Pathways & progress to low carbon transport in the UK

Automotive World Conference

Shaping a Greener Future:
Decarbonising Road Transport in the UK

London

15th October 2009

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Low Carbon Vehicle Partnership

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

Stimulating opportunities for UK businesses

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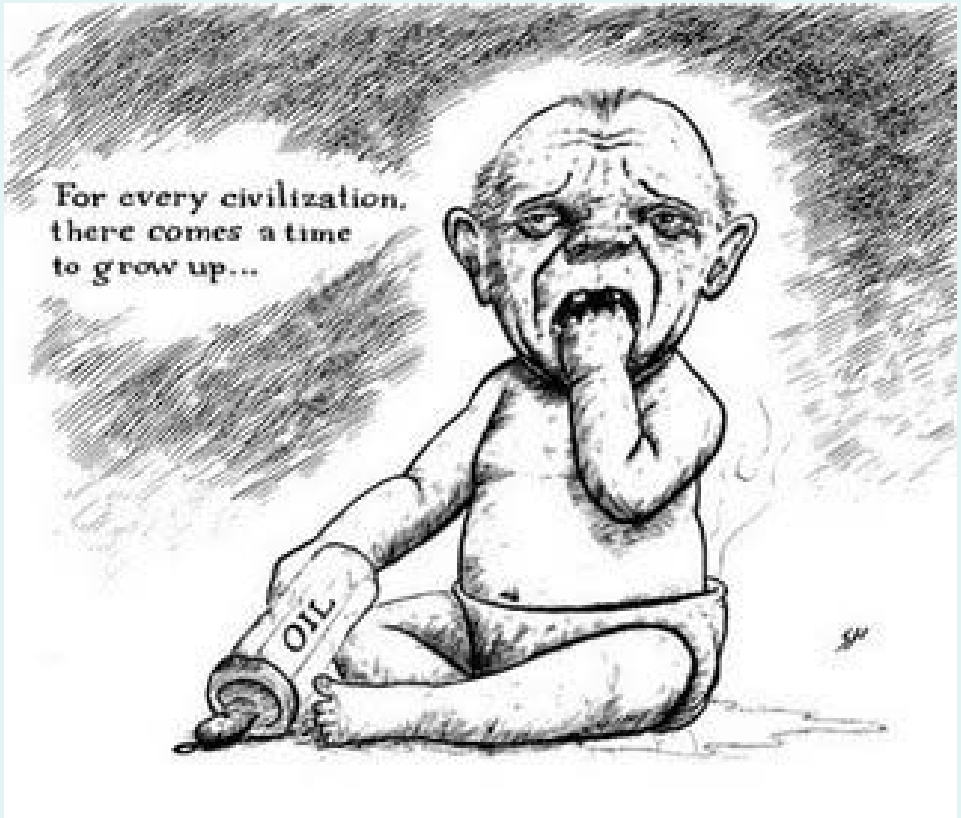
Outline

- The scale of the challenge
- Pathways and progress to low carbon transport
  - Improving vehicle efficiency
  - Electrification
  - Biofuels
  - Hydrogen fuel cells
  - Demand management
- Greening Transport
- Conclusions



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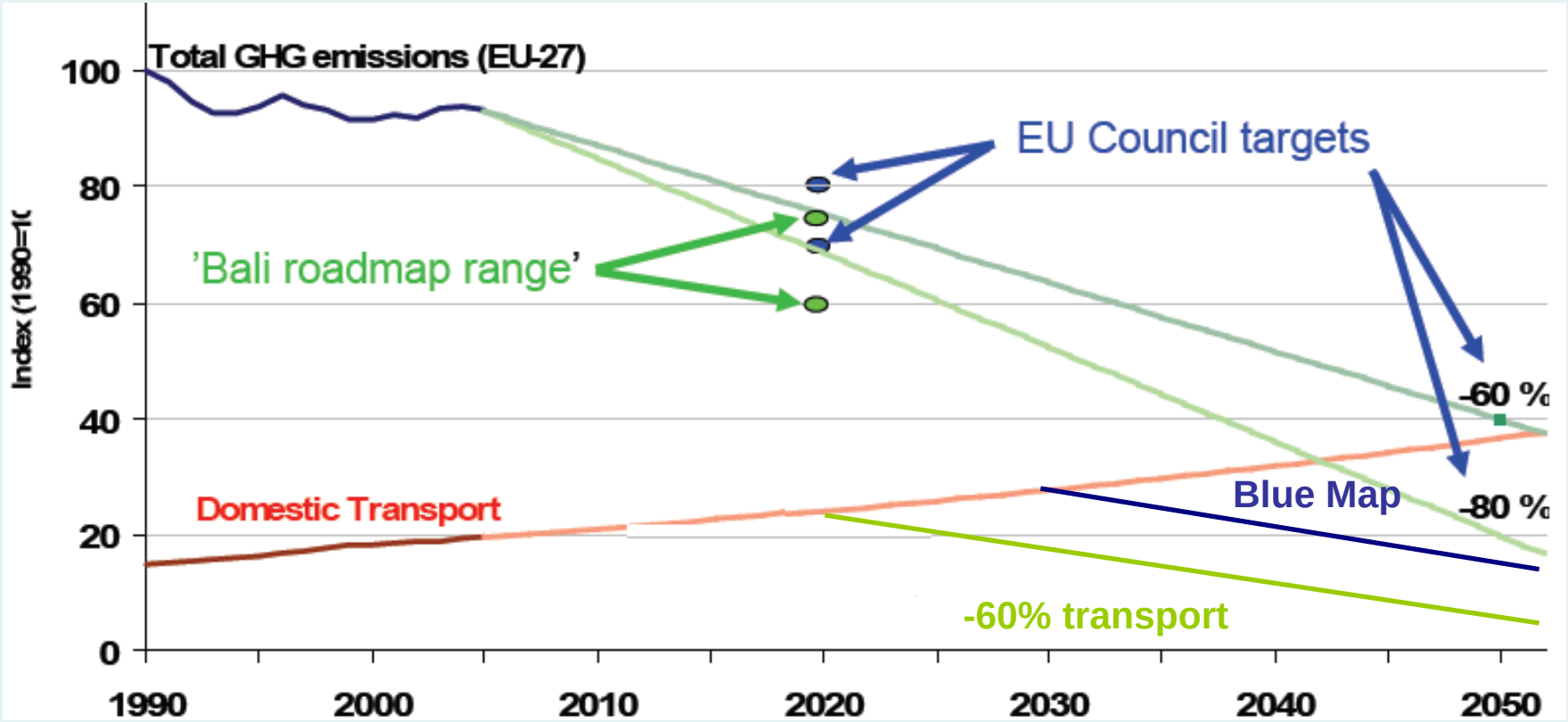
EU domestic transport emissions will consume the CO2 budget on current trends – Even ambitious emission reductions may not leave sufficient headroom for other sectors



