

Electric cars: Opportunities and implications for utilities

Smart Utility Forum

18th March 2010

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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 CO₂

LowCVP 'Low Carbon Road Transport Challenge'

Proposals to reduce road transport CO₂ 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 (estimated) for 1000 miles

CO₂ emissions (estimated) for 1000 miles

VED for 12 months

£662

£50

LowCVP Accelerating the Shift to Low Carbon Vehicles and Fuels

Low Carbon Transport Innovation Strategy

ACT ON CO₂

Future events

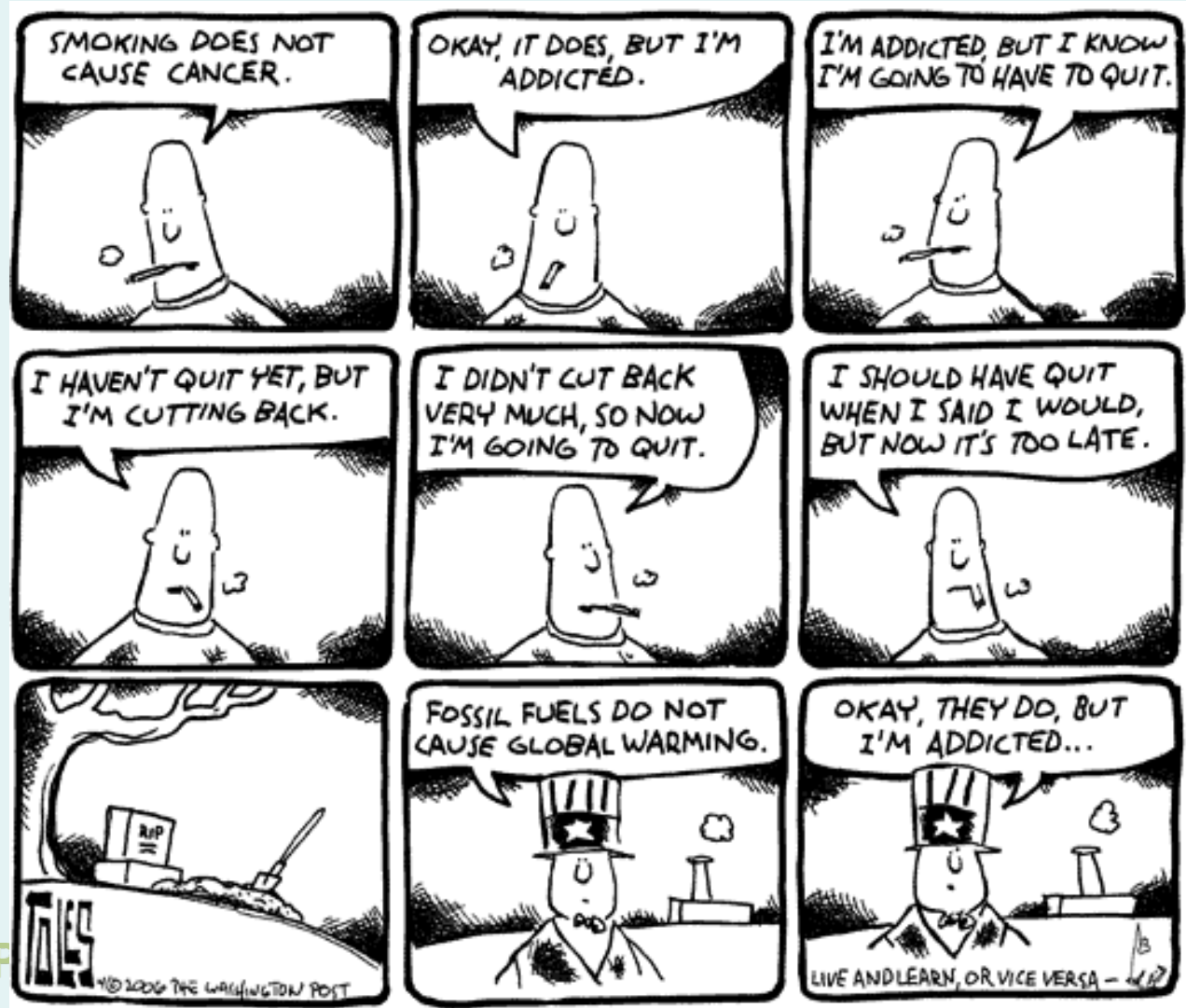
LowCVP Annual Conference 2009 'The Transport Challenge for Vehicles and Fuels'

