

# The Bus of the Future

*UK Bus Summit 2016 – 11 February 2016*

*QEI Conference Centre*



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# ...is here now



# Mobility solutions should be

**Low Carbon Energy - in**

Renewable Electricity, *Green Hydrogen*, Biodiesel, *Biomethane*

**High Efficiency Vehicles - with**

*Electric*, Hybrid, *Plug-in*, Fuel Cell, *Gas engine*, Light weight, Space saving

**Low Emissions**

*Zero emissions*, Geo-fence ZE mode, *Euro VI engines*, Low Noise



# “The Journey of the Green Bus”

- LowCVP in partnership with Greener Journeys published at UK Bus Summit 2016 today.
- High-level overview of the key challenges and innovative low carbon and low emission solutions of the last 20 years.
- Growth/change in UK bus market since 1996.
- 1<sup>st</sup> Phase of 3 studies of the UK bus market.

**BACKGROUND**

**What is an LCEB**

In 2008, the LowCVP devised a definition of a Low Carbon Emission Bus as one producing 30% less well-to-wheel greenhouse gases (GHGs) emissions than a normal Euro III diesel bus.

The greenhouse gas emissions covered were methane, carbon dioxide and nitrous oxide. This served as a performance target for different low carbon bus technologies and fuels and as the bar for qualification for the Government's fiscal incentives.

Recognising the need to balance air quality and climate change objectives, the definition of a LCEB has now been superseded by new Low Emission Bus (LEB) criteria (see page 11).

**DID YOU KNOW...**

A Low Carbon Emission Bus produces 30% less well-to-wheel greenhouse gas (GHG) emissions than a normal Euro III diesel bus.

**HYDROGEN**

Hydrogen fuel cell buses are powered by fuel cells which convert the chemical energy of hydrogen and deliver electrical energy into the powertrain. Hydrogen is, typically, stored compressed in tanks on the roof of the bus with hydrogen refuelling facilities normally located at the bus depot. These buses produce no greenhouse gases or air pollution in use; water vapour is the only tailpipe emission.

Hydrogen can be produced from a variety of sources including fossil fuel-based industrial processes and the electrolysis of water using renewable electricity. The largest hydrogen bus fleet is currently run by Stagecoach in Aberdeen. The

**DID YOU KNOW...**

Road transport contributes around 60% of NOx emissions at the roadside where air quality is poor.

**The carbon challenge**



**Recent policy developments**

**Tackling air quality**

**UK policy initiatives**

Over the last decade, UK government policy has focused on accelerating the introduction of clean, low carbon buses. The bus sector has been a key area of attention because of the contribution buses have made to air pollution in the most congested urban areas.

Following the DfT's approach, Transport Scotland introduced their own Green Bus Fund and BSOG LCