

An insights report by the
Energy Technologies Institute

Transport

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



Introduction

Cutting transport carbon emissions is expensive compared to most other sectors. However the UK will need to tackle greenhouse gas emissions in all sectors if it is to meet its legally binding obligations.

Light vehicles contribute around 16% of UK CO₂ emissions and are a major contributor to congestion and urban air quality. Light vehicles are likely to remain central to UK mobility over the coming decades.

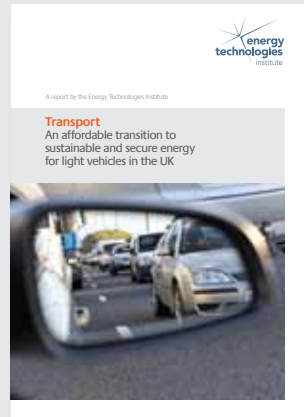
At the ETI we have spent the last four years analysing the light vehicle market and its energy supply infrastructure to define a potential carbon transition path that is affordable, secure and sustainable for the UK. Our methodology for this analysis is included within a report entitled – ‘An affordable transition to Sustainable and Secure Energy for Light Vehicles in the UK’.

The report is informed by ETI commissioned research projects with third parties, in house research, ETI membership data and other ETI technology programme activity.

⋮ **An affordable transition to Sustainable and Secure Energy for Light Vehicles in the UK**



⋮ The full report can be found on www.eti.co.uk/technology_programmes/transport



ETI Light Vehicle Research Projects

Consumers and Vehicles

This project looked at the potential long-term performance and cost of all vehicle types together with the consumer behaviour in both buying and using them. This included in-depth surveys with 3,000 consumers and real-world trials.

Project Partners



elementenergy



US
University of Sussex



Economics and Carbon Benefits

This project provided a strategic level analysis of the potential size of the market for different vehicle types, the total level of investment needed and the total carbon offset.

Project Partners

ARUP

e-on



Electricity Distribution and Intelligent Infrastructure

This project looked at the potential impact of plug-in vehicles on the UK's electricity distribution grid. This assessed the recharging infrastructure required to support any mass market adoption of plug-in vehicles in the UK.

Project Partners



Key insights into a potential low carbon transition for UK light vehicles

The cutting of transport carbon emissions is expensive when compared to most other industry sectors, but UK energy and climate change goals can be achieved without a need for consumers to compromise on their expectations from light vehicles. In all likelihood – a combination of petrol, biofuels and the at-home charging of plug-in hybrid electric vehicles is expected to enable light vehicles to achieve their required contribution to the UK's 2050 energy and climate change goals. Using petrol for light vehicles instead of diesel makes the most efficient overall use of the natural balance of compounds in crude oil and minimises energy intensive fuel processing and refining.

Developments in other parts of the UK energy infrastructure could have a major effect on the decarbonisation of transport and light vehicles. Innovation in other parts of the energy generation system, such as the development of biomass electricity generation with carbon capture and storage could allow some fossil fuel to still be used in light vehicles out to 2050. This could amount to approximately 40% of the current UK light vehicle energy mix, and is likely to significantly reduce the overall cost of carbon reduction.



A combination of different fuel types is expected to provide the most cost effective pathway to reducing light vehicle CO₂ emissions

Key insights into a potential low carbon transition for UK light vehicles

Most of the fundamental technology building blocks to transform to a low carbon solution are already in development or in the early stages of commercialisation. This provides confidence that the transition can be achieved at an affordable price.

There are significant industrial opportunities to the UK – firstly through the exploitation of existing UK energy and automotive capabilities in liquid fuels, electricity systems, vehicle design, development and manufacture – secondly it allows for the creation of new UK capabilities in the development and exploitation of biofuels and smart energy demand management.

Government policies can help smooth the impact of any transition costs whilst also ensuring that the UK capitalises on these industrial opportunities. Both the energy and automotive industries are in a position to meet the technology development pathways, but they require a supportive policy environment such that low carbon technology can compete on a level playing field with high carbon technology.

