Low Carbon Bus Market in the UK and Barriers to Technology Take-Up

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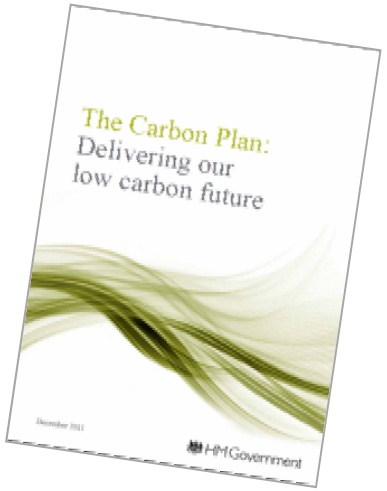
Background to Low Carbon Buses

- Government climate change targets
  - 34% GHG reduction by 2020, 80% GHG by 2050
  - Road transport – 21% CO2 emissions of which 4% due to buses

- Improving local air quality
  - EU infraction of UK failure to meet NO_2 limit value

- UK economic growth
  - Bus manufacturing contributes to automotive sector growth

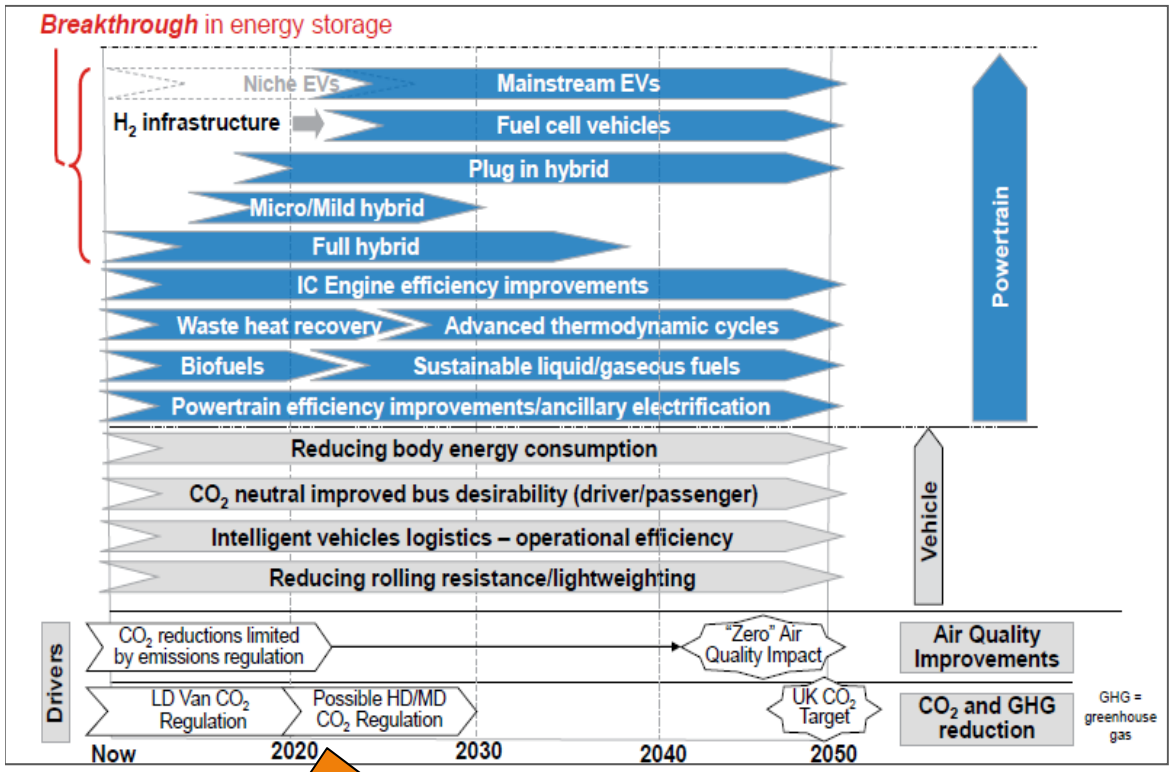


LowCVP – Influencing the take-up of low carbon buses

- Low carbon emission bus definition and accreditation scheme
  >30% WTW GHG emission compared to Euro 3 diesel bus
- Green Bus Fund & BSOG additional 6p/km for LCEBs
- Local Authority Low Carbon Bus Toolkit
- Creation of a Low Carbon Bus Technology Roadmap to 2050
- Barriers and opportunities to expand the low carbon bus market study

(*near completion)*

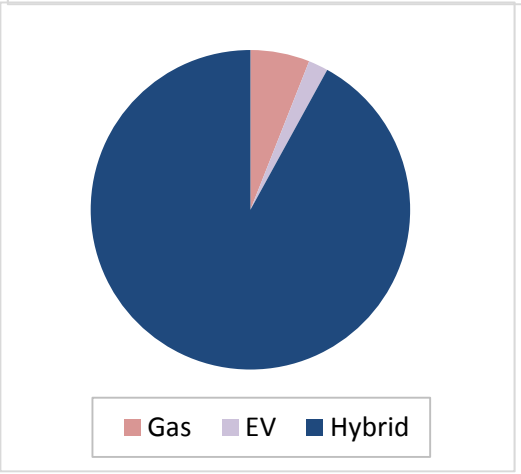
Low Carbon Bus Technology Roadmap



Low Carbon Technology Roadmap (LowCVP/Ricardo 2013)

Where is the UK now?