Adapted from EEA 2009 & TNO 2009

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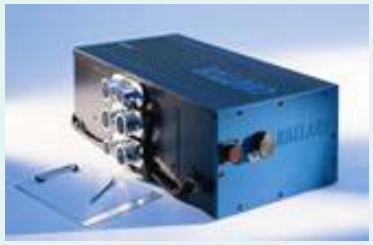
There are no silver bullets to low carbon transport but 4 (maybe 5) complementary pathways

- Efficiency improvements
- Biofuels and biomethane
- Electrification
- Demand Management
- Hydrogen Fuel Cells?



2000

2004

2006

2008

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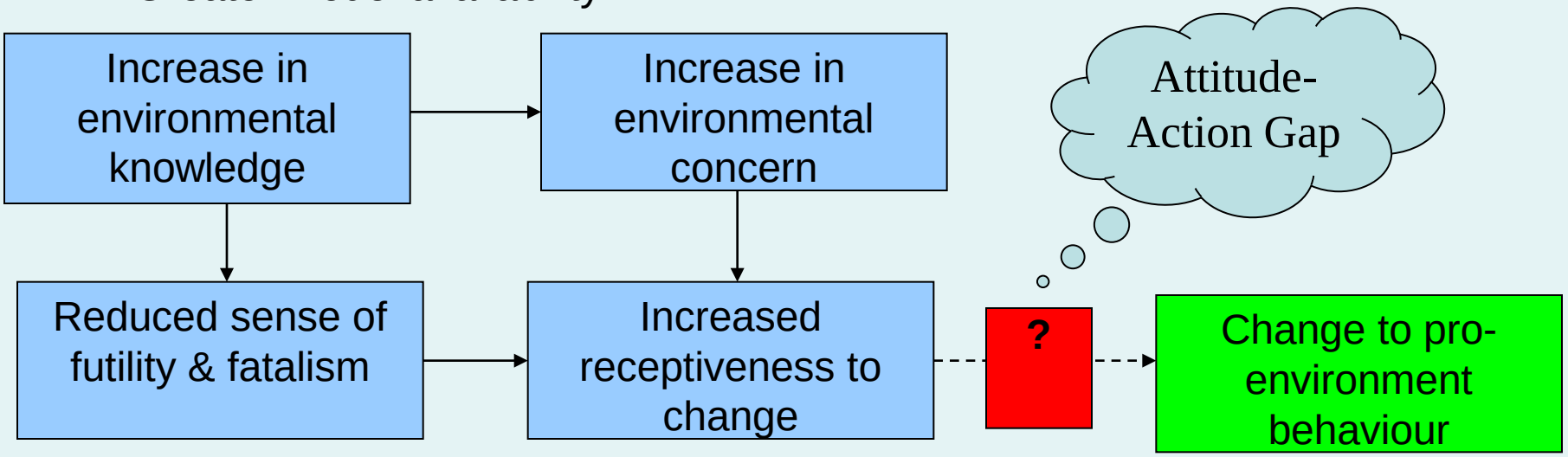
Vehicles are becoming more efficient but accelerated progress depends upon:

- Reversing unsustainable trends in vehicle size, weight and power
- Maintaining consistently high fuel price
- Industry-wide action - regulation
- Increased consumer demand - bridging the attitude action gap, through:
  - Improved customer information
  - Increased desirability of low carbon technologies
  - Stronger incentives
  - Greater model availability



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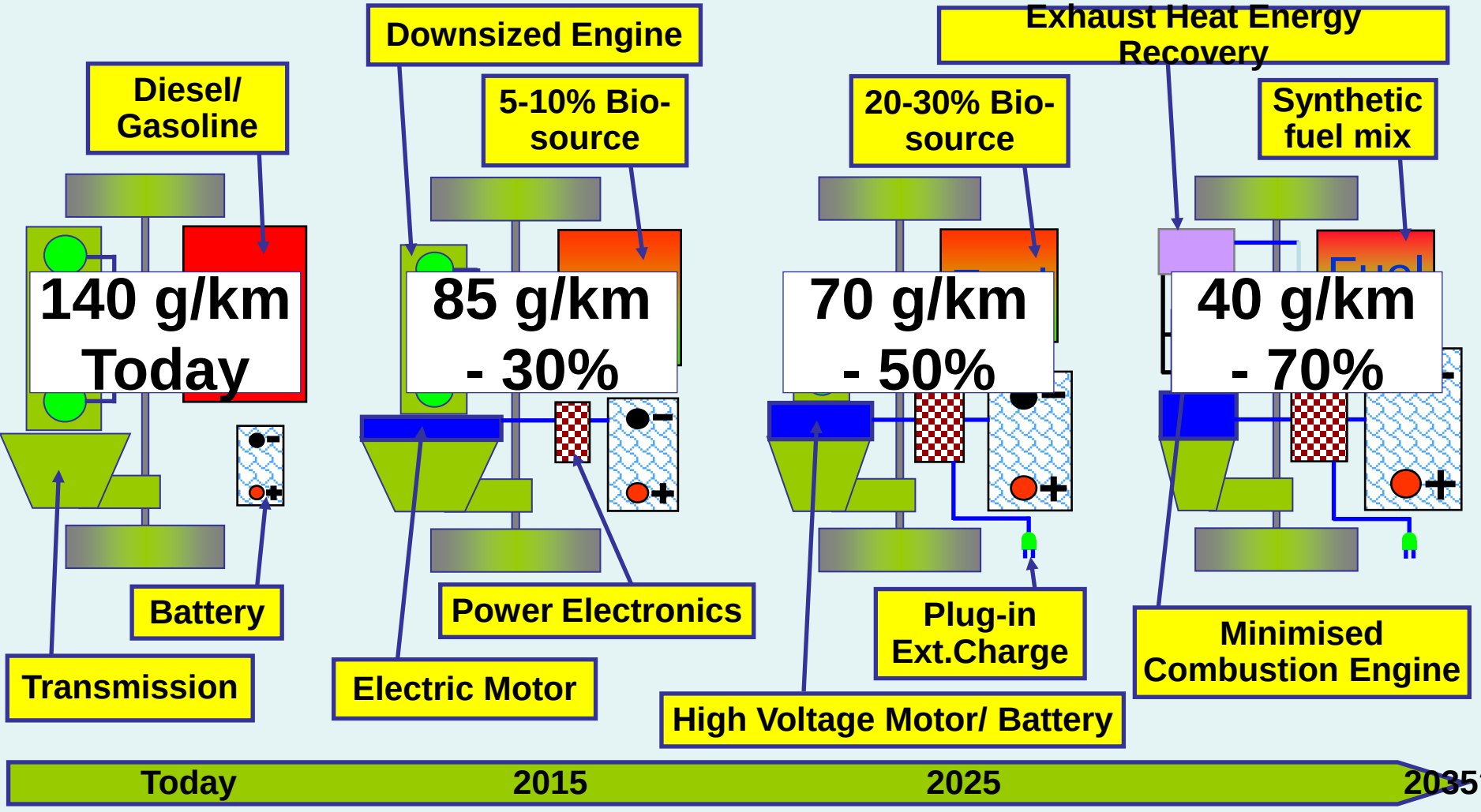
Efficient powertrains using advanced low carbon liquid fuels provide an alternative route to ultra-low carbon