Outline

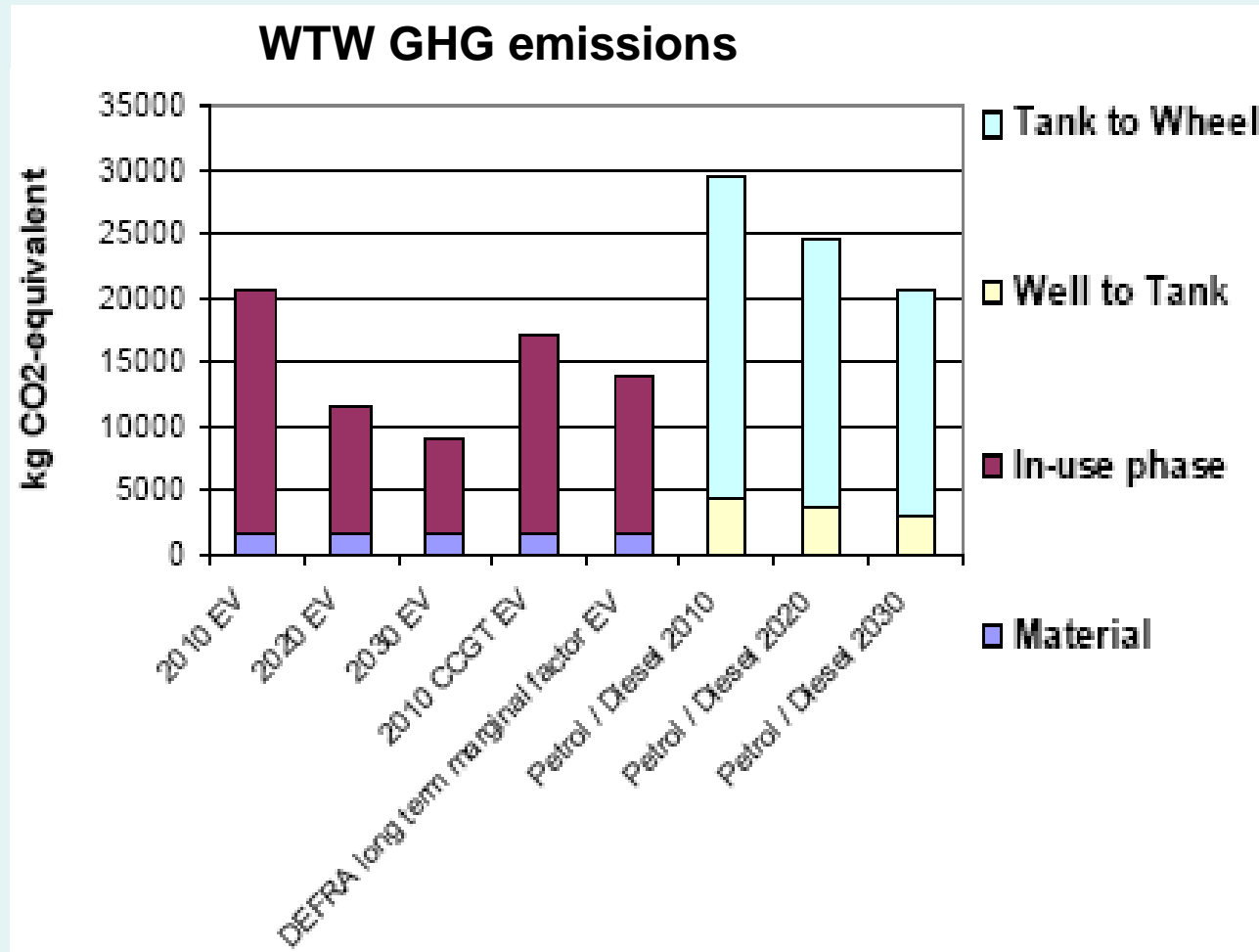
- ❑ The scale of the challenge
 - Transport GHG-emissions
 - EV CO2 benefits
- ❑ The market potential for EVs
 - Technology options
- ❑ Key challenges
 - Batteries
 - Consumer acceptability
- ❑ Alternative business models
- ❑ Supply constraints and opportunities
 - Grid impacts
- ❑ UK support
- ❑ Conclusions