Any transition is likely to require significant infrastructure investment. The country has to understand that the cost of operating multiple infrastructures is very expensive.

The partial electrification of light duty vehicles through the roll out of plug-in hybrids is one of the most affordable pathways to meeting the country's CO₂ targets. But any large scale public vehicle recharging infrastructure is a very high risk investment and is unlikely to be necessary to meet 2050 targets. Our analysis shows that any charging infrastructure should be focused around homes and commercial depots and that a 3kW charge rate (the power rating of a standard domestic socket) would be sufficient for most users needs. The supply of these charge points has to match the physical demand (they can be installed at the time someone buys a plug-in vehicle). It is not a case of trying to create demand by building an infrastructure that does not match consumer needs.



Large scale public vehicle recharging infrastructure is a very high risk investment

A hydrogen energy infrastructure for light vehicles is potentially an important insurance option for the UK to consider.

The social impact of any transition has to be understood. Three potential impacts of note:

01 With increasing efficiency and electrification the reduced volumes of liquid fuel sales will threaten the market viability of the current “universal coverage” model which consumers expect

02 Not everyone will be able to affordably access electric fuel for vehicles – this would make them sensitive to liquid fuel prices which would likely begin to carry scarcity premiums

03 The least affluent in society – the ones who depend on older, higher carbon emitting cars – during the transition period will become the section of society who will be most susceptible to carbon based taxes on fuels

A least risk, least cost, evolutionary path

01	There needs to be continued ambition in EU emissions legislation for light vehicles so low carbon technology can compete with high carbon technology
02	There needs to be rapid increases in the efficiencies of conventional vehicles
03	There needs to be a move back to petrol from diesel as the liquid fossil fuel in light vehicles
04	There is a requirement to upgrade the UK oil supply system to increase resilience and balance its petrol, diesel and other product outputs with demand
05	There needs to be growth in the volume of plug-in hybrid electric vehicles
06	Rapid improvement is needed in the efficiency of conventional vehicles, including hybridisation; a 50% improvement by 2030 is potentially achievable
07	There is a need to adapt electricity distribution regulations to allow for efficient network upgrades to manage potential demand
08	The development of a market and the systems that would support it, to allow for “smart” energy demand management

09	The targeting of zero emissions from electricity generation by 2030
10	The establishment of clear long-term biofuel sustainability regulations such that industry can invest in innovation and deployment with confidence
11	The focusing of the UK's vehicle energy supply research and development into advanced sustainable biofuels
12	The definition of a clear fuel standard that will allow the management of a transition to high blend biofuels
13	The ability to enable vehicles that are available now, to run on high blend biofuels by the mid 2020s
14	Through the use of carbon linked taxes create a level playing field when addressing decarbonisation
15	The creation of long term stability in policy with regards automotive decarbonisation to provide investors with confidence to invest in any transition
16	Ensuring policy strikes an equitable balance for different segments of society who rely on light vehicles

Key facts and figures

75%

– of UK households now own at least one car

30,000 miles

The UK major road network is around 30,000 miles – the minor road network 200,000 miles – the UK has 20,000 miles of rail track

400 bn

– person miles are travelled by car each year in the UK – 10x more than rail, 20x more than bus/coach

50%

There is the potential to improve the efficiency of conventional liquid fuelled vehicles by around 50% by 2030

5%

The costs in 2050 for a low carbon light vehicle system are only about 5% more expensive than a do nothing approach – but transition costs are significant

6^{Mt}

Dieselisation of vehicles has led to a 6 million tonne petrol surplus and a diesel deficit

1/3

Only one third of UK car mileage is in urban areas

£10^{bn}

It would cost over £10bn to replace the current refuelling station network

8,700

The UK has a network of 8,700 refuelling stations – each distributes an average of nearly five million litres of fuel per year



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