- Sustainability concerns must be addressed

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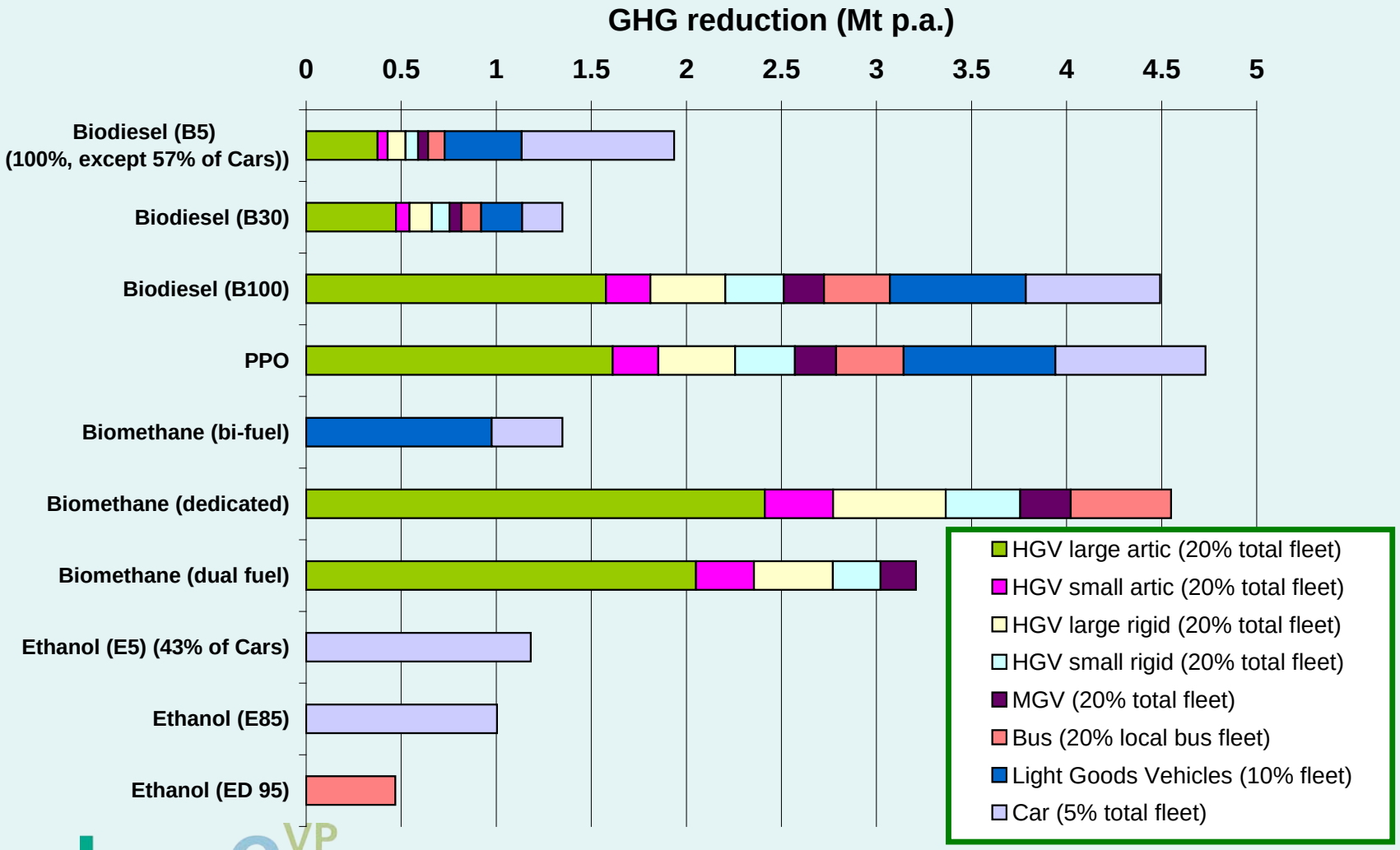
Significant GHG-emissions can be delivered through targeted use of high blend biofuels and biomethane



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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

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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
- Recharging infrastructure currently unavailable
- Vehicle availability minimal
- Pathway to profit highly uncertain
- Widespread consumer acceptability low
- Safety concerns must be allayed
- Immature supply chain

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Preparing the market for renewable fuels or EVs requires:

- Coordinated support throughout the innovation chain
- Tackling market failures & supporting niche applications
- Long-term commitments to promising alternatives
- Adequate incentives to reward low carbon
- Bridging the customer attitude-action gap
- Preparing for the rebound effect and changes to transport fuel tax revenues

"It has very low emissions - it's impossible to find a garage selling the fuel."

