

# Electric cars: Opportunities and implications for utilities

**Smart Utility Forum**

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**Low Carbon Vehicle Partnership**

# Low Carbon Vehicle Partnership

**Accelerating a sustainable shift to low carbon vehicles and fuels in the UK**

**Stimulating opportunities for UK businesses**

Renewable Fuels Agency

Carbon and Sustainability Reporting Within the Renewable Transport Fuel Obligation

Technical Guidance Part One

Office of the Renewable Fuels Agency V1.2

August 2008

**cenex**

**ACT ON CO<sub>2</sub>**

LowCVP 'Low Carbon Road Transport Challenge'

Proposals to reduce road transport CO<sub>2</sub> emissions in the UK to help mitigate climate change

June 2008

Fuel Economy	Low Carbon Car
115-130 mpg (litres/100 miles)	
107-120	
97-106	
87-96	
77-86	
67-76	
57-66	
47-56	
37-46	
27-36	
17-26	
11-16	
1-10	
Fuel used (predicted) for 1000 miles	£662
VED for 12 months	£50

LowCVP Accelerating the Shift to Low Carbon Vehicles and Fuels

Low Carbon Transport Innovation Strategy

low carbon vehicle partnership

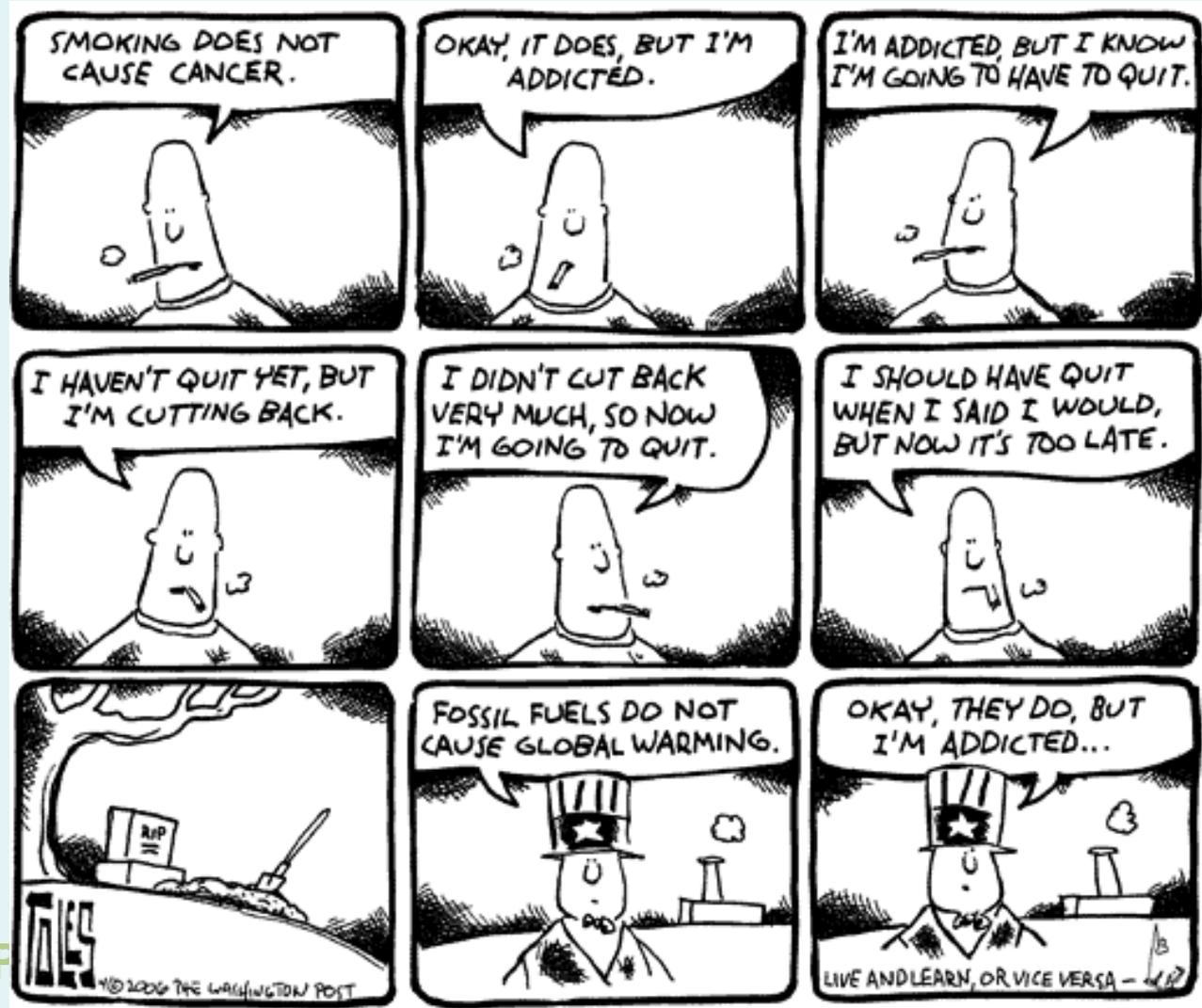
low carbon vehicle partnership

# Outline

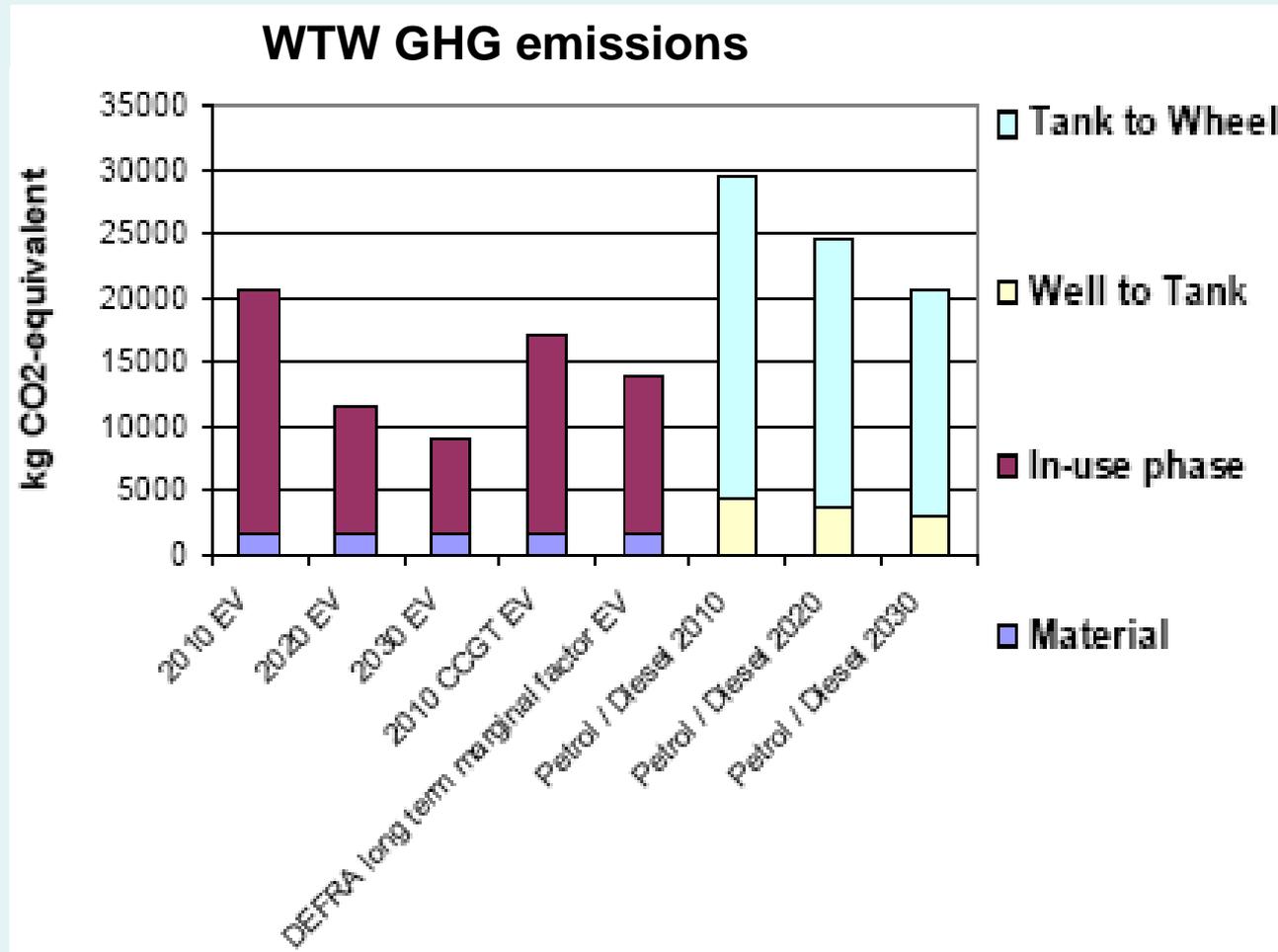
- ❑ The scale of the challenge
  - Transport GHG-emissions
  - EV CO2 benefits
- ❑ The market potential for EVs
  - Technology options
- ❑ Key challenges
  - Batteries
  - Consumer acceptability
- ❑ Alternative business models
- ❑ Supply constraints and opportunities
  - Grid impacts
- ❑ UK support
- ❑ Conclusions



*Transport fuel use is forecast to double by 2050 -  
Petroleum accounts for 99% of current use*



