Expanding the low carbon bus market and influencing Government policy

Euro Bus Expo 2014
Wednesday, 5th November 2014

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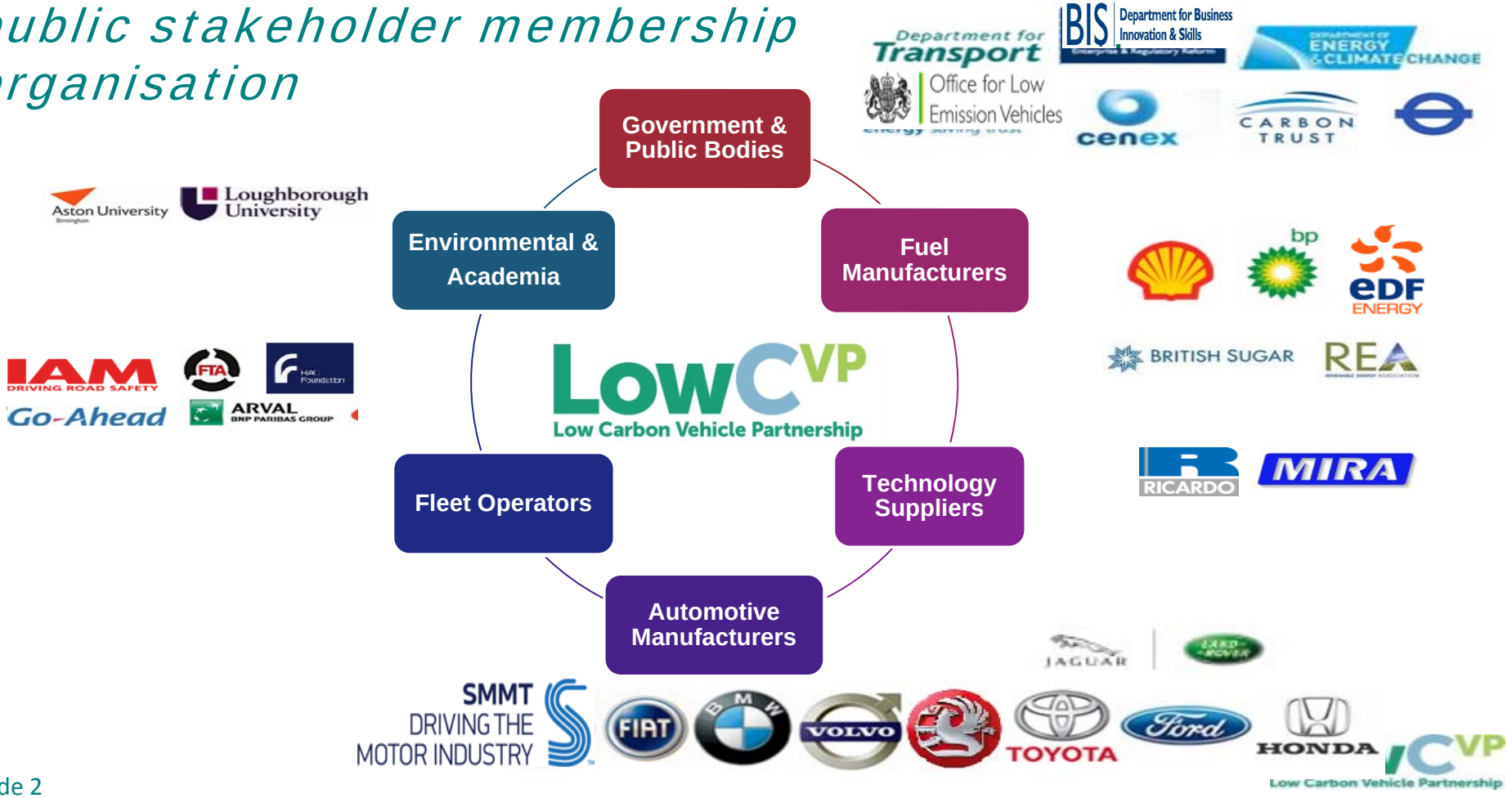
Low Carbon Vehicle Partnership