*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

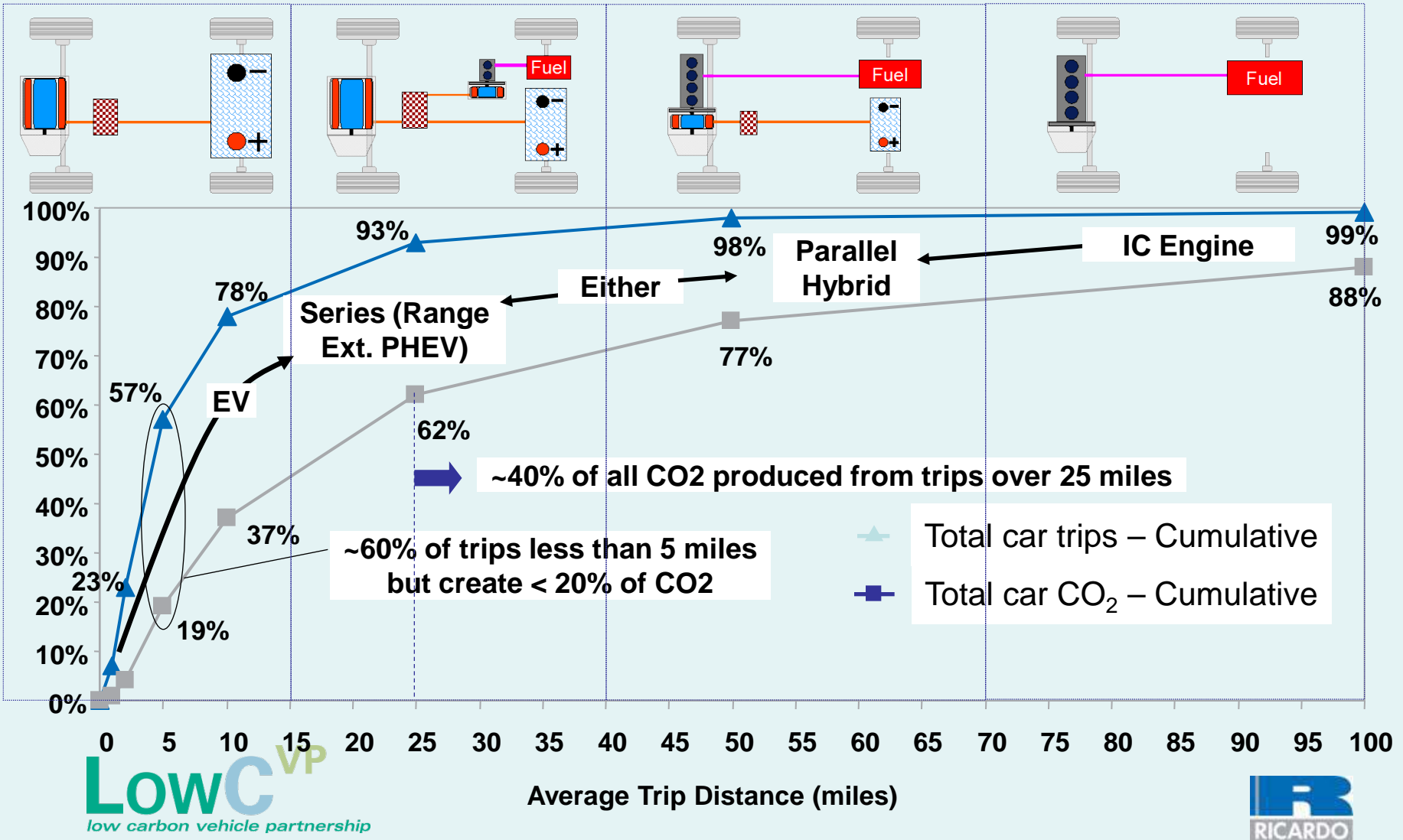


Renault Fluence – 2011
