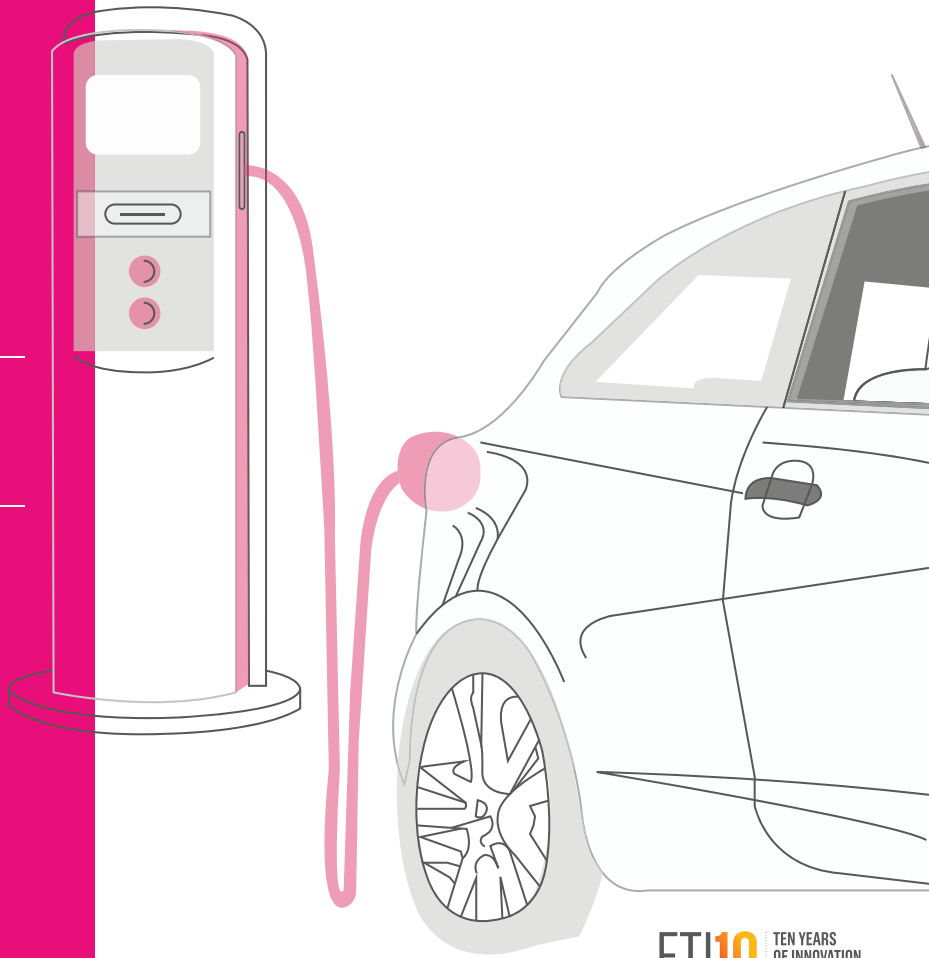
energy technologies institute

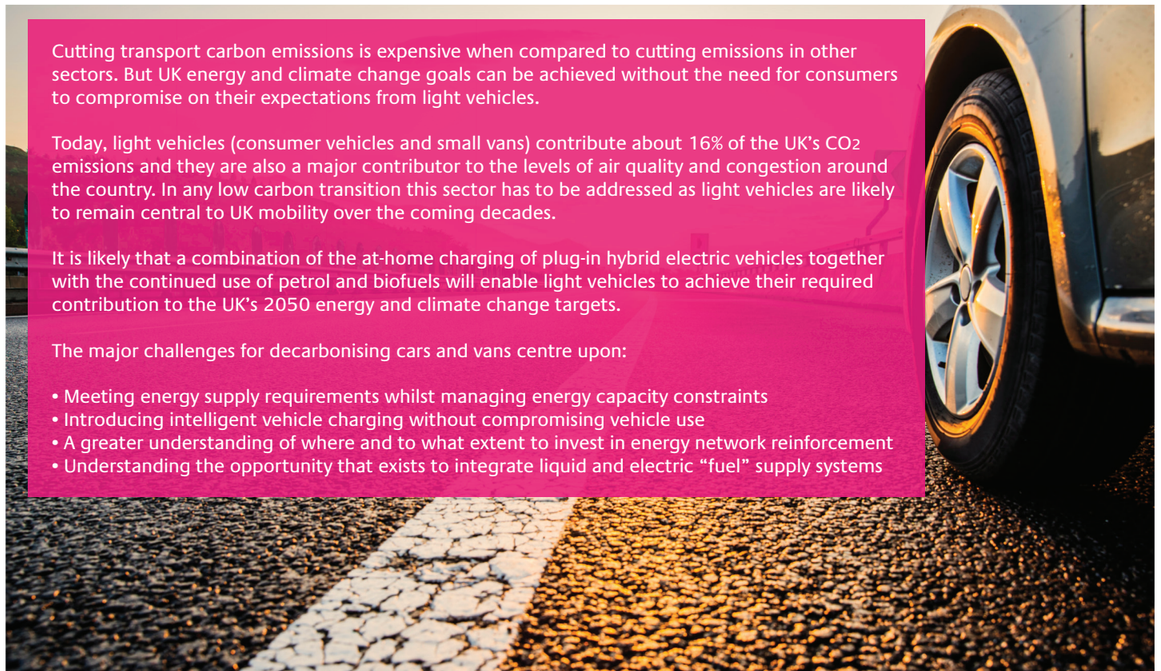
An ETI Perspective

Understanding the changes needed to markets and energy supply to encourage a wider take up of plug-in vehicles



ETI10 TEN YEARS OF INNOVATION 2007 – 2017

THE CHALLENGE



Cutting transport carbon emissions is expensive when compared to cutting emissions in other sectors. But UK energy and climate change goals can be achieved without the need for consumers to compromise on their expectations from light vehicles.

Today, light vehicles (consumer vehicles and small vans) contribute about 16% of the UK's CO_2 emissions and they are also a major contributor to the levels of air quality and congestion around the country. In any low carbon transition this sector has to be addressed as light vehicles are likely to remain central to UK mobility over the coming decades.

It is likely that a combination of the at-home charging of plug-in hybrid electric vehicles together with the continued use of petrol and biofuels will enable light vehicles to achieve their required contribution to the UK's 2050 energy and climate change targets.

The major challenges for decarbonising cars and vans centre upon:

- Meeting energy supply requirements whilst managing energy capacity constraints
- Introducing intelligent vehicle charging without compromising vehicle use
- A greater understanding of where and to what extent to invest in energy network reinforcement
- Understanding the opportunity that exists to integrate liquid and electric "fuel" supply systems

THE ETI's CONSUMERS, VEHICLES & ENERGY INTEGRATION PROJECT

This is a £5million, two and a half year project which aims to address the challenges involved in transitioning to secure and sustainable low carbon vehicle fleet in the UK.

A key aim of the project is to understand the changes that will be required to markets and energy supply systems to allow for a high deployment of plug-in vehicles, identifying the technical implications of such a shift and predicting how people might respond to any such transition. This is being delivered by a consortium of independent transport specialists – TRL, Element Energy, Baringa Partners, Cenex, EDF Energy, Route Monkey, EV Connect, Shell and The Behavioural Insights Team. The results are envisaged to benefit vehicle users, vehicle manufacturers and organisations throughout the energy supply chain.

The first stage of the project which completed in the Autumn of 2016 has focussed on detailed design and analysis to characterise:

- Market, policy and regulatory frameworks
- Business models and customer offerings
- Integrated vehicle and infrastructure systems and technologies using electricity, liquid fuel and hydrogen
- Consumer and fleet attitudes to adoption and usage behaviours

The second phase which started at the end of 2016, will deliver a trial involving 440 mass-market users (not early adopters of electric vehicles) to validate the impact of solutions identified in the first stage. This will help to understand both consumer and fleet responses to the vehicles tested (battery electric, plug-in hybrid and normal combustion engine) and to managed charging schemes.