LowCVP Low Carbon Vehicle Partnership
Connect Collaborate Influence

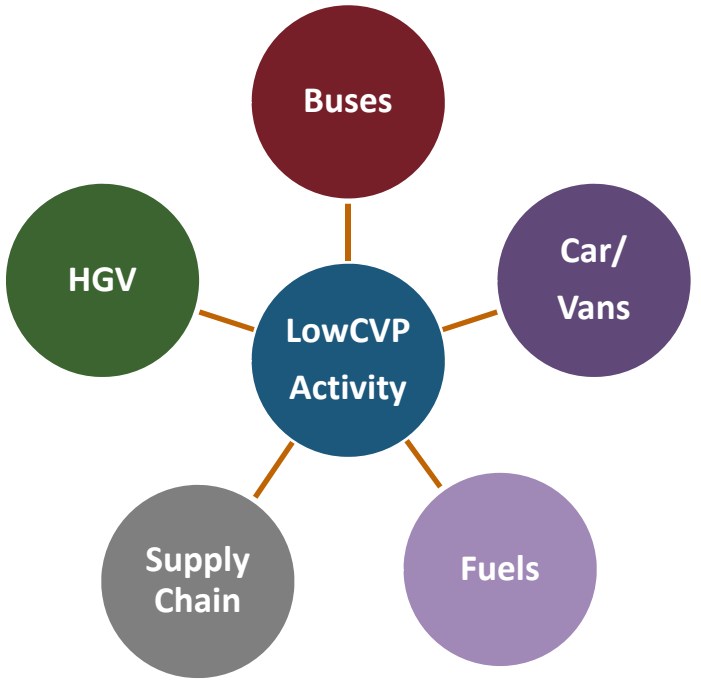
LowCVP is a unique private-public stakeholder membership organisation



Mission: To accelerate a sustainable shift to low carbon vehicles & fuels in the UK and stimulate opportunities for UK business

Facilitate multi-stakeholder engagement with the aims of:

- Building understanding and consensus to overcome market barriers through the provision of robust evidence.
- Developing innovative and collaborative initiatives that stimulate the supply and demand of low carbon vehicles and fuels.
- Influencing Government on low carbon vehicle and fuel policy.



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LowCVP - Bus Working Group Activities

Technical

- Testing & accreditation procedures for LCEB
- Low Carbon Bus Technology Roadmap
- Information sharing e.g. demonstration trials, fleet performance

Policy

- Created the low carbon emission bus definition
- Supporting DfT & OLEV developing fiscal incentives – Green Bus Fund, BOSG LCEB, OLEV Low Emission Bus grant
- Local Authority Tool Kit
- 'Barriers and Opportunities to Expand Low Carbon Buses' research study

Awareness Raising

- LCEB market monitoring
- LCEB news and accreditation updates
- Low Carbon Emission Bus Case Study Guide and Workshops (2015)
- Networking with industry, operators and Gov – BWG meetings

Stakeholder forum chaired by TfL - Bus OEMs, technology, infrastructure and fuel suppliers, bus operators, academia, DfT, OLEV and local authorities

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What is a Low Carbon Emission Bus?

A Low Carbon Bus produces at least 30% fewer greenhouse gas emissions than the average Euro 3 equivalent diesel bus of the same total passenger capacity. Greenhouse gas emissions cover 'Well-to-Wheel' (WTW) performance.

Well - to-Tank

GHG emissions associated with fuel production

\+

Tank - to - Wheel

GHG exhaust emissions - real life bus drive-cycle eg MLTB test cycle.