(not EU) + others

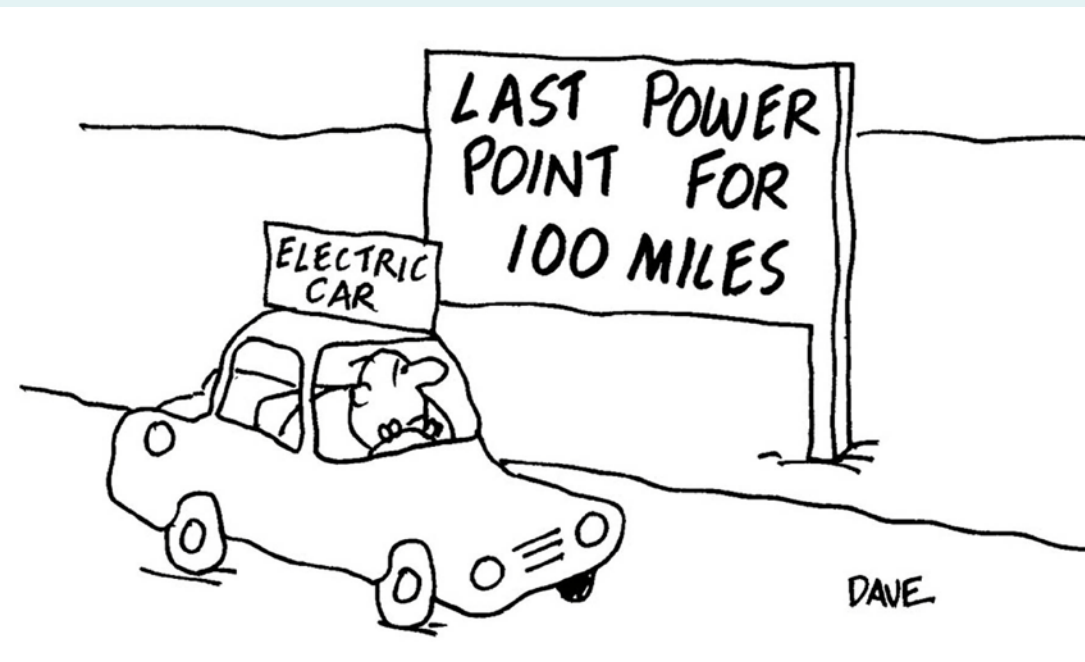


Vauxhall Ampera - 2011

*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