*EVs deliver security of supply & CO2 benefits which will increase as the grid is decarbonised*



*There is global momentum towards electrification of transport*

- ❑ EVs address key geopolitical concerns:
  - Climate
  - Energy security
  - Peak oil
  
- ❑ Early consumer interest as sustainable, cool, high technology products
  
- ❑ Substantial public funding of RD&D
  
- ❑ Investment & commitment from global OEMs

*But ... early visionary vehicles do not create a mass market*



*A limited range of electric vehicles are becoming available - with more to follow*



Toyota FT EVII - 2012



Toyota Prius PHEV - 2011



Nissan Leaf – 2010 (not EU)



Mitsubishi MiEV – 2010  
Citroen Evie – 2011

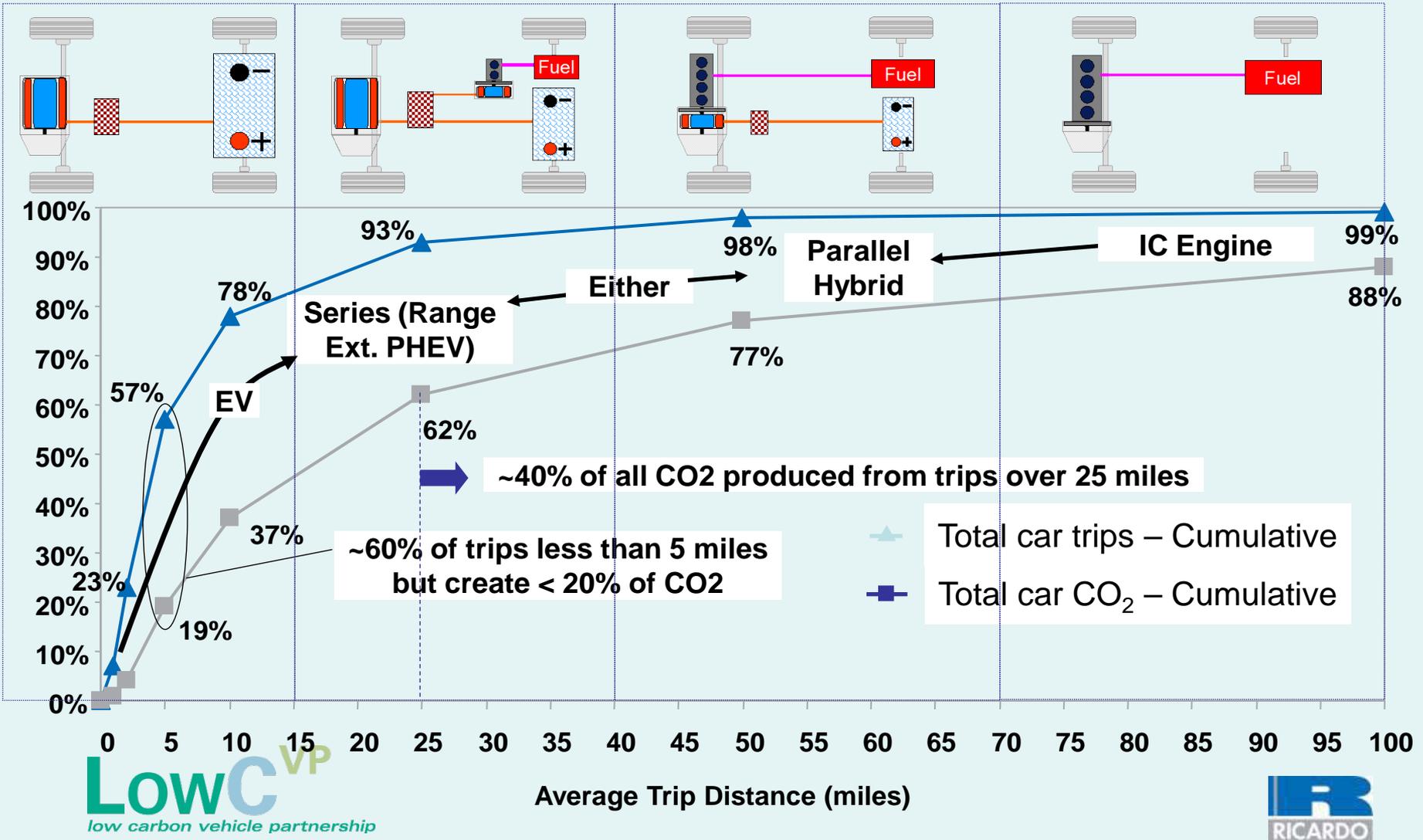


Renault Fluence – 2011  
(not EU) + others

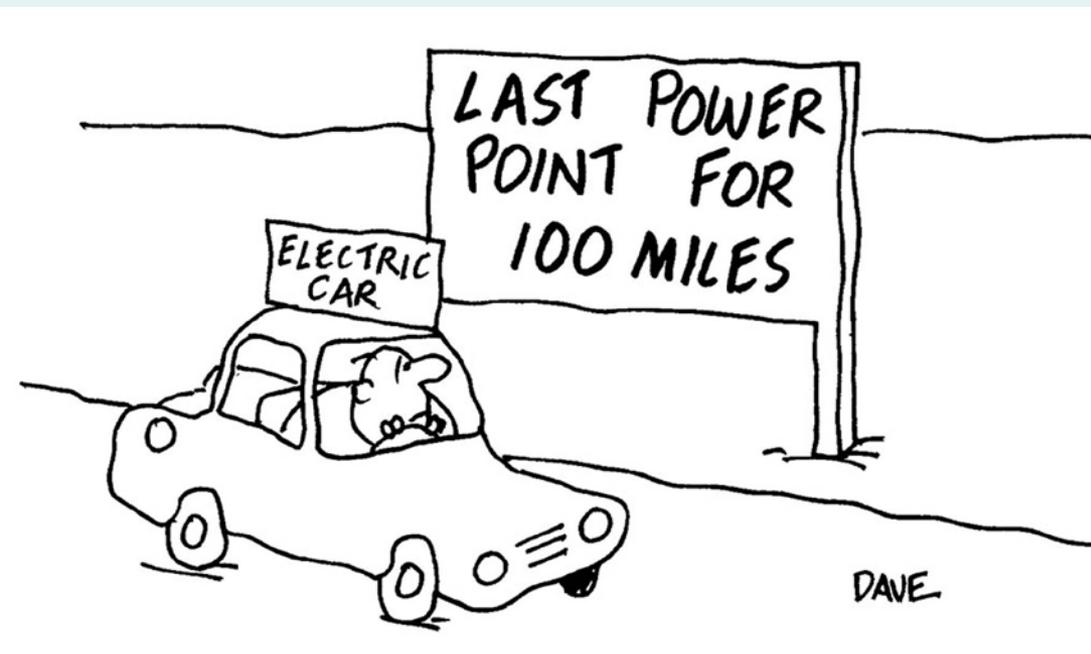


Vauxhall Ampera - 2011

*Technology will be tailored to the application:  
 EV for city use, PHEV or parallel hybrid for medium length  
 journeys; IC for long journeys*



*There are substantial technical and commercial barriers making widespread, rapid consumer uptake unlikely*



- ❑ Battery performance limits range
- ❑ Battery cost constrains market
- ❑ Battery reliability / lifetime uncertain
- ❑ Home recharging constrained
- ❑ Limited vehicle availability
- ❑ Pathway to profit highly uncertain
- ❑ Consumer acceptability low
- ❑ Safety concerns must be allayed
- ❑ Immature supply chain