- 1467 low carbon bus
- 2% bus market
- Diesel hybrid dominate
- Green Bus Fund important for EV/hybrid sales



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Diesel Hybrid Buses

Technology/Market Status

- Technology - Combination of ICE and lithium battery to power bus
- Series or parallel in configuration, combined with start-stop
- Options: single and double deck
- Manufacturers: Alexander Dennis Ltd, Wrightbus, Volvo, Optare
- Market: 1355 hybrid operating across UK

London, Manchester, Oxford highest take up of hybrids

Environmental Benefits

- Well-To-Wheel CO_2 savings: 30%
- Lower air pollution emissions

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Hybrid Bus Performance Transport for London

	12	16	27	73	76	94	139	188	436
MPG (Hybrid)	6.6	7.3	7.4	7.7	6.8	6.8	6.8	7.6	7.5
MPG (BM)	5.8	5.6	5.1	5.5	5.1	5.0	6.1	4.4	5.3
YTD Hybrid	6.6	7.3	7.3	7.2	6.5	6.9	7.0	7.3	7.5
YTD BM	5.8	5.6	4.9	5.2	5.4	4.9	6.1	4.1	5.3

Ref: TfL Quarterly monitoring report March 2014

TfL data shows an improvement in fuel consumption for hybrid buses between 25-30% compared to a standard diesel bus.

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Gas Buses

Technology/Market Status

- Spark ignition engine powered by natural gas/biomethane
- Options: Single deck
- CNG refueling infrastructure required
- Manufacturers: MAN and Scania/ADL
- Market: 65 gas buses operating in UK

Environmental/Financial

- WTW CO2 savings biomethane >100%
- Air pollution emissions >50% reduction

Biomethane can be produced from any biodegradable waste

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Demonstration Trials

Flywheel hybrid

- Energy storage based on KERS, can be retrofitted.
- Williams Hybrid Power systems with Go-Head Group trials in London (9) & Southampton (30).
- Flybrid with Wrightbus demonstration forthcoming
- WTW CO2 savings: 15-25%

Hydrogen Fuel Cell

- Fuel cells convert the chemical energy of hydrogen into electrical energy that powers the bus
- Hydrogen buses (6) in London; forthcoming in Aberdeen
- Tail-pipe emission: 100%
- WTW CO2 savings: 17-94%

Induction Charging for EV

- Wireless charging for electric and plug-in hybrid buses
- Milton Keynes (Wrightbus Streetlight) and London (BYD)

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LowCVP study - Barriers and Opportunities to Advance the UK Low Carbon Bus Market

Study Objectives

1. Identify the barriers to advancing the low carbon bus market in the UK.

2. Outline recommendations for overcoming non-fiscal barriers which could be implemented by key stakeholders.

3. Outline a range of fiscal mechanisms that could be adopted by Government to scale up the low carbon emission bus market.

4. Examine the costs and benefits of selected technologies on a case study basis with an estimation of uptake volumes against different payback rates.

Methodology

Interviews with stakeholders and desk-based analysis

Deliverables

Final report June 2014.

Technologies Examined

Diesel hybrid
Hydraulic hybrid
Electric
Flywheel
Ethanol
CNG/biomethane
Light-weighting plus smart ancillaries

Organisation type	Number interviews
Bus operator	12
Local Transport / Integrated Transport Authority / PTE	4
Transport for London	1
Manufacturer	3
Technology supplier	1
Leasing company	1
Passenger Transport Executive Group	1
Total	23

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Interim findings - barriers to uptake and suggestions for stimulating the market

Key Barriers to Take-up

- High capital cost of some technologies (hybrid/EV)
- Concern of battery life and replacement cost for these technologies
- Infrastructure CNG and battery EV require significant investment
- Range concerns regarding EVs
- Concern of performance in real-world vs standard test cycle
- Insufficient steer/guidance on future of the low carbon technologies and Government support
- Application process for funding can be complicated and always fit financial planning
- Confusion over which technology is best
- Uncertainty regarding environmental benefits (LA)
- Reluctance of operators to adopt LCB (LA)

Overcoming Barriers

- Continued availability of subsidies or reduction in purchase price
- Support of linear subsidy rate based on level of CO_2 saving
- Support for infrastructure
- Working in partnership to share knowledge
- Guidance on what low carbon techno available
- Govt to provide stronger steer on information regarding LCB
- Demonstration of techno important
- Low emission zone and other transport policy measures

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Concluding Comments

- Low carbon buses have an important role in reducing CO_2 & air pollution emissions & can help bus operators reduce fuel costs.
- Good progress in the low carbon bus market in the UK especially hybrids, but still niche market.
- Key barriers to take-up - high upfront costs for hybrid and electric, confidence in performance of low carbon buses plus cost of infrastructure.
- Technologies such as gas/biomethane and flywheel achieve payback within 5 years without Green Bus Fund.
- What will help – review of DfT fiscal policy to accelerate market take up, provision of information on different technologies and their performance for bus operators & sharing of real world data will increase confidence in low carbon buses.
- BWG will undertake a new piece of work looking at specific policy interventions which can help advance the low carbon bus market.

Thank You

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The Low Carbon Vehicle Partnership

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- **Connect**: With privileged access to information, you'll gain insight into low carbon vehicle policy development and into the policy process.
- **Collaborate**: You'll benefit from many opportunities to work – and network - with key UK and EU government, industry, NGO and other stakeholders
- **Influence**: You'll be able to initiate proposals and help to shape future low carbon vehicle policy, programmes and regulations

LowCVP is a partnership organisation with over 180 members with a stake in the low carbon road transport agenda.

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