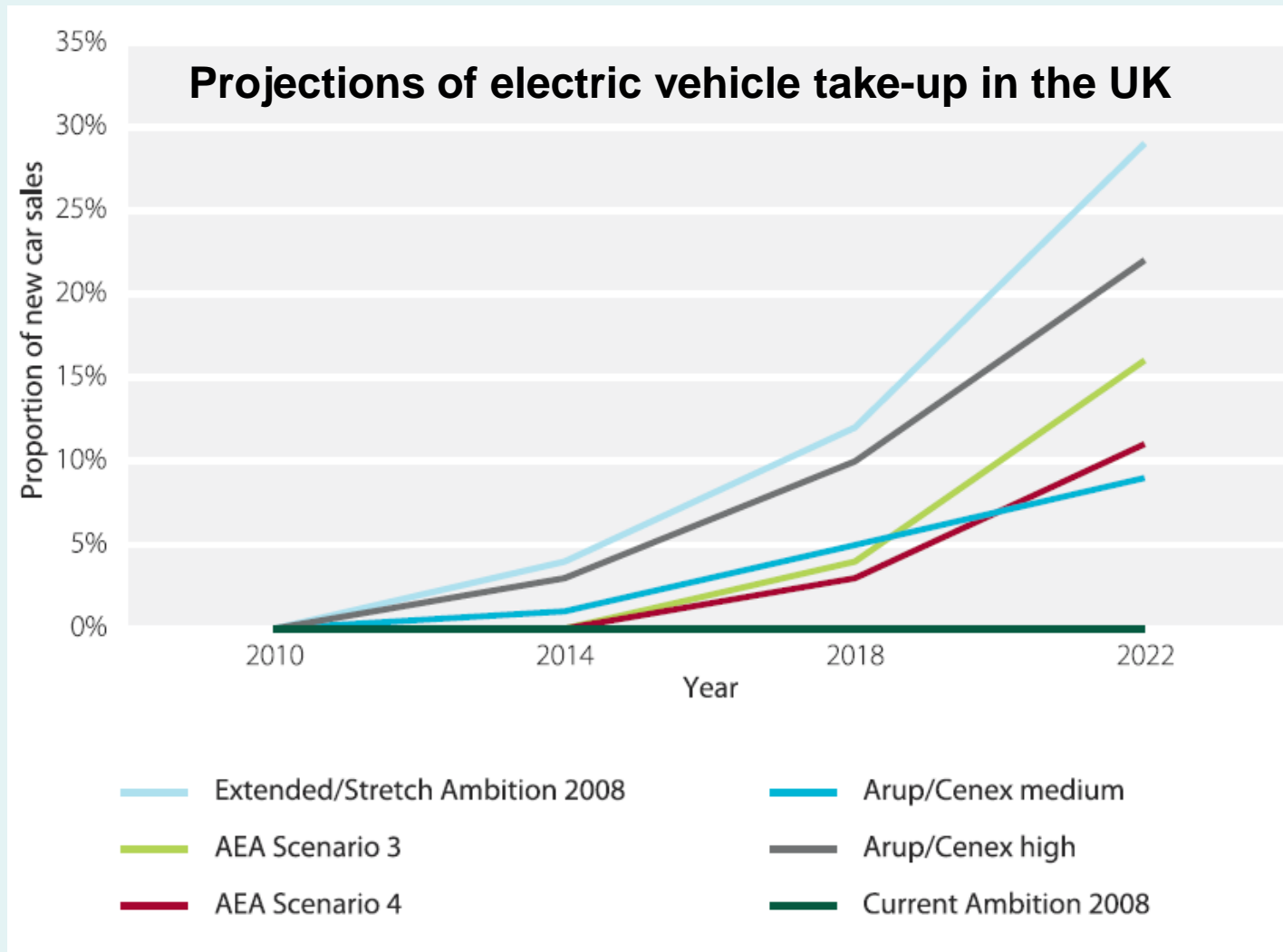
Electric vehicles will only appeal to most car-buyers with significant incentives