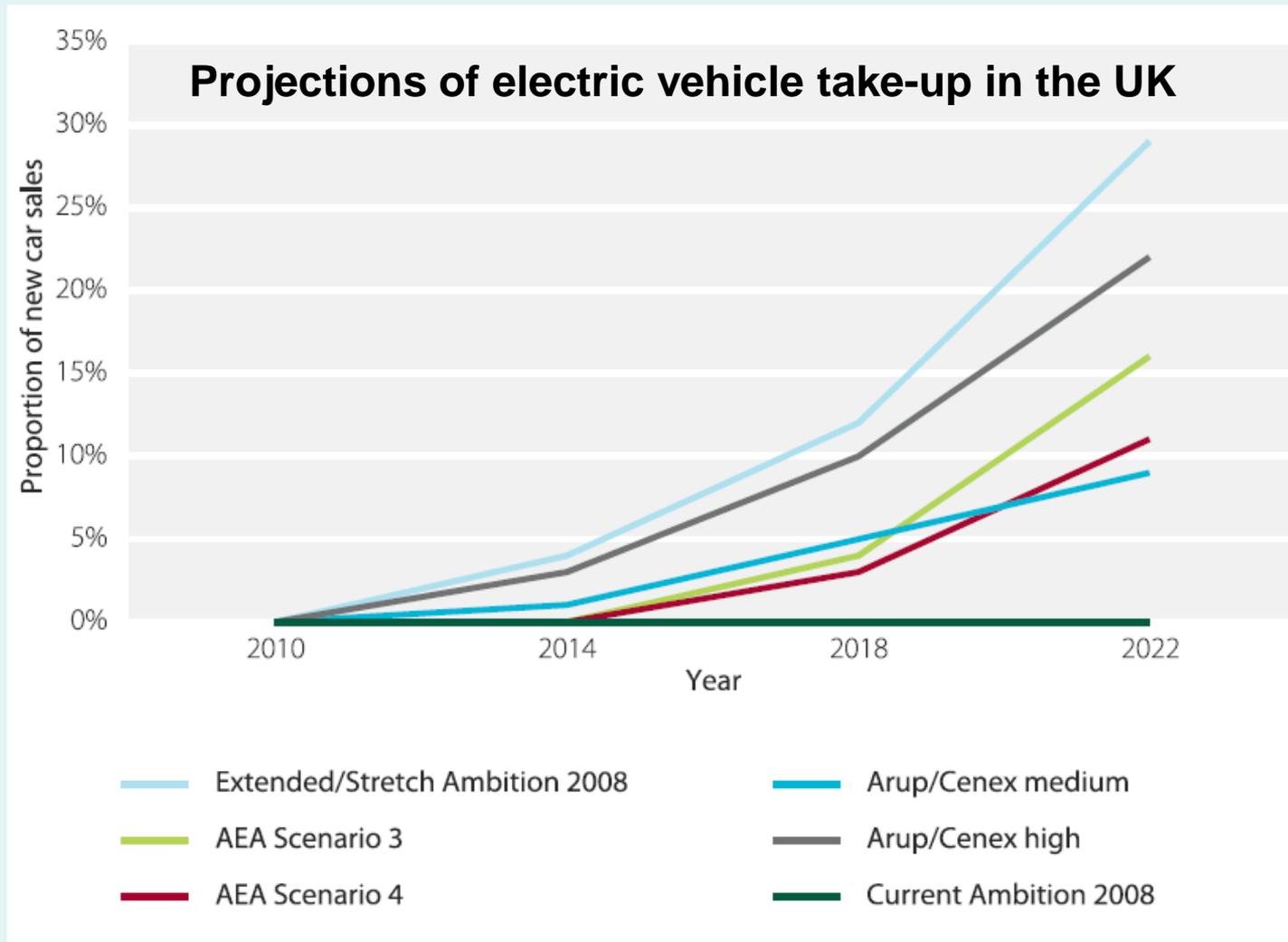
## *Electric vehicles will only appeal to most car-buyers with significant incentives*



EV users are educated, relatively affluent, multi-car households with off-road parking

- ❑ High capital costs – key purchase determinant
  - Leasing options likely
- ❑ Fuel-cost savings heavily discounted
- ❑ Requirement for very high range
- ❑ Range anxiety reduces usage to 33-50% of technical range
  - Fast charging / battery swap builds confidence
- ❑ Low willingness to pay – beyond early adopters
- ❑ Limited availability of recharging infrastructure
- ❑ New technology aversion

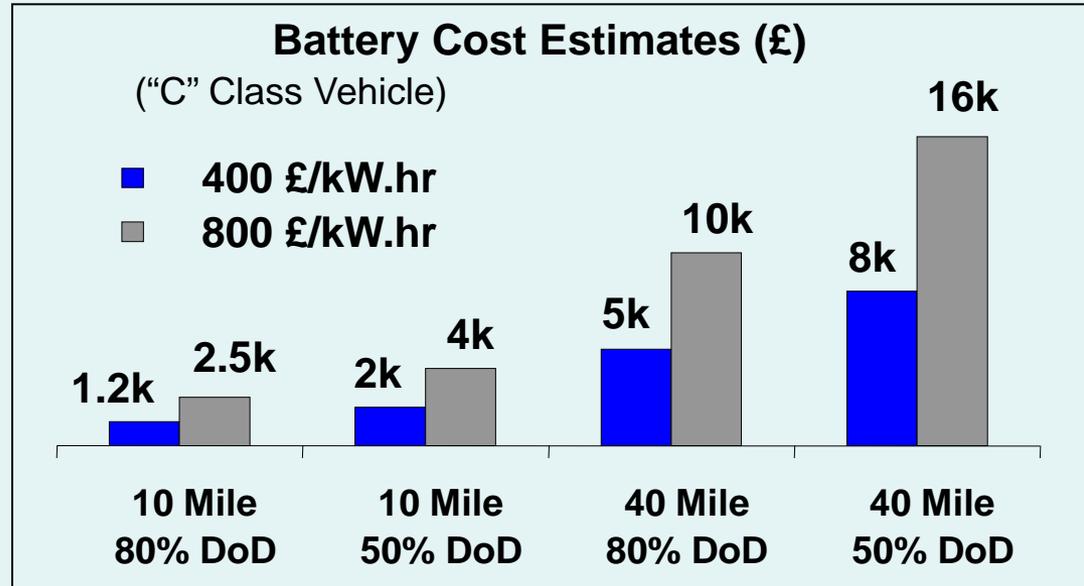
*Market uptake is highly uncertain – depending upon public acceptability, battery costs / subsidies*



*There are complex interactions between vehicle range & battery depth of discharge, lifetime & cost*