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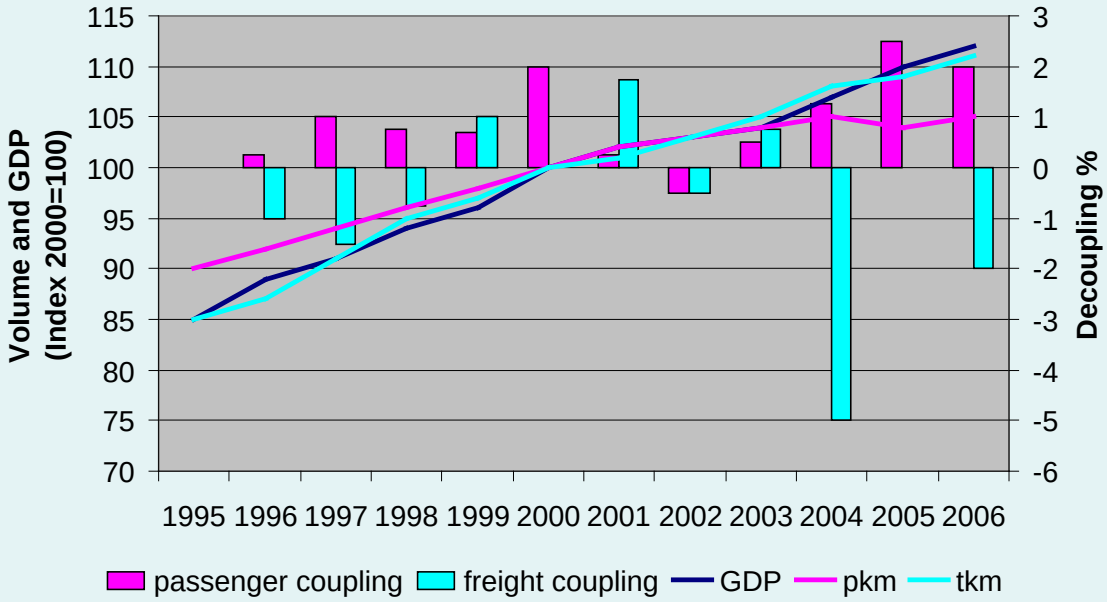
Technology can only be part of the solution - demand management and mode shift are also needed to delink transport demand & growth; & manage rebound effects

- Smarter driving improved driver behaviour
- Reduced vehicle use
- Better freight distribution
- Modal shift
- Land-use planning
- Tele-working

EU trends in freight and passenger transport compared to GDP



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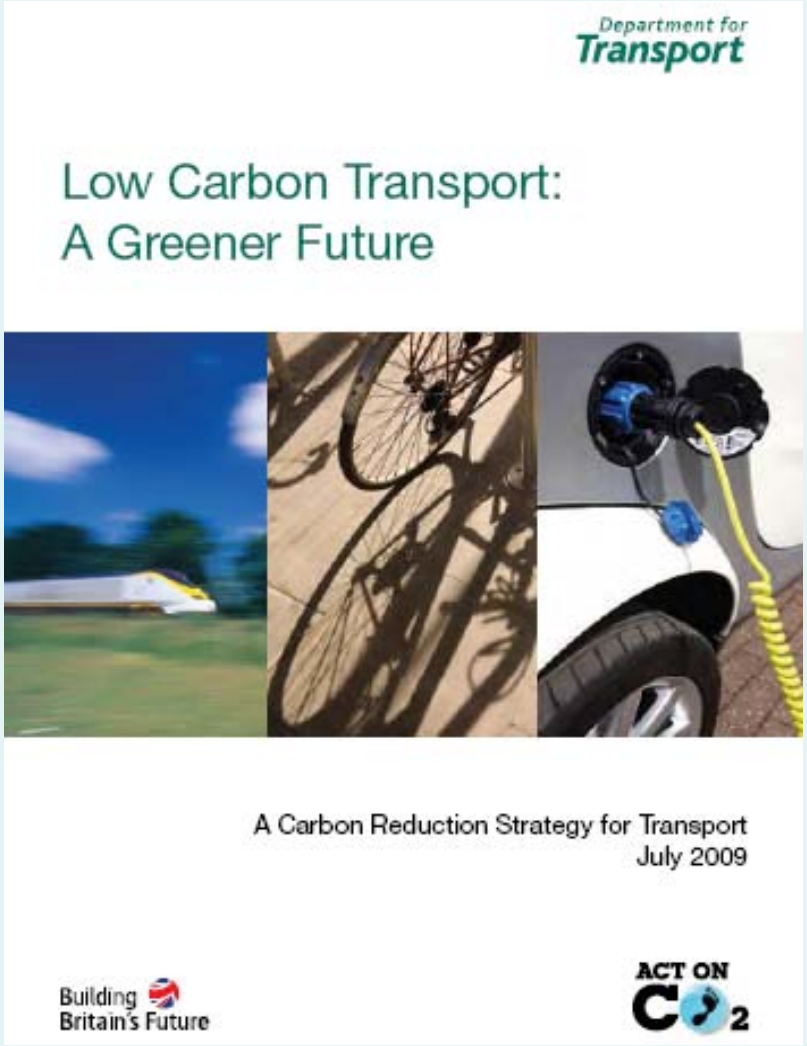
Greening Transport

- ✓ Established carbon budgets in transport for the first time
- x Few new announcement or policy interventions
- x Less ambitious than Climate Change Committee
- x Questionable assumptions underpinning key projections



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Key message – there are no silver bullets

- We must wean ourselves off our petroleum dependency
- In the next 10-years deploying existing technology to improve vehicle efficiency is the priority, accelerated by:
  - Reversing unsustainable vehicle characteristics trends; consistently high fuel prices; legislation; and, increased consumer demand
- Beyond 2020 renewable fuels will play an increasing important role
- Barriers to electrification of transport are unlikely to be resolved quickly; share of electric and plug-in hybrid vehicles will become important 2020+
- Biofuels will make-up an increasing proportion of liquid fuels-
  - Ultimately may be used with PHEVs and HGVs
- Hydrogen fuel cell vehicles may ultimately compete –
  - Unlikely to have significant market share before 2030
- Technology is only part of the solution – demand management and building public transport infrastructure to encourage modal shift is crucial
- Strategy is a good start – but further action is needed

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Any Questions?