This is being delivered by a consortium of transport, energy, policy and behavioural science specialists.

TRL THE FUTURE OF TRANSPORT
cenex
elementenergy
Baringa
EDF ENERGY
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THE BEHAVIOURAL INSIGHTS TEAM.

WHAT HAS PHASE ONE HIGHLIGHTED

Phase One has delivered a number of interesting insights across the themes of policy, infrastructure investment, electric vehicle use and charging behaviour. Some of the headlines that have emerged are:

The majority of today's electric vehicle users prefer to charge their vehicles at home, overnight and to a full charge. This indicates that the charging behaviour of an owner is driven by their own preferences, convenience and habit rather than from the question of availability or cost of public charging infrastructure. This is consistent with earlier ETI research and further industry evidence that suggests private owners charge their electric vehicles mainly at home, on a daily basis and generally in the evening (when the car is more likely to be idle).

Further work is required to overcome the upfront cost of purchasing ultra-low emission vehicles – this is a key barrier to widespread deployment. This appears to be true at both a consumer and system level. For consumers, they have identified that despite a wider range of vehicles available to the market, cost is still a barrier and until it is addressed (perhaps through market forces) it will remain a crucial driver in uptake levels in the near to medium term. At a systems level encouraging a significant increase in the uptake of ultra-low emission vehicles in the near term appears costly when it is directly compared to the value of the avoided CO_2 emissions. However an increase in uptake in the near term is actually necessary for any mainstream adoption of the vehicles to emerge.

Another impact of an increased uptake in ultra-low emission vehicles for policy makers to consider is that any such move can lead to a sizeable drop in net transport related government revenues.

Effective demand management of electric vehicles is important to reduce overall energy systems costs. The analysis shows that infrastructure parties are likely to be profitable in the long term but will be loss-making in the near to medium term. This indicates that some de-risking and direct support for new infrastructure is likely to be required to encourage investment with short-term objectives looking towards charge points and the development of rapid charging (minutes rather than hours) more important over the medium term. With rapid charging there is the potential to use the existing motorway network as they occupy the locations and points in journeys where rapid charging would be of most benefit.

Other findings of interest included the conclusion that hydrogen is the most costly route for decarbonising transport making hydrogen a hedging option for the energy system, but one that should be more prominent in the system beyond 2050. Today it is hard to see the UK hydrogen industry given its size and development trajectory being able to match the scale needed for mass market transport use. Plug-in vehicles (hybrids and battery operated) are favoured over fuel cell vehicles but moderate fuel cell vehicle uptake can be seen in the long term. In cars, plug in hybrids are favoured over battery electric vehicles especially in the near to medium term. For vans, a combination of battery electric vehicles and standard combustion engines dominate over plug-in hybrids given the duty cycles and charging options currently available.

WHAT NEXT

The second stage of the project which has commenced will seek to address any gaps in knowledge and test and validate proposed solutions by undertaking field trials with mainstream (mass market) private vehicle consumers driving widely-applicable plug-in vehicles alongside undertaking in-depth case studies with business fleets. This should report back at the end of 2017 with public dissemination rolling out into 2018 to help inform decision makers around energy integration between consumers, vehicles and energy systems in the future.

FURTHER READING

The route to a low cost, low carbon light vehicle transition

http://www.eti.co.uk/library

UK networks transition challenges
A system view

www.eti.co.uk/insights/uk-network-transition-challenges-a-system-view

An affordable transition to sustainable and secure energy from light vehicles in the UK

www.eti.co.uk/library/ldv-an-affordable-transition-to-sustainable-and-secure-energy-from-light-vehicles-in-the-uk

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