- ❑ Li-ion currently c\$1750/kwh
- ❑ **Outlook** battery price for automotive applications c\$1000/kwh
- ❑ Cost must be reduced to c\$400/kwh for EV city cars to be competitive
- ❑ PHEV applications more likely outside city applications
- ❑ Cell price stable - high cost of raw materials
- ❑ Technology breakthrough necessary for widespread adoption



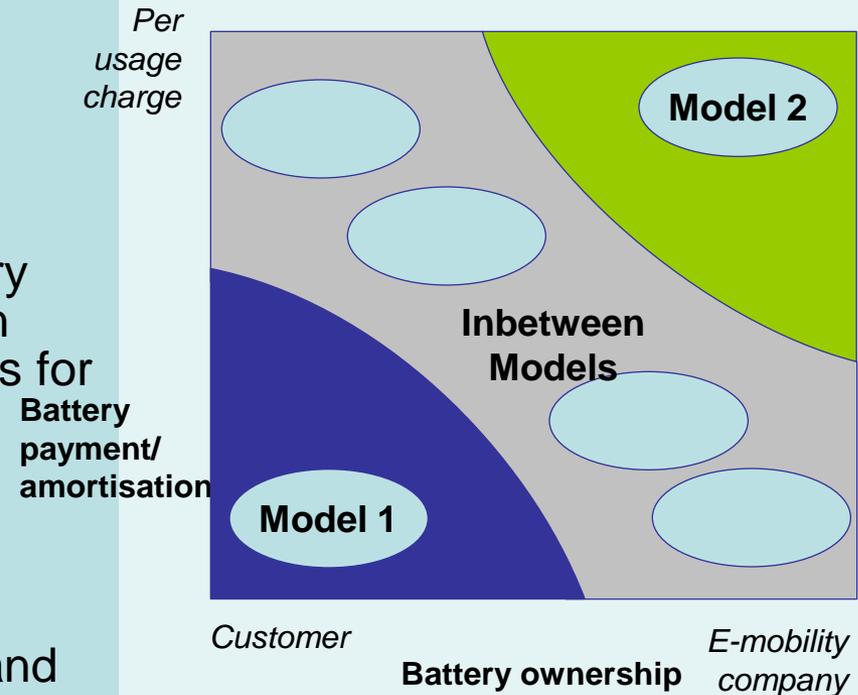
*A range of business models are being considered  
- the pathways to profit remains uncertain*

### Model 1

- ❑ Vehicle manufacturer sets battery standard for its own vehicle range and markets vehicle including battery
- ❑ Utility company sets up charging infrastructure
- ❑ Customer buys vehicle including battery and charges battery at charging station (home, e-charging station, ...) and pays for electricity consumption only

### Model 2

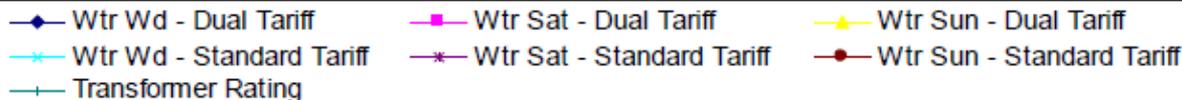
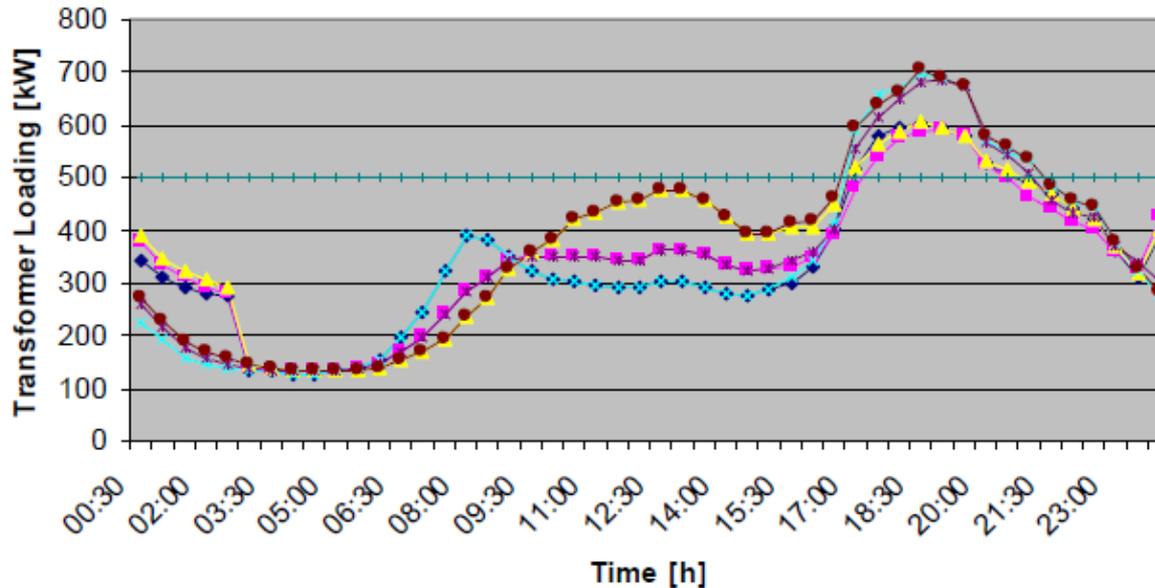
- ❑ E-mobility company sets the battery standard and owns the battery
- ❑ E-mobility company sets up charging and battery exchange infrastructure
- ❑ Customer charges battery at charging station or swaps complete battery
- ❑ Customer pays for electricity consumption and battery amortisation