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The Low Carbon Vehicle Partnership

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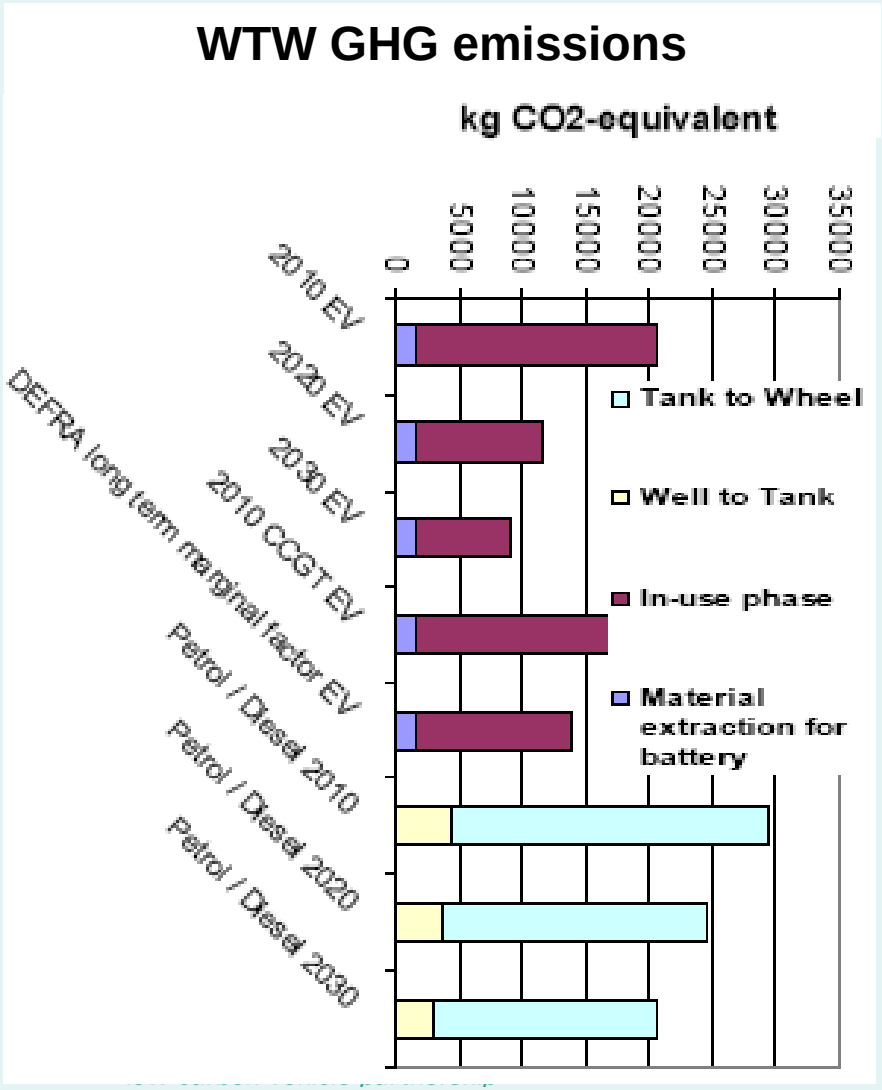
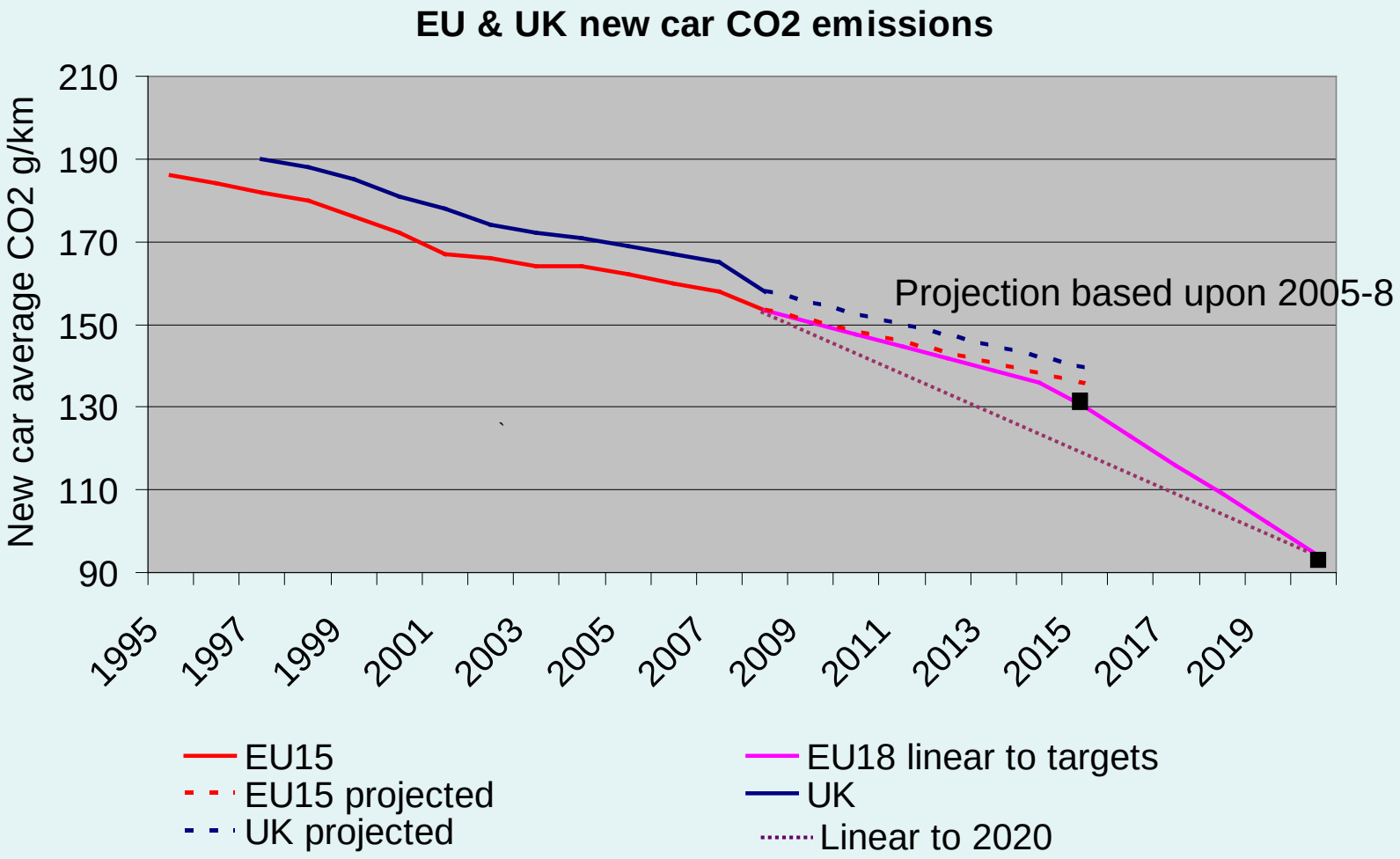
EVs deliver CO2 benefits over ICEs with minimal grid impacts



- EV share of national electricity production
  - 2020 0.1 – 2%
  - 2030 1 – 8%
- Smart metering and 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

Cenex / Arup 2008

New cars are becoming more efficient – but the rate of progress must be accelerated to achieve targets



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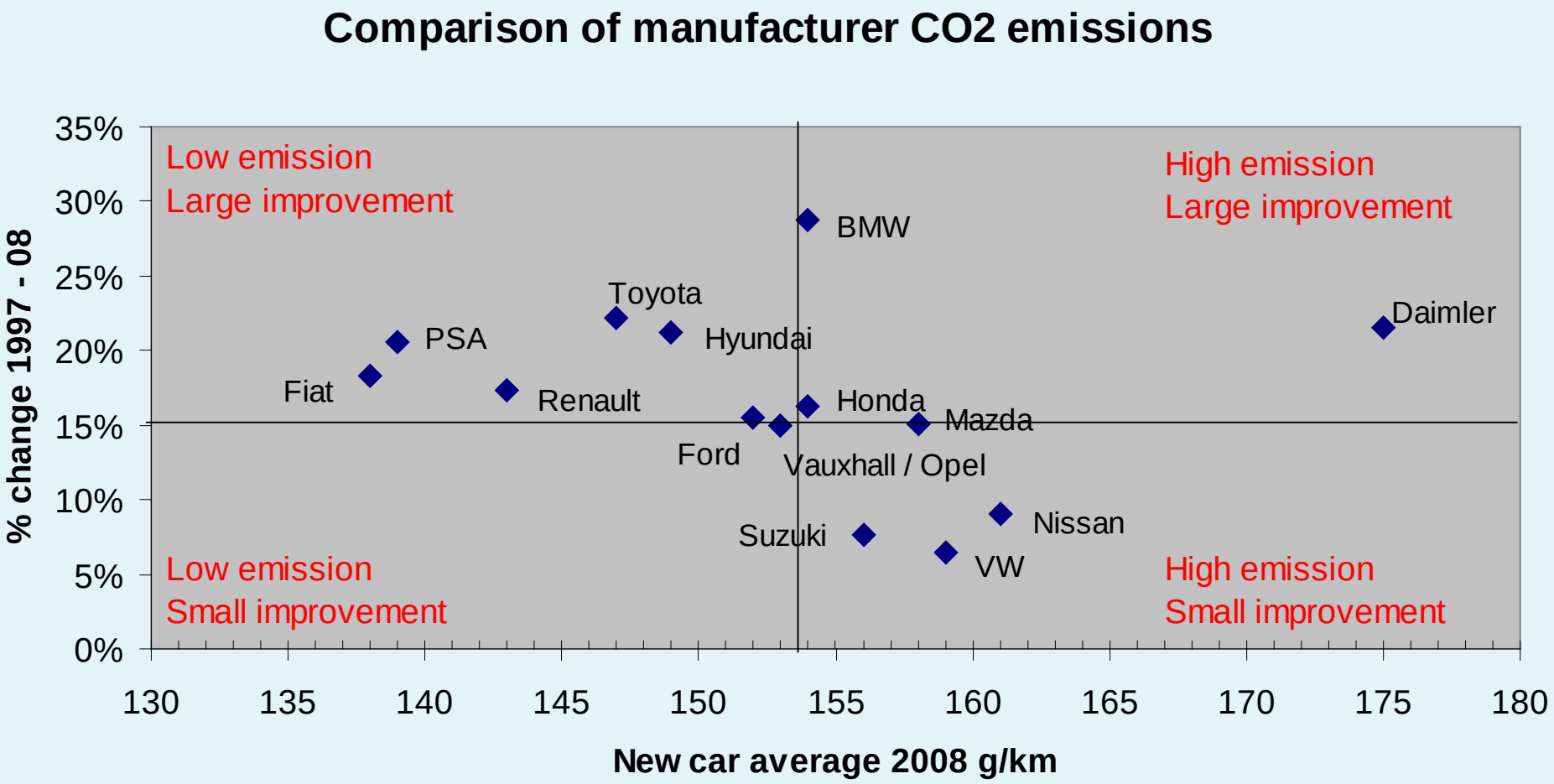
Based upon T&E and SMMT data

There is a wide range of performance between manufacturers



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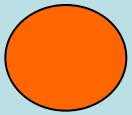
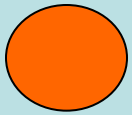
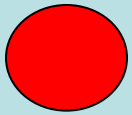
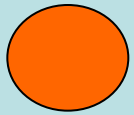
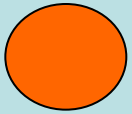
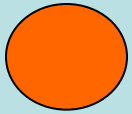
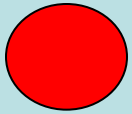
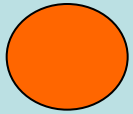
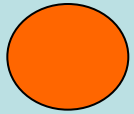
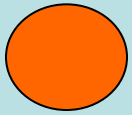
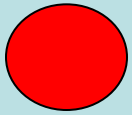
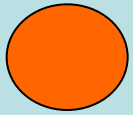
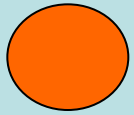
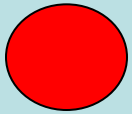
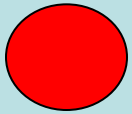
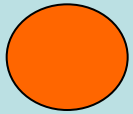
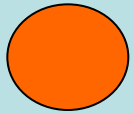
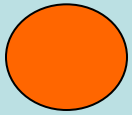
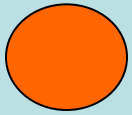
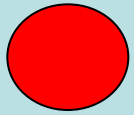
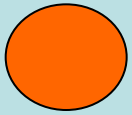
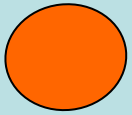
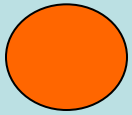
Based upon T&E 2009

To 2020 the challenge is to ready the market for renewable fuels – but which option?