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

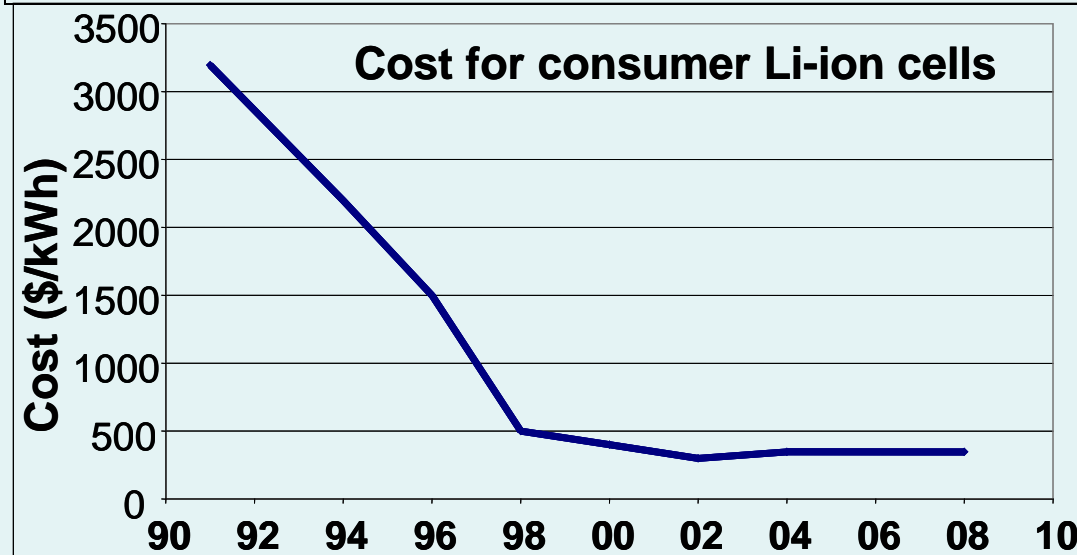
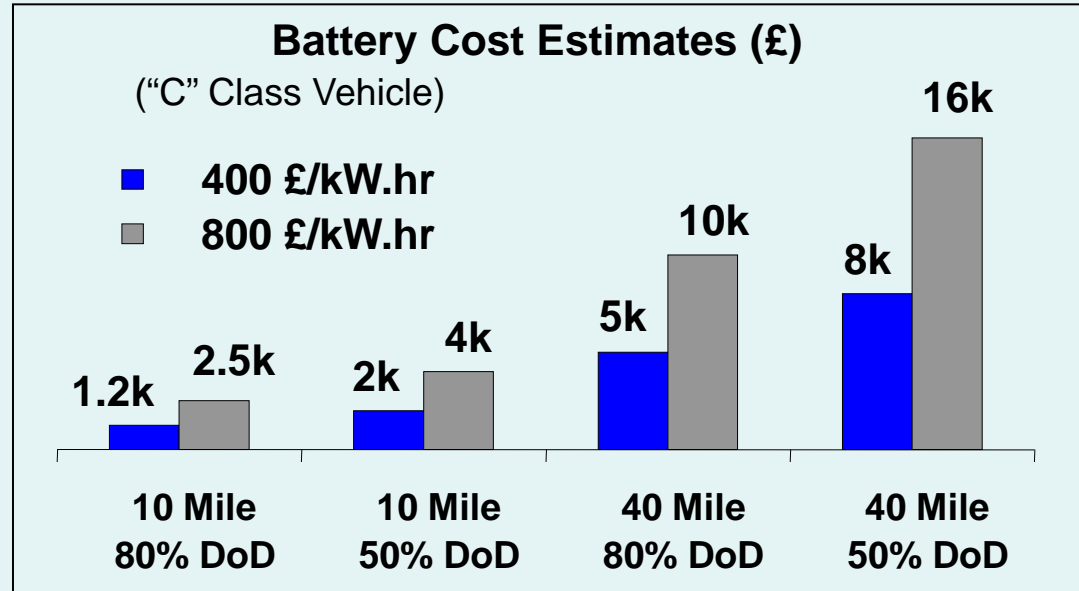
Market uptake is highly uncertain – depending upon public acceptability, battery costs / subsidies