# Grid impacts are manageable – particularly with smart metering

## Impact of smart-metering (dual tariffs) on transformer loading

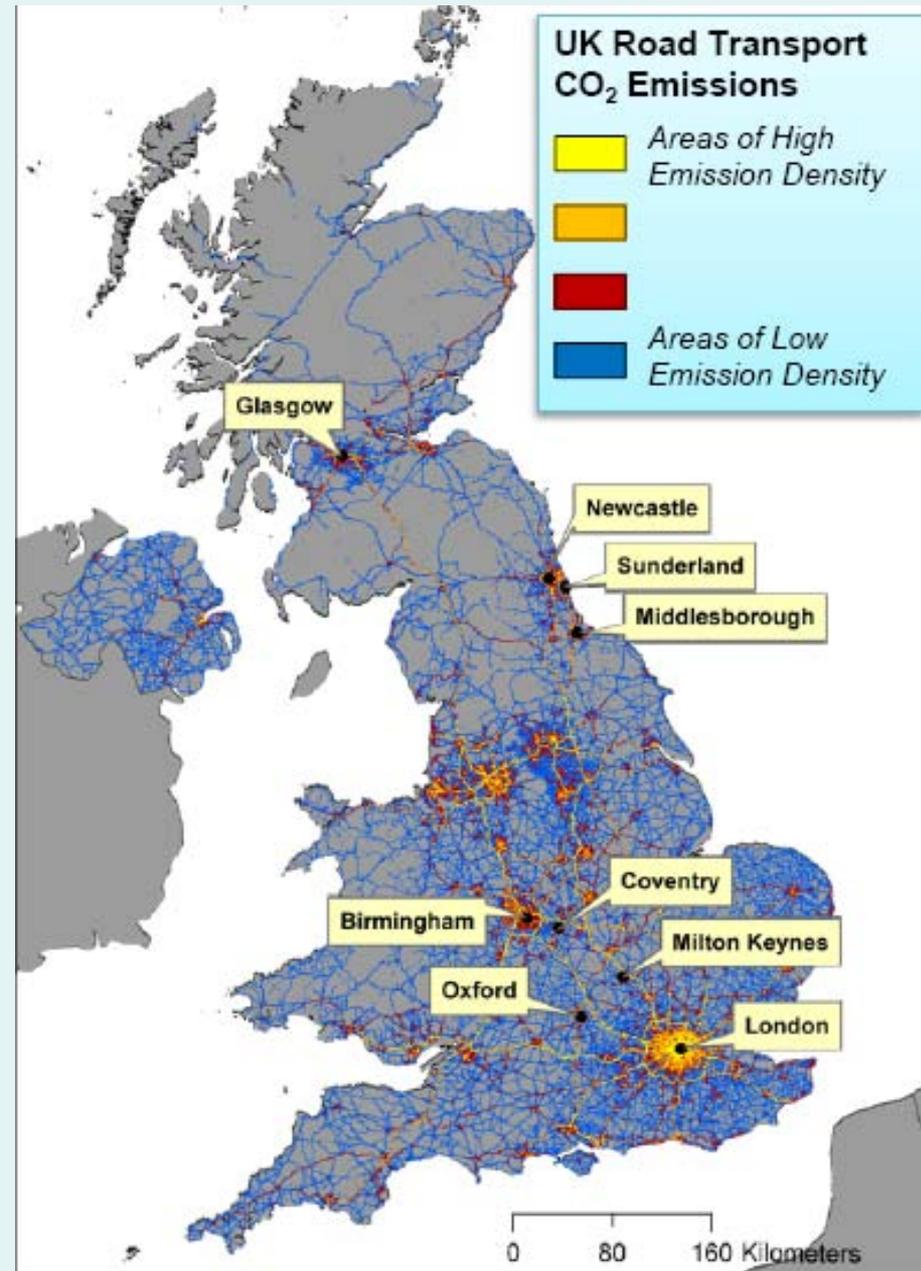
Scenario 1 - Slow Charging @ Home



- EV share of national electricity production
  - 2020 0.1 – 2%
  - 2030 1 – 8%
- Smart metering with differential pricing can discourage peak demands
- Could create night-time base load for renewables
  - Flattening of daily demand profile will create efficiencies for generators
- Some local grid reinforcement may be needed in peak uptake locations