= WTW CO2eq g/km

Examples of Accredited Low Carbon Buses

Diesel hybrid

ADL Environ 400

Electric

Optare Solo

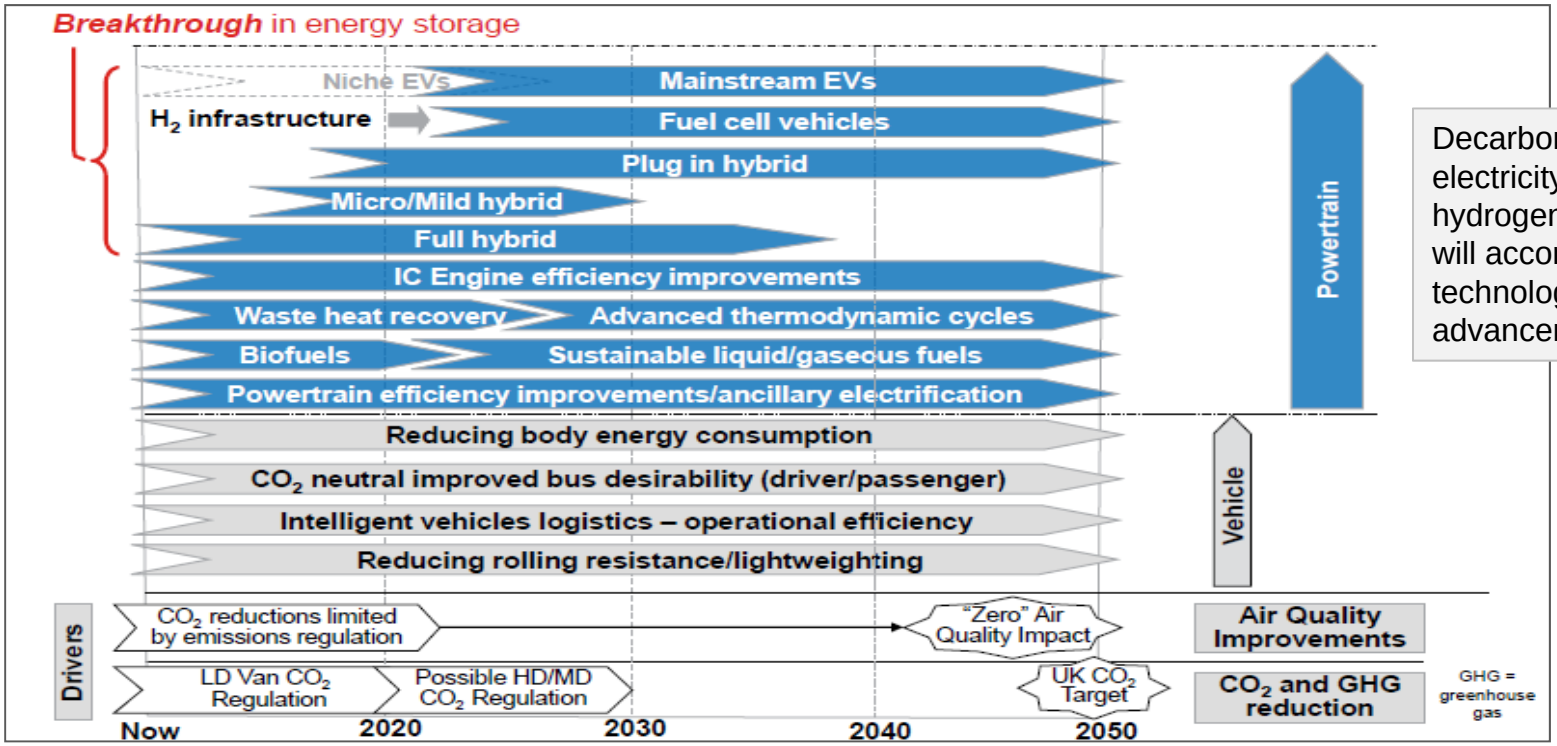
Biomethane

MAN Ecocity

Micro-Hybrid

Wrigthbus Streetlite

The Pathway To Zero Emission Buses



Decarbonisation of electricity & hydrogen production will accompany technological advancements

Low Carbon Technology Roadmap (LowCVP 2013)

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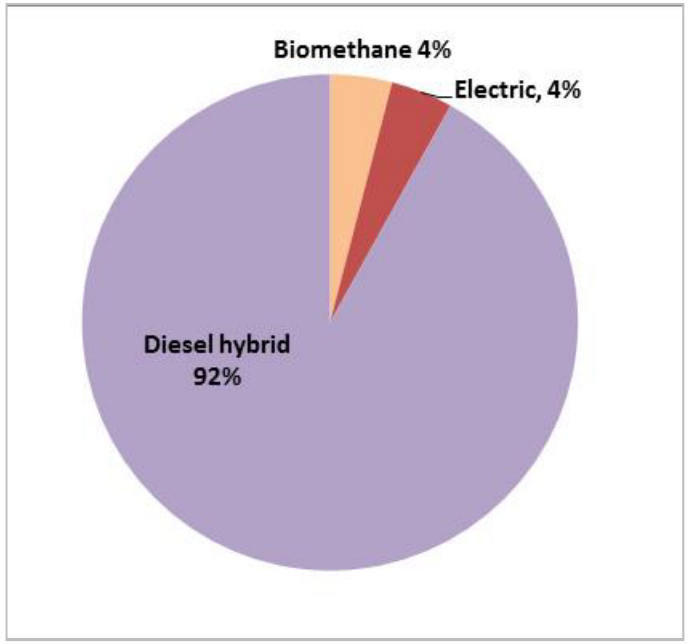
How has policy influenced the LCEB market?

