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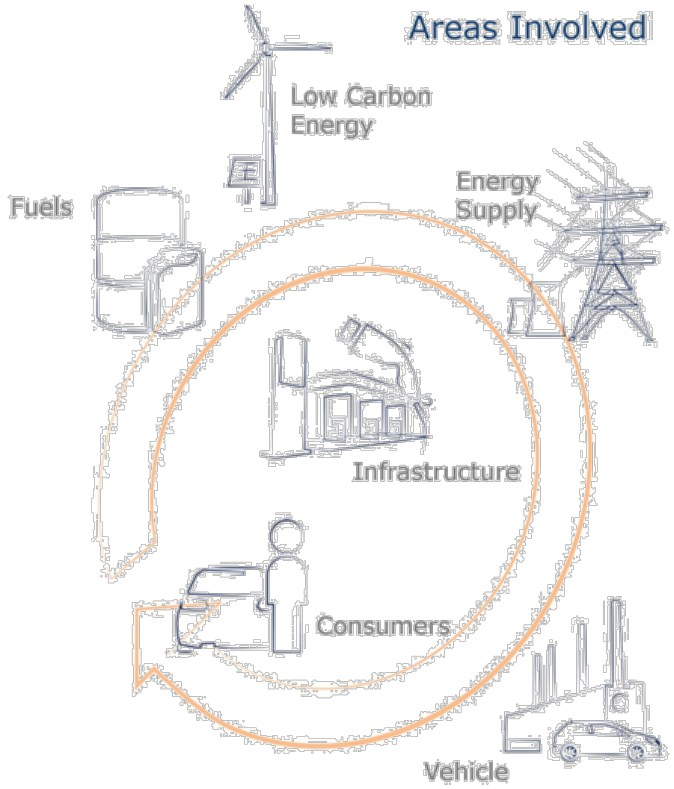
Consumers, Vehicles and Energy Integration (CVEI) project

Auto Council Technology Group meeting

Wednesday 22nd February 2017

ETI10 TEN YEARS OF INNOVATION 2007 – 2017

CVEI project overview



- **£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 will be available to:
  - help inform UK and European government policy
  - help shape energy and automotive industry products

Project structure

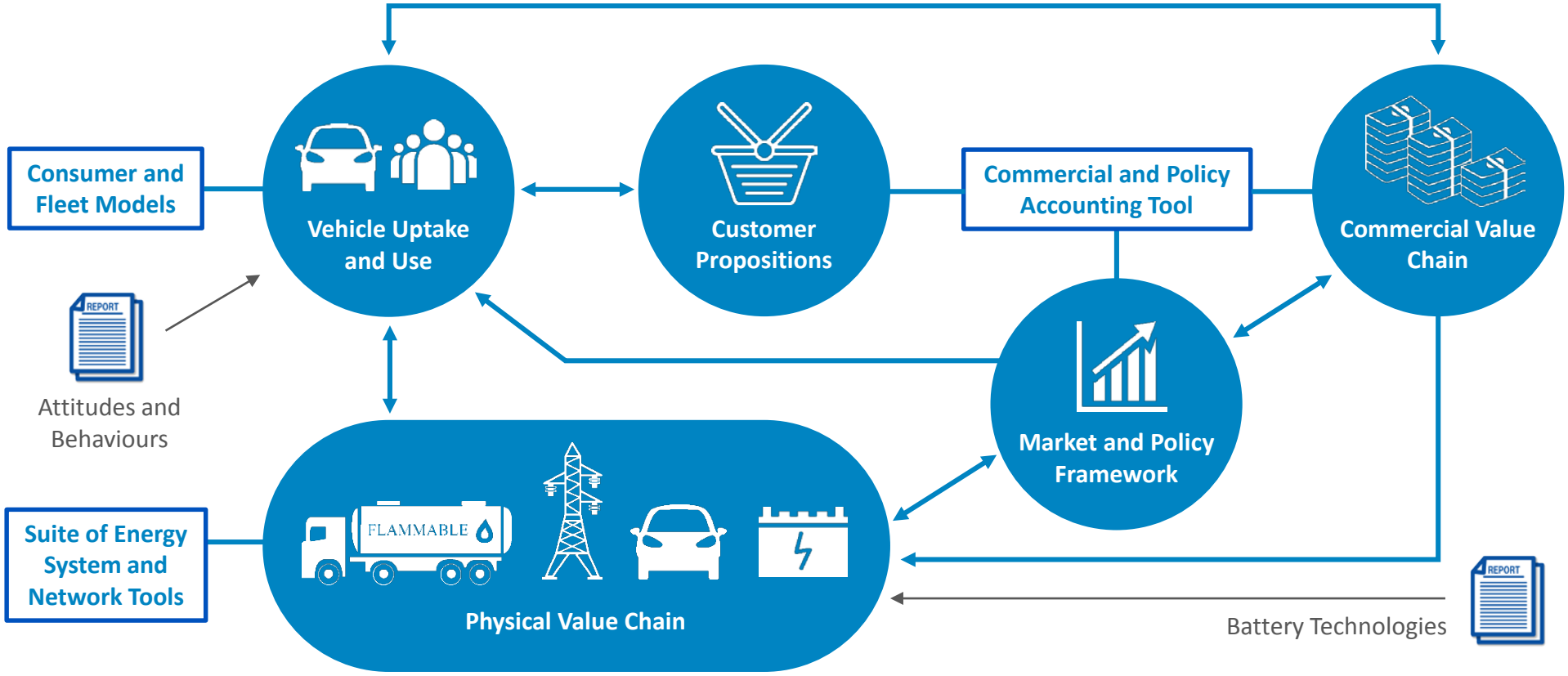
Stage 1 - detailed design & analysis to characterise:

- market, policy and regulatory frameworks
- business models and customer offerings
- integrated vehicle and infrastructure systems and technologies for electricity and liquid fuel / hydrogen
- consumer and fleet attitudes to adoption and usage behaviours

Stage 2 – test and validate solutions and assess responses:

- Experimental field trials with mainstream consumers
- In-depth case studies with fleets
- Updates to analytical tools

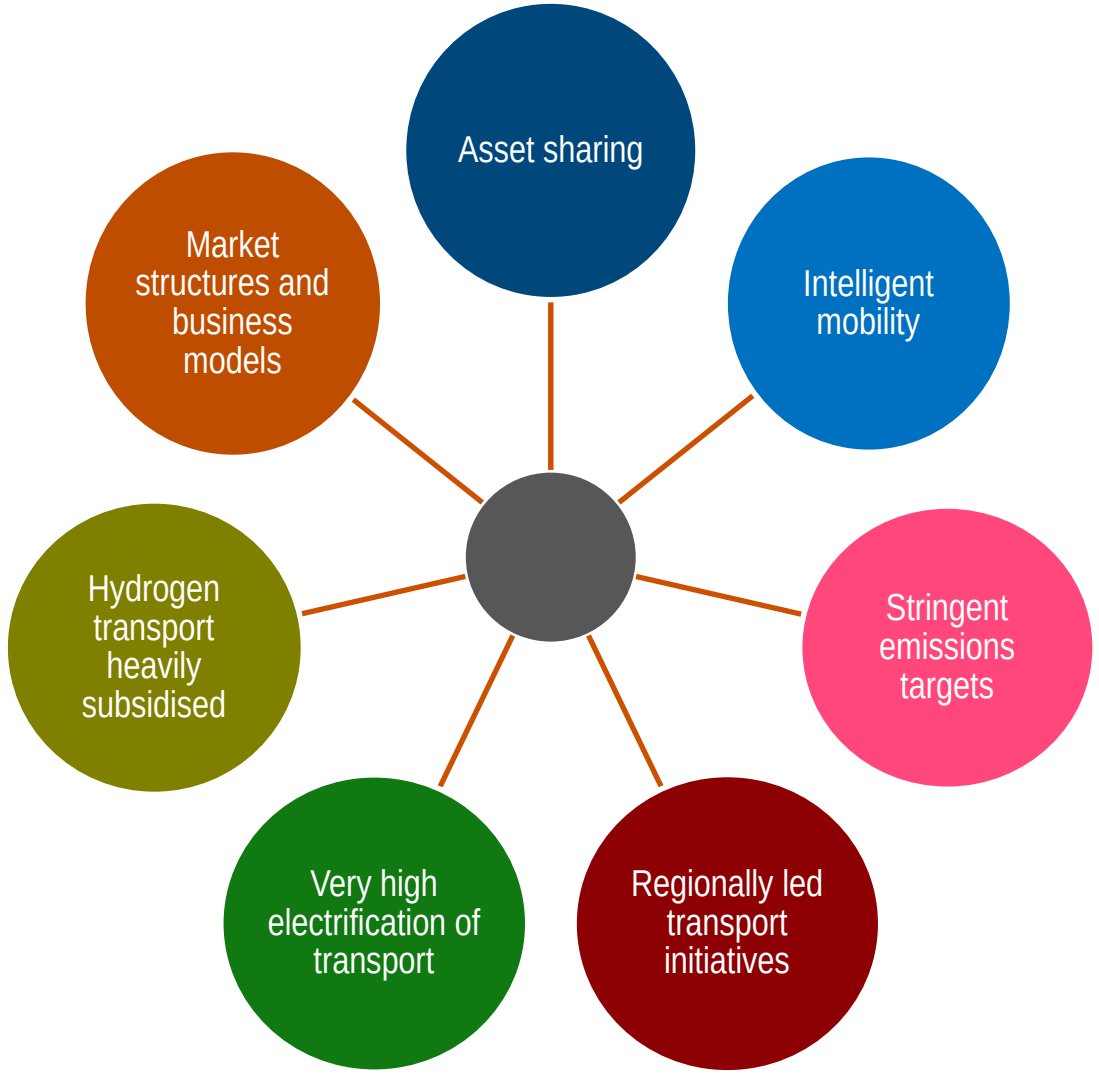
Analytical framework



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

Accounting for trends and developments elsewhere

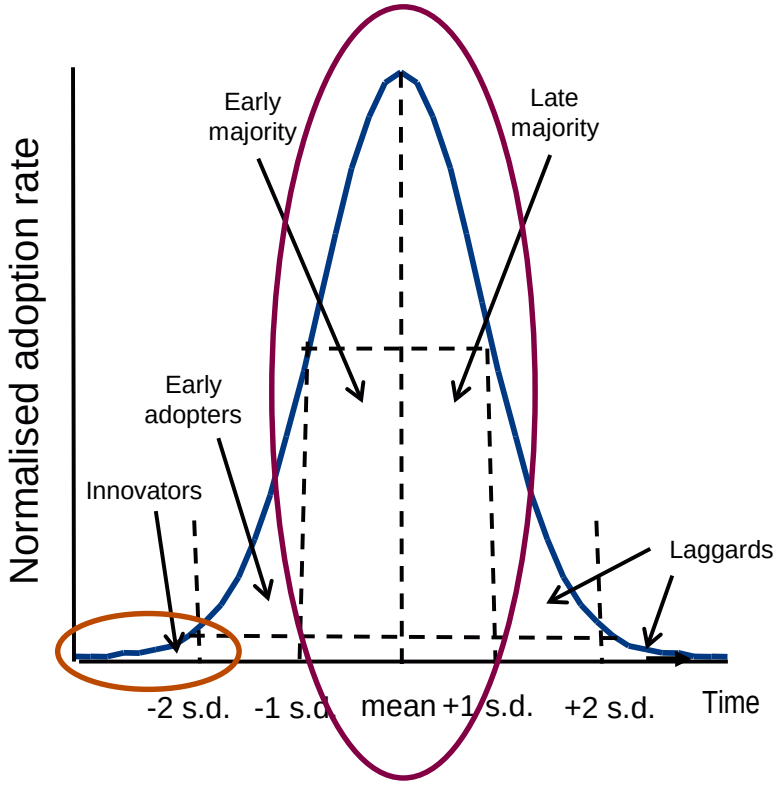
- Various “narratives” (scenarios) defined to describe aspects of possible future environments for **ultra low emission vehicle (ULEV)** deployment and use.
- These are used to “stress test” the effectiveness and robustness of solutions in different futures.
- Each narrative is designed to be self-consistent in how it represents key aspects of the:
  - customer proposition,
  - market & policy framework,
  - physical value chain, and
  - commercial value chain.



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

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

The economic benefits of car sharing appear material

Amongst adopters to date:
- Changes to “main” and “second” car dynamic
- EVs being driven comparable mileages to ICEs

Awareness of public charge points may be more important than actual availability

Charging behaviour is primarily driven by EV owner preferences, convenience and habit, rather than cost

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

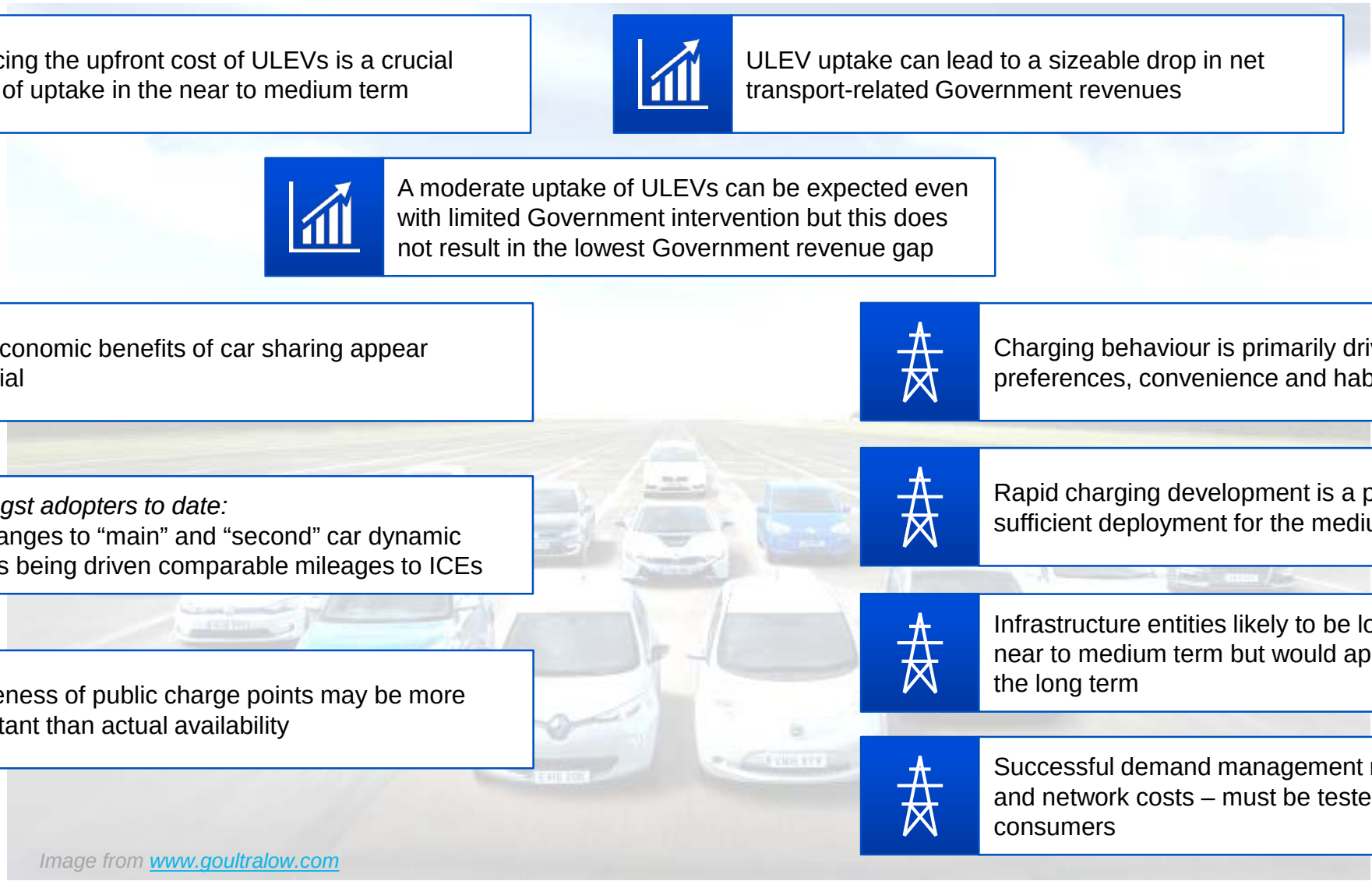
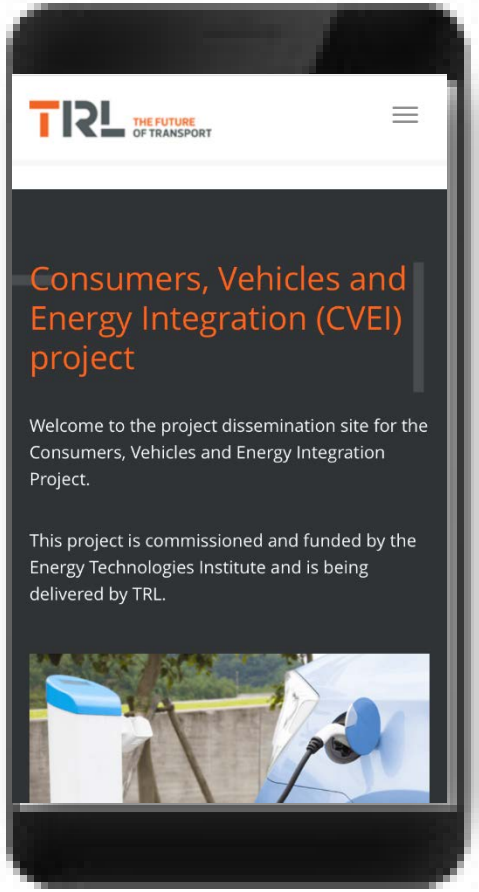
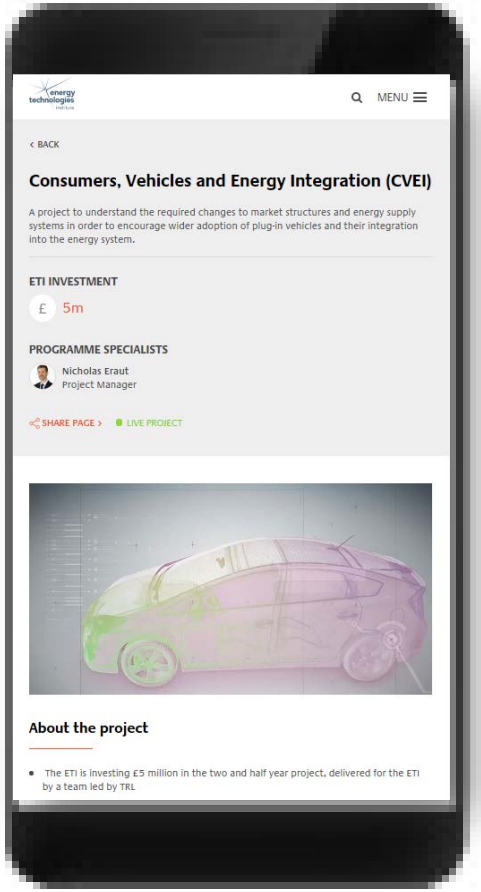


