An affordable and effective route to decarbonising transport

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Light Vehicles in the UK

- **30m**
  - There is a total parc of over 30m cars

- **42.6%**
  - There was a 42.6% increase in the number of vans in the parc (2003 – 2016)

- **4.6m**
  - Between 2003 and 2016 the overall parc grew by 4.6 million cars

- **13.9yrs**
  - The average life of a car on the road has now exceeded 13 years

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*average car scrappage age in 2015 (SMMT, 2017)*

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Based on DfT vehicle statistics (2017)
Light Vehicles in the UK

Light vehicles contribute around 16% of CO₂ emissions

Only around a third of UK car mileage is in urban areas. Over two thirds of UK mileage is on motorways and major “A” roads

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

400 billion person-miles are travelled by car each year – 10x more than rail and 20x more than bus/coach

Based on DfT vehicle statistics (2017)
Plug-in vehicle sales

Based on DIT vehicle statistics (2017)
Vehicle life

Some vehicles are pre-registered or sold on within first year

28% of mileage

33% of mileage

19% of mileage

20% of mileage

Compiled using NTS data
Vehicle usage

- **Cars with an Annual Mileage above 10k Miles**
- **Cars with an Annual Mileage between 5k and 10k Miles**
- **Cars with an Annual Mileage below 5k Miles**

**Round-trip Distance from Home**

- >200 Miles
- <200 Miles
- <150 Miles
- <100 Miles
- <50 Miles
- <25 Miles

**Proportion of Mileage within each Mileage Band**

- **Rural Based Cars**
- **Semi-Urban Based Cars**
- **Urban Based Cars**

**Trip Length (Per Leg of Journey)**

- > 50 Miles
- < 50 Miles
- < 25 Miles
- < 10 Miles
- < 5 Miles

**Proportion of Trips within Area Group**

Compiled using NTS data
Consumer attitudes to plug-in vehicles

- Earliest Purchasers
- Interested Consumers
- Reluctant Consumers

- PIONEERS
- Zealous OPTIMISTS
- Willing PRAGMATISTS
- Anxious ASPIRERS
- Uninspired FOLLOWERS
- Conventional SCEPTICS
- Image-conscious REJECTERS

- Increasing premium
- Increasing discount

- Pure Battery Electric Vehicle
- Plug-in Hybrid Electric Vehicle
Where to support charging

Parking availability at homes

Proportion of Parc

Arrivals of a Given Vehicle at a Given Location Each Week

- Home
- Food Shopping Location
- Eat / Drink Location
- Workplace
- Other Shopping Location

Based on DCLG data

Compiled using NTS data

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Meeting vehicle charging requirements

Journey arrival times (2007-2010) and Electricity demand profile (7th December 2010)

- Education (But Excl. Escorting Others)
- Holiday Base / Day trip
- In course of work
- Personal Business (Medical, Eat/drink, Other)
- Visiting Friends / Socialising / Entertainment / Sports
- Escorting Others
- Shopping (Food and Other)
- Travel to Work
- Return Home
- Electricity demand

Compiled using NTS and UKERC data
Network reinforcement costs

- High Uptake of Plug-in Vehicles
- Medium Uptake of Plug-in Vehicles
- Low Uptake of Plug-in Vehicles

Worst Case Recharging Patterns
- Recharging Always Overnight

Cumulative network reinforcement costs (£bn)

Year

Cumulative Network Reinforcement Costs (£bn)

Low Uptake of Plug-in Vehicles

Medium Uptake of Plug-in Vehicles

High Uptake of Plug-in Vehicles

Worst Case Recharging Patterns

Recharging Always Overnight
ETI analysis examining how to decarbonise “light vehicles” securely, sustainably and affordably was published in 2013, highlighting:

- Electrification (PHEVs and BEVs) as the least risk, least cost evolutionary path
- Where to support charging and the interactions with the energy system
- The importance of considering how to transition the fleet as a whole
- The need for a cohesive market and policy framework

The work also highlighted that, in decarbonising cars and vans, there are major challenges around:

- Meeting user energy supply requirements, whilst managing energy capacity constraints
- Implementing intelligent vehicle charging without compromising vehicle utility
- Developing greater understanding as to where and to what extent to invest in network reinforcement
- Understanding the opportunity for integrating liquid and electric “fuel” supply systems for vehicles, and utilising the capability of the liquid fuel system


Or search for: ETI transport transition or ETI light vehicles report
• £5m, 2.5 year project to address the challenges involved in transitioning to a secure and sustainable low carbon vehicle fleet

• Aims to understand changes to market structures and energy supply systems to support high deployment of plug-in vehicles, the technical implications of any changes and how people might respond to them

• It will examine how tighter integration of vehicles with the energy supply system can benefit:
  – vehicle users
  – vehicle manufacturers
  – organisations throughout the energy supply chain

• The outputs are being made available to:
  – help inform UK and European government policy
  – help shape energy and automotive industry products
The project is in two stages

### Stage 1

**Detailed design & analysis to characterise:**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Market, policy and regulatory frameworks</td>
<td></td>
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<tr>
<td>Business models and customer offerings</td>
<td></td>
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<tr>
<td>Integrated vehicle and infrastructure systems and technologies for electricity and liquid fuel / hydrogen</td>
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<tr>
<td>Consumer and fleet attitudes to adoption and usage behaviours</td>
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### Stage 2

**Test and validate solutions and assess responses**

- Experimental field trials with mainstream consumers
- Case studies with fleets
- Updates to analytical tools
Consumer adoption: understanding the mass-market

Early stages of adoption
- Users with access to EVs are still classed as ‘Innovators’ (i.e. very early stage of adoption)
- To date, trials have been conducted using only Innovators
- Low numbers of consumers
- Attitudes and behaviours are not representative of the majority of users

Future majority ‘Mass-market’ consumers
- Much larger numbers of users
- These will significantly influence the energy system
- Very different motivations, attitudes and behaviours to those of Innovators
- Unlikely currently to use or own a plug-in vehicle
- Do not generally have specific motivations for early adoption of plug-in vehicles
- Less likely to adapt behaviour (e.g. to accept managed charging) to meet needs of the vehicle or energy system
A combined set of modelling tools have been developed to provide an *integrated, holistic* means of quantifying and qualitatively assessing the impacts on and from *infrastructure, consumers, vehicle uptake and use, policy measures* and *commercial models* across the system.
Interim findings

Reducing the upfront cost of ULEVs is a crucial driver of uptake in the near to medium term

ULEV uptake can lead to a sizeable drop in net transport-related Government revenues

A moderate uptake of ULEVs can be expected even with limited Government intervention but this does not result in the lowest Government revenue gap

Rapid charging development is a priority to enable sufficient deployment for the medium term

Infrastructure entities likely to be loss-making in the near to medium term but would appear profitable in the long term

Successful demand management reduces balancing and network costs – must be tested with mainstream consumers
Roadmap for efficient ULEV uptake and use

Government policy and market intervention
- EU emission regs
- Tightening emissions regs
- Limited coordination and support for rapid charging
- DM shared services framework
- Coordinated DM procurement
- Facilitation of urban car sharing
- H₂ appraisal
- H₂ infrastructure de-risking

Actions by commercial entities
- User-Managed Charging use
- Supplier-Managed Charging use
- Rapid charging infrastructure investment
- Initial car sharing implementation
- Mass market car sharing implementation
- Hydrogen infrastructure investment

2015
- Upfront cost mitigation for ULEVs
- Social transition support

2020
- Carbon price pass through for liquid fuels
- Central DM market platform
- Support for larger scale car sharing
- Road pricing
- Competition monitoring

2030
- Essential

2040
- Desirable

2050
- Provisional
Trials will deliver further robust evidence

Charging Behaviour Trial

- Assess response to different tariff propositions – user-managed (ToU tariff) versus supplier-managed charging
- 240 consumers, 2 months with a vehicle, (parallel) BEV and PHEV trials
- Data on use and charging with additional questionnaires and choice experiments

Vehicle Uptake Trial

- To enhance understanding of adoption of EVs
- 200 consumers, given 4 days with each of 3 vehicles in turn (BEV, PHEV, ICE)
- Additional questionnaires and choice experiments (with reduced ‘psychological distance’)