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



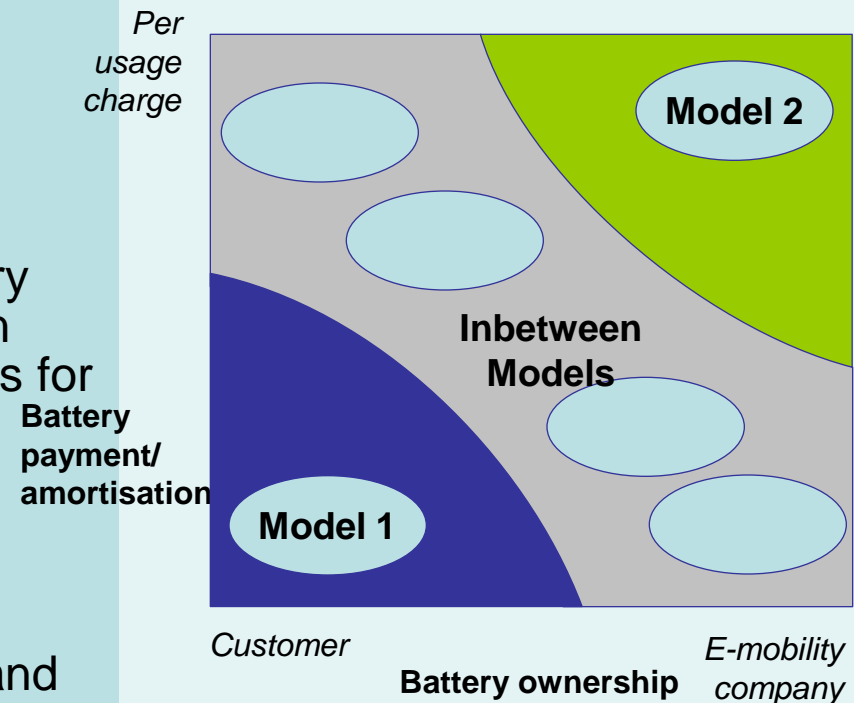
*A range of business models are being considered
- the pathways to profit remains uncertain*

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

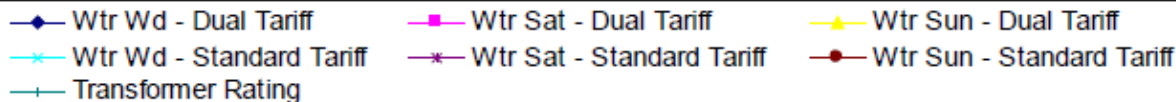
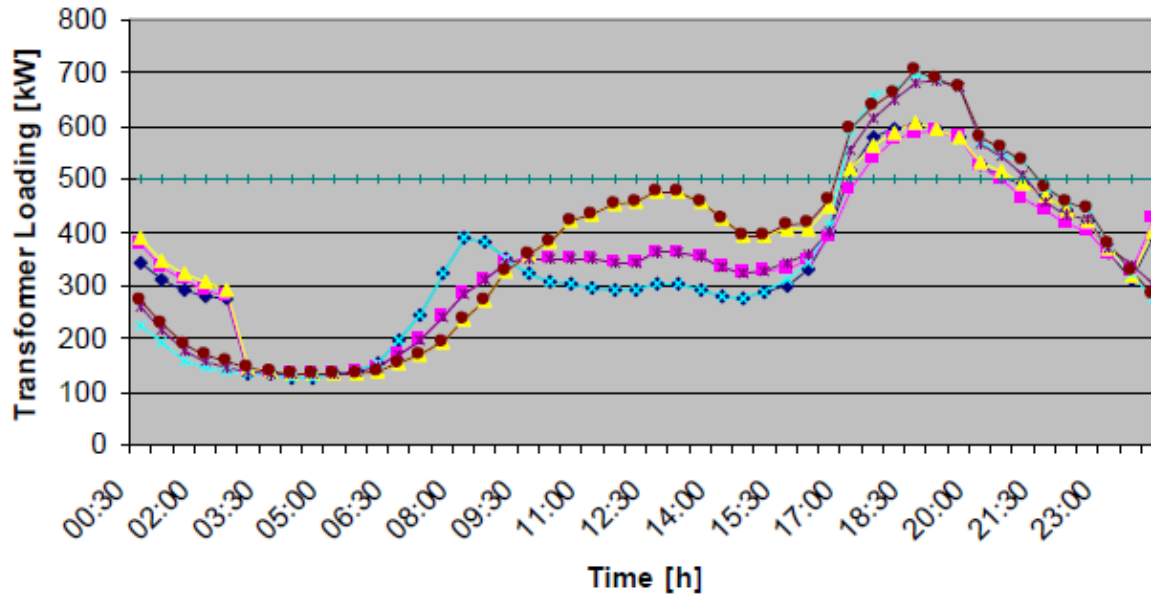
- ❑ E-mobility company sets the battery standard and owns the battery
- ❑ E-mobility company sets up charging and battery exchange infrastructure
- ❑ Customer charges battery at charging station or swaps complete battery
- ❑ Customer pays for electricity consumption and battery amortisation