Image from www.goultralow.com

Dissemination of outputs

- Outputs will be made available throughout the course of the project:
  - Presentations at key events
  - Reports and other materials will be published through the ETI and TRL's websites (there is the option for these to published through other websites as well)
  - A dedicated portal will provide updates and material
- The development of the dissemination plan is ongoing and any suggestions are welcomed





Websites: http://cveiproject.trl.co.uk/ http://www.eti.co.uk/programmes/transport-ldv/consumers-vehicles-and-energy-integration-cvei

Or search for: ***CVEI project TRL*** or ***ETI***

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For more information about the ETI visit www.eti.co.uk

For the latest ETI news and announcements email info@eti.co.uk

The ETI can also be followed on Twitter @the_ETI

BACKUP

Decarbonising light vehicles in the UK

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

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

Or search for: ***ETI transport transition*** or ***ETI light vehicles report***

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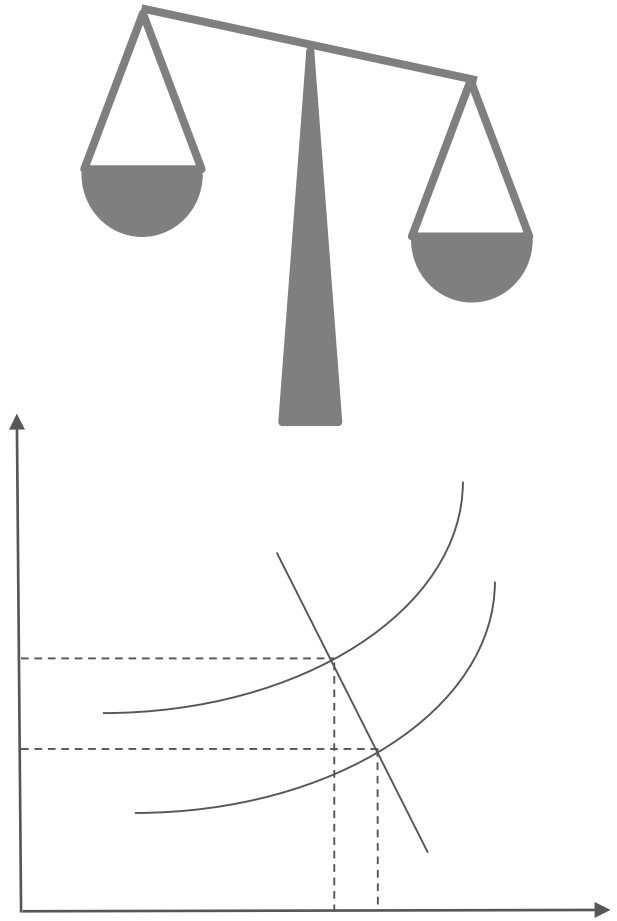
Interim findings – policy