	1st G Bio	2nd G Bio	H2-IC	H2-FCV	Bio-CH4	EV
Technology readiness						
Cost competitiveness						
Vehicle availability						
Infrastructure deployment						
Driver acceptability						
Sustainability						

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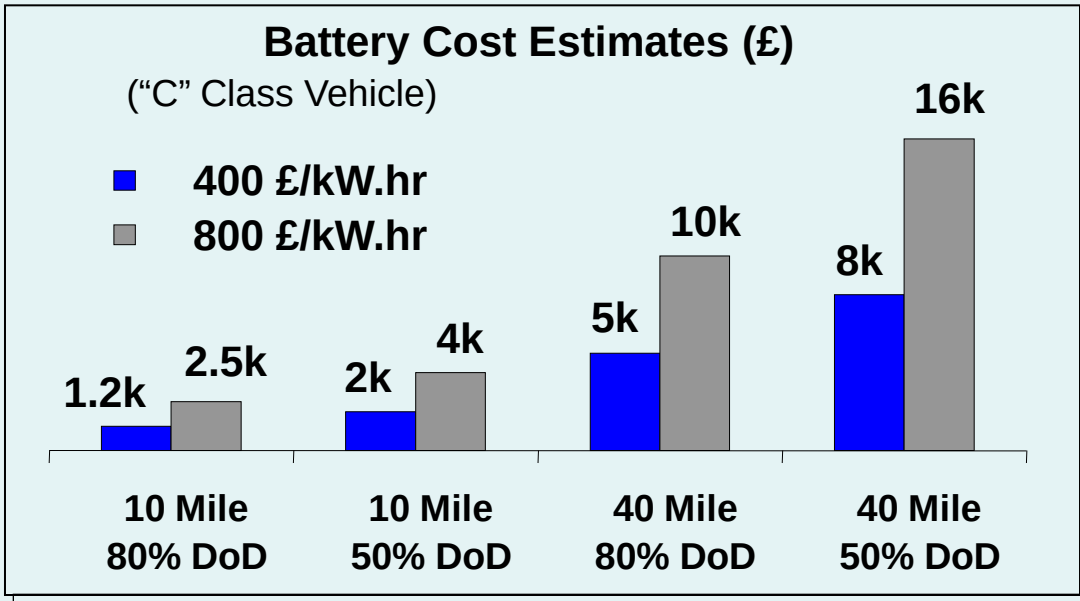
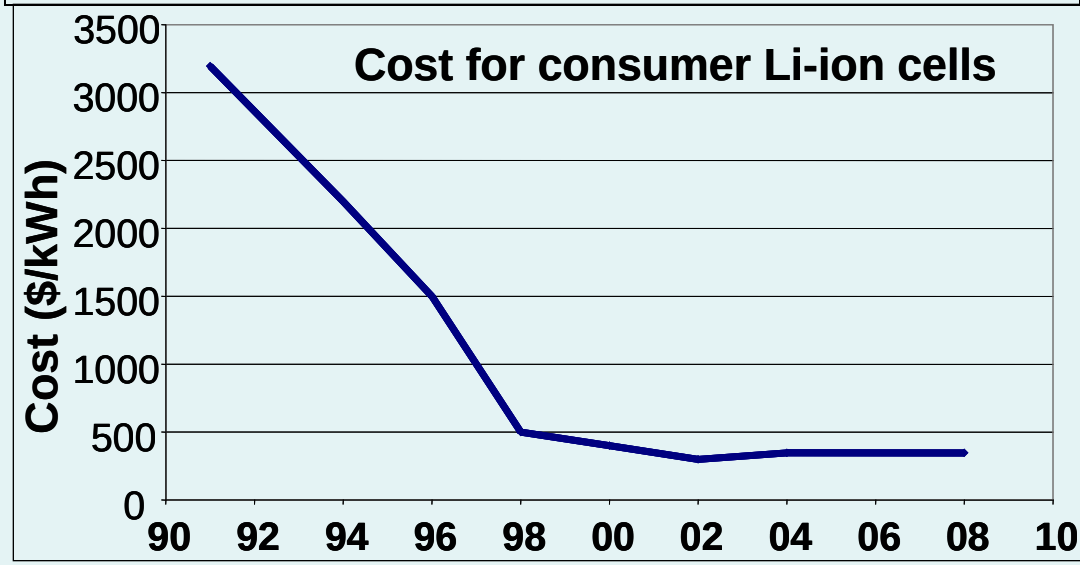
The relative scores do not represent LowCVP policy

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

- Li-ion currently c$2000/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





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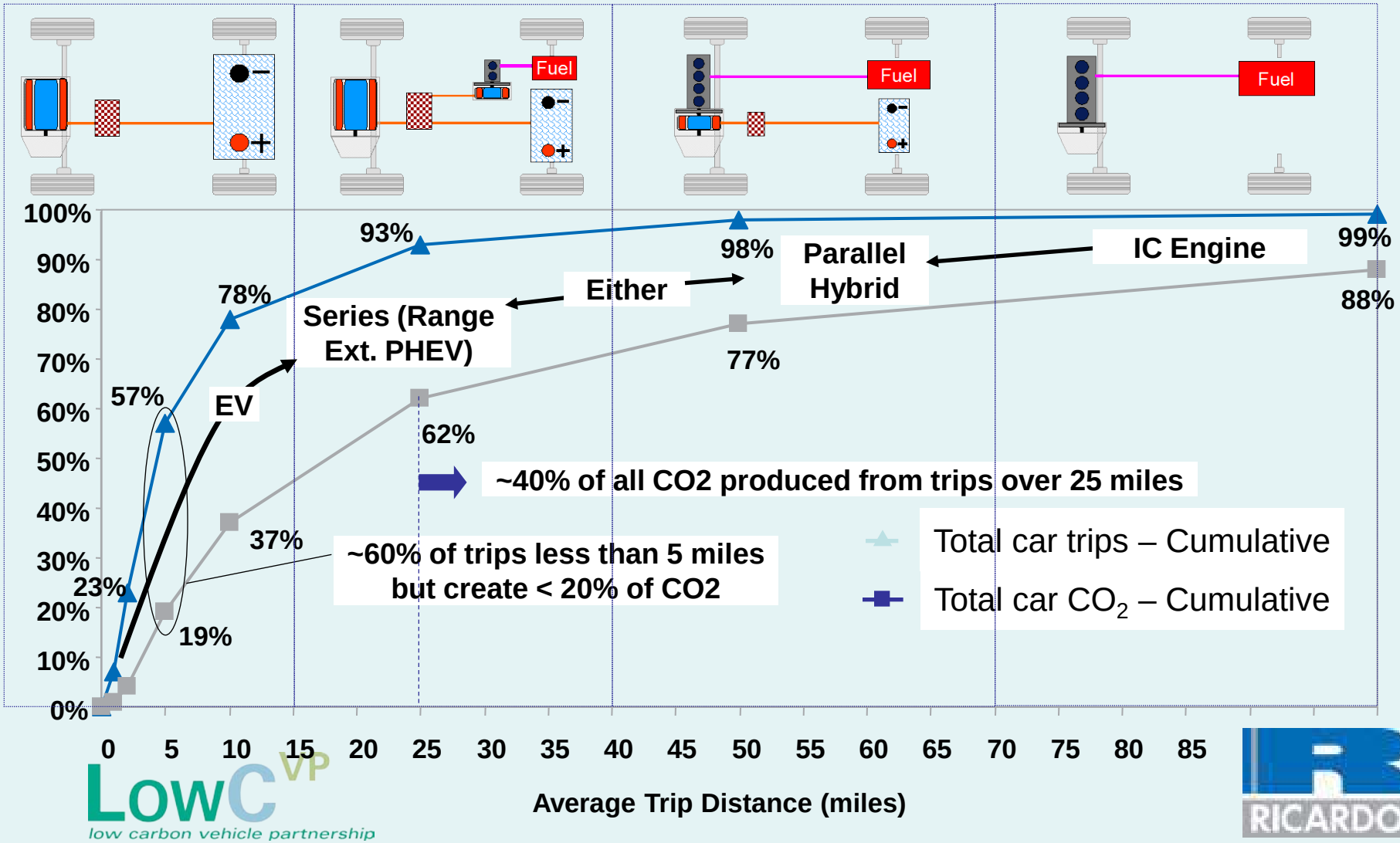
Technology will be tailored to the application: EV for city use, PHEV or parallel hybrid for medium length journeys; IC for long journeys



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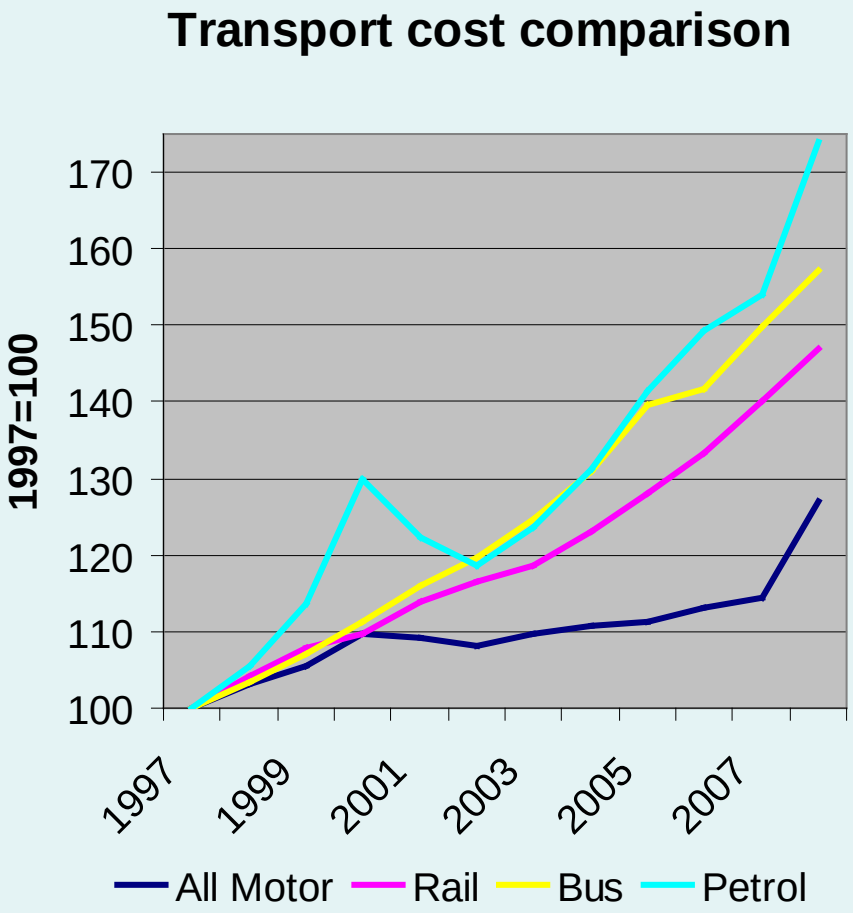
High fuel prices stimulate lower carbon and reduced demand for transport - but not necessarily mode shift



- High fuel prices <u>short term</u> lead to
  - Fewer journeys
  - Shorter journeys
  - More efficient driving
  - Lower speeds
  - Mode shift
- High fuel prices <u>long-term</u> lead to
  - Trip destination changes
  - Location changes
  - More efficient vehicles
- High fuel prices reduce technology payback times
- Public transport has become increasingly expensive compared to motoring

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Based upon DfT 2008