Grid impacts are manageable – particularly with smart metering

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

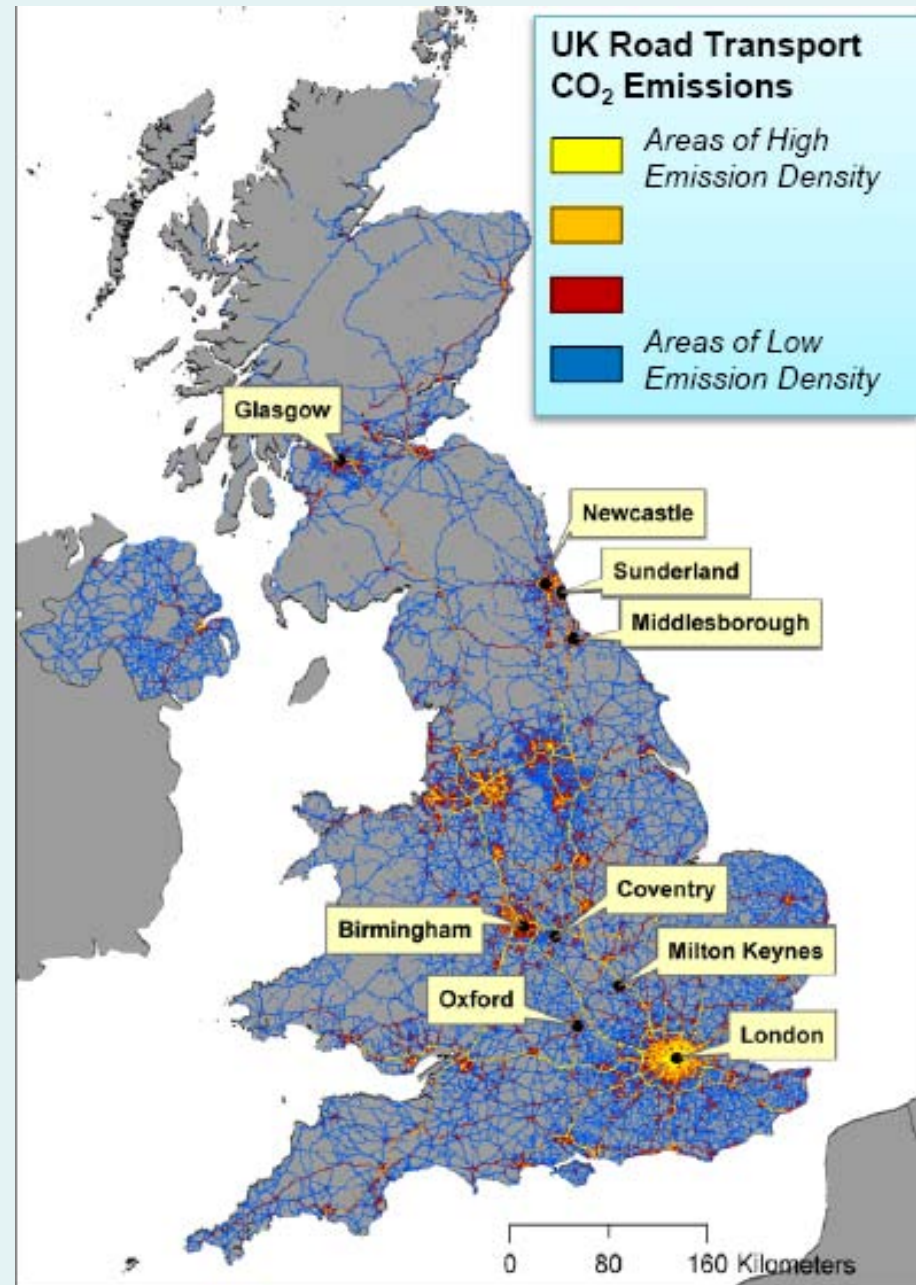
Scenario 1 - Slow Charging @ Home



- 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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