- Encouraging significantly increased uptake of ULEVs in the near term appears costly compared to the value of the avoided CO_2 emissions
  - Uptake in the near term is necessary for mainstream adoption to emerge
  - **Reducing the upfront cost of ULEVs is a crucial driver of uptake in the near to medium term**
- Fiscal mechanisms are important
  - ULEV uptake can lead to a sizeable drop in net transport-related Gov. revenues
  - ULEV differentiating measures (e.g. carbon tax) are effective (in the longer term) at encouraging uptake
  - Consequently they have a limited effect on reducing the Government revenue gap
  - Maintaining the share of net transport revenues within the wider economy would need technology neutral mechanisms (e.g. road prices in the order of 1-2p/km)
- Unilateral support for hydrogen is the most costly route for decarbonising transport



Interim findings – vehicles

- **A moderate uptake of ULEVs can be expected even with limited Government intervention**
  - **To meet the UK's GHG emission targets, this requires much greater decarbonisation outside of transport**
  - **This does not result in the lowest Government revenue gap**
- Plug-in vehicles (PHEVs and BEVs) are favoured over fuel cell vehicles (except where fuel cell vehicles and hydrogen supply are unilaterally supported) but moderate fuel cell vehicle uptake can be seen in the long term
- In general, for cars, PHEVs are favoured over BEVs (especially in the near to medium term)
- **The economic benefits of car sharing appear material**
- For vans, a combination of BEVs and ICEs dominates over PHEVs (given duty cycles and charging availability)

Image from www.goultralow.com

Interim findings – EV use and charging behaviour

- **EV adoption changes the "main" and "second" car household dynamic**
  - EVs amongst adopters to date are typically being used for the majority of day-to-day journeys to work, education and other local destinations
  - Other cars in household being used for infrequent longer journeys
- EVs are being driven comparable mileages to ICE vehicles
- Some evidence that travel patterns of EV owners change upon adoption, possibly even increasing the number of trips undertaken by car
- **Charging behaviour is primarily driven by EV owner preferences, convenience and habit**
  - Rather than the availability or cost of public charging infrastructure
  - Recent evidence is consistent with prior analysis suggesting that private owners charge their EV mainly at home, on a daily basis, and generally in the evening.
  - Low overall levels of utilisation of public charge points are likely to mask wide variations between charge points in different areas and at different types of venues

Interim findings – infrastructure investment

- Some de-risking and direct support for new infrastructure to encourage investment is important
  - More important in the short-term for chargepoints;
  - **Rapid charging development is a priority**
- **Demand Management for EVs is important for reducing overall system costs, in particular balancing and network reinforcement costs**
  - This appears to allow for a viable Aggregator business model
  - But, **must be tested in Stage 2**; 'modest' customer response to Static ToU tariffs leads to sizeable reduction in system costs; this is even larger for Supplier Managed Charging
- **Infrastructure entities likely to be loss-making in the near to medium term but would appear profitable in the long term**

Interim findings – infrastructure and adoption

- Range is a greater barrier than price (availability of charging infrastructure plays a role in this)
  - Range is sensitive to “refuelling” time and charging availability
- Public charging infrastructure may have an equal or greater impact on EV uptake than financial incentives
  - This is based on non-EV owner *perception*
  - A strong suggestion that this may only be true for BEV uptake rather than PHEV uptake
- No literature has been found on the impact of grants for the installation of dedicated charge points
- **Awareness of charge points may be more important than actual availability**
  - Strength of the relationship depends on the number of chargers believed to be available
  - Adoption and awareness may not be causal as participants with pre-existing EV interest might be more likely to have become aware of public chargers in the first place