential lack of customer demand;
- Availability of charging points and a potential lack of standardisation of charging points (such that different vehicles might require different types);
- The second-hand market for vehicles—poor marketing and information being made available by the motor manufacturers to support the second hand buyer;
- Battery life (and lack of information about battery life) and lack of extended warranties to help build confidence;
- Range constraints (and customer concerns about range constraints); and
- The different charging speed options, their relative cost and their potential effects on battery life. (For example, one company described the three main charging options—"trickle" (eight to 12 hours), "fast" (four to five hours) and "rapid" (30 mins), where the quicker options would be more expensive to offer, would require a more powerful electric supply and might be detrimental to battery life—but—for obvious reasons, would be more attractive to consumers.)

4.2.2 We note that the Committee on Climate Change has estimated that 1.7 million plugged-in vehicles will be needed by 2020 to meet the Carbon Budget target. This target is not only ambitious, but will not be realised, given the current low sales volumes of this type of vehicle. To put this into context, it would require sales of over 200,000 plugged-in vehicles every year until 2020—c.10% of new car sales. Given the current financial constraints on the Government and low level of consumer confidence, we feel the Government needs to look at a range of policy instruments and taxation incentives to help stimulate adoption of this technology. This would, for example include supporting and promoting the use of rental vehicles and ensuring it preserves the current First Year Allowance for the corporate sector including leasing companies to utilise.

### 4.3 *Clear market signals and certainty*

4.3.1 The BVRLA believes that for tax incentives to work well and deliver volume take up, incentives need to be well signalled and changes to incentives need to be made on an incremental basis. The examples below provide further detail.

4.3.2 First year allowances in the corporation tax regime have not followed the above requirements. Businesses were offered 100% first year allowances for vehicles which emitted under 110g/km $CO_2$ in 2010 but only for a limited time. In this year's Budget this was extended until March 2015 but the threshold was reduced to under 95 g/km $CO_2$, which represents a 13.6% reduction. These changes do not give businesses the necessary certainty to change buying habits because the drop from 110g/km $CO_2$ to 95g/km $CO_2$ is too dramatic and should be more gradual.

[53] Defined as vehicles which emit under 110g/km CO2

4.3.3 An example of where this has worked well is the company car tax regime. Changes to the bands which cars fall in are made gradually, normally no more than 5g/km of $CO_2$ and the changes are signalled three years in advance. Making changes in this way gives businesses the confidence to add vehicles to their fleet knowing that can plan their total tax liability.

4.3.4 The last company car tax report published in 2004 showed that the average $CO_2$ emissions figures from company cars are estimated to be around 15g/km lower as a result of the company car tax reform. HM Revenue and Customs research also suggested that around 60% of company car drivers who were given a choice of car by their employers were influenced by the company car tax reform and chose cars with lower $CO_2$ emissions figures. Even allowing for some company car drivers not being given a choice of car by their employers, it suggested that by the end of 2004 the company car tax reform had already prompted nearly 50% of all company car drivers to choose company cars with lower $CO_2$ emissions figures.

4.3.5 Given the apparent success of the company car tax regime we would urge government to carry this concept over to the vehicle purchaser where a minimum of five years rolling notice of incentives/taxation regime is needed to support policy setting. It is far better to move in small planned steps than have cliff edge changes forced through with only one years notice as is currently being experienced in the company car tax regime.

## 5. Experience of Plugged-in Vehicles

5.1 The primary objective of the Plugged-in Places (PiP) scheme was to promote plugged-in vehicles across the UK and facilitate coordination with local authorities, energy and utility companies, and local operators with the development and expansion of the UK's charging infrastructure in key potential markets across the country.

5.2 The development of the charging points was vital to support the take up of plugged-in vehicles especially as it builds confidence with the ease and convenience at which motorists can recharge their vehicles. However, installing charging points, even for PiP regions, has proven to be a complex, expensive and lengthy process due to planning laws.

5.3 On-street rapid and/or quick charging points are likely to be needed to make charging in public spaces a realistic option for plugged-in vehicle users. However, it must be understood that once a charging point is being used, for example while the customer is shopping, or using railway car park, etc, that charging point will not be available to any other user. This is a limitation that will need addressing either by developing additional charging points to match demand, or an alternative innovative solution which is affordable and one that will not place an undue strain on the electricity grid.

5.4 Local authorities should be encouraged to develop a host of policies to encourage plug-in (and other low-carbon) vehicles, other than merely installing charging points. These could include conveniently or free parking and automatic exemption from congestion or low emission zones.

5.5 Some of our rental members have worked closely with Transport for London (TfL) in receiving match funding to install charging points in rental locations within London. Rental members were able to demonstrate that due to the high utilisation of their vehicles, 55 different customers over the six to eight months the vehicle is on fleet, the points are effectively publicly available.

5.6 Where lessons can be learnt from the experience in London is that there was not enough signposting and support from TfL so that people in London knew there was a rental company with an plugged-in vehicle on fleet offering a "try before you buy" solution. The website which alerts people to where charging points are available did not mention rental companies and we feel this was a missed opportunity for encouraging take up of plugged-in vehicles.

5.7 We do not believe that plug-in vehicles should be seen as the silver bullet solution or panacea to the decarbonisation challenge in transport, but instead be seen as one of the technologies that will help meet this challenge.

5.8 Internal-combustion engine (ICE) vehicles will remain the technology of choice for motorist over the next 10 to 15 years. Motor manufacturers will continue to innovate and bring a range of new technology to the market, especially as they try to meet EU $CO_2$ mandatory targets. We believe that engine sizes will continue to become smaller and the vehicles become lighter coupled with greater use of turbocharging technology to maintain the power to weight ratio.

5.9 It is important to note that there are many cross-benefits that will apply to all power trains: weight reduction, engine downsizing (for all vehicles that use an ICE), advances in battery technology (hybrids, plug-in hybrids and all-electric vehicles), low rolling resistance tyres, and improved aerodynamics.

## 6. Closing Comments

6.1 We trust our comments add value to Committee's inquiry into whether Plugged in Vehicles Low carbon vehicles offer a potential means by which road transport can be decarbonised. If the Government expects to see tens of thousands of plugged-in vehicles on the roads by 2015 as part of its Plugged-In Vehicle Infrastructure Strategy then we believe much more work is required to help stimulate and support the

marketplace. One of which would be to recognise the vital role leasing and rental firms is playing and for policy and tax incentives to be made available on a fair level playing field with other forms of financing acquisition.

## 7. Glossary

### 7.1 *Leasing Members*

7.1.1 In general, vehicle leasing is an arrangement where the user simply hires the use of the vehicle and assumes operational responsibility for a predetermined period and mileage at fixed monthly rental from the owner (the leasing company). Legal ownership is, in the majority of cases, retained by the leasing company.

### 7.2 *Short Term Rental Members*

7.2.1 Rental members offer hourly, daily, weekly and monthly rental of vehicles to corporate customers and consumers. As explained above, rental members are the owners of the vehicle.

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