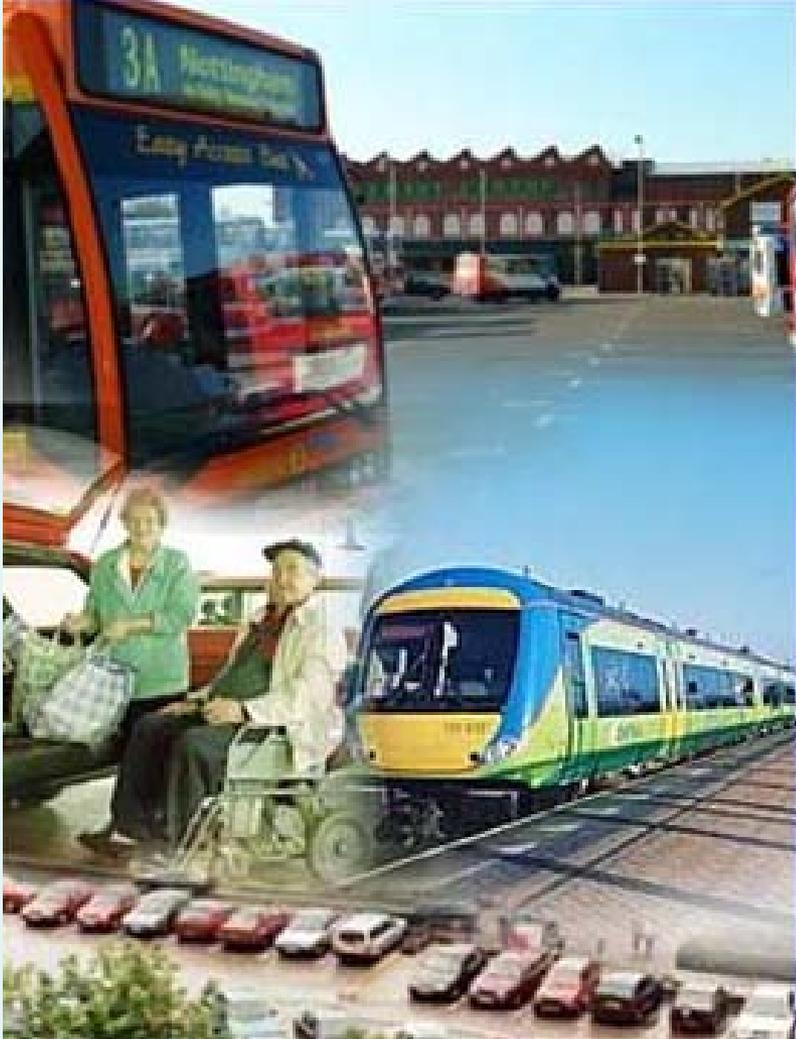
## *Strong UK Government support programme for electrification of transport*

- ❑ Creation Office of Low Emission Vehicles
- ❑ £250M purchase support fund for cars
  - 2011-14
  - £5k per vehicle
- ❑ 140M Low Carbon Vehicle Innovation Platform
- ❑ £30M infrastructure support
  - Plugged-in-Places
- ❑ £5M Ultra-low carbon car competition
  - 340 vehicles
  - Joint cities demo programme
- ❑ £20M public procurement support for electric vans



*Technology alone cannot sufficiently reduce transport emissions*

*EVs are not a silver bullet – but will perform a major role from 2025+*



2000



2004



2006



2008+

## *Key messages for utilities*

- ❑ EVs will play an important role in reducing transports dependency on oil and reducing GHG-emissions in the longer term
- ❑ EVs are likely to be one of a portfolio of low carbon technology solutions
  - Early visionary vehicles do not make a mass market
- ❑ There are significant barriers to EV market adoption, notably:
  - Battery cost and performance
  - Car buyer acceptability
  - Availability of practical recharging solutions
- ❑ To 2020-5, market penetration is likely to be modest even with generous incentives
  - These are long-term opportunities - don't expect quick returns
- ❑ New E-mobility business models are likely to be important
  - Opportunities for new market entrants
- ❑ Grid impacts are generally small and will be alleviated by smart-metering
  - Local distribution network may require reinforcement in some areas
  - EVs provide an important new use for overnight baseload capacity
- ❑ Second-hand batteries could be used for energy storage

Thank you for your  
attention

Any Questions?

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