- Green Bus Fund - £100m over four years *(no longer running*)
- BSOG LCEB incentive - £6ppkm (*under review*)



1803 LCEB in service

Represents 2% of UK bus market

Barriers to overcome

- **Financial**
- **Technical**
- **Performance data**
- **Perception**

NEW! OLEV Low Emission Bus Grant

£30m between 2015-2020 , details to be announced

Diesel Electric Hybrid Buses

Technology / Market Status

- Combination of diesel engine & lithium battery
- Series or parallel in configuration, combined with stop-start
- 1647 hybrids in service across 21 regions of the UK

Environmental

- CO_2 emission saving: up to 30%
- Lower air pollution emissions
- Brighton & Hove Council undertaken real world testing

Barriers to Uptake

- High capital cost
- Uncertainty battery life
- Cost of battery replacement
- Residual value
- Confidence in performance

London, Manchester and Oxford largest fleet

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Flywheel Hybrid

Technology

- Electro mechanical energy to drive the bus based on kinetic energy recovery (KERS)
- Retrofit and OEM product
- Go-Ahead Group trialled 8 Gyrodrive (GKN) system, retrofitting 50 buses
- 30 buses in Southampton & 19 Wiltshire - Clean Bus Technology Fund

Environmental

- CO_2 emissions savings: 15-25%
- Lower air pollution emissions will be demonstrated through CVTF

A flywheel is an alternative energy storage devise to batteries and ultra-capacitors

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Electric Buses

Technology / Market Status

- Bus driven entirely by electric motor powered lithium battery
- 64 electric buses in service, 8 regions
- Nottingham largest fleet
- York City Council 1st retrofit double decker electric bus

Environmental

- Zero tail-pipe emissions
- WTW CO_2 emission savings: 50 -100%
  (carbon intensity of grid)

Barriers to Uptake

- High capital cost
- Uncertainty battery life
- Cost of battery replacement
- Mileage/range
- Cost of charging infrastructure
- Confidence in performance

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Demonstrations - Wireless (Induction)Charging

Technology Benefits

- Requires no cable connection
- Battery topped up on route
- High efficiency of transfer (90%+)
- Significantly increases vehicle range

Milton Keynes - Electric Bus

- Mitsui-Arup Joint Venture
- 15 miles in centre of Milton Keynes
- 2014 to 2019

London – Range Extended DD Hybrid 2015

- TfL to trial 3 new ADL Enviro400H buses
- 11km, running time electric ~50ms
- GPS to operate all electric on certain routes

Biomethane Buses

Technology / Market Status

- Spark ignition engine powered by compressed biomethane gas
- Biomethane: anaerobic digestion of organic waste, biomethane injected into natural gas grid, depot refuelling infrastructure
- Green Gas Certificates guarantee biomethane supply
- 119 biomethane buses in service, 6 regions, Reading largest fleet

Compressed biomethane stored on roof

Environmental

- WTW CO_2 emission savings: >80%
- Lower air pollution emissions (*when replacing E3/4/5 diesel*)
- Renewable transport fuel, indigenous fuel supply from waste

Barriers to Uptake

- Higher capital cost
- Cost of refueling infrastructure
- Confidence in performance (*proven internationally*)

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Hydrogen Fuel Cell Buses

Technology/Market Status

- Fuel cells convert the chemical energy of hydrogen into electrical energy that powers the bus
- London - 8 fuel cell hybrid buses TfL (demonstration)
- Aberdeen - 10 fuel cell buses multi0stakholder collaboration – First Group, Stage Coach, SSE, Aberdeen Council

London Hydrogen Bus

Environmental

- Zero tail-pipe emissions
- WTW CO_2 emission savings: +15% to -90%

(Method of H2 generation)

Aberdeen Hydrogen Bus

Barriers to Uptake

- Significantly higher capital cost
- High cost of H_2 infrastructure
- H&S considerations
- Confidence in performance

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LowCVP policy recommendation for stimulating growth in the UK LCEB market

- Uncouple BSOG from fuel use, replace with subsidy per km or per passenger for all buses.
- Modify LCEB incentive to be on a sliding scale based on WTW CO2 savings of the low carbon emission bus e.g. higher CO2 savings technologies receive a higher payment.
- Revise the LCEB accreditation procedure – new Euro 5 baseline vehicle and expand testing to cover an 'rural' routes and ancillaries.
- Ensure a technology neutral approach is taken with new vehicle grant schemes and encourage rewarding technologies and fuel in line with their WTW CO2 and air quality performance.
- Consider provision of funding for infrastructure.

Thank You

For more information or to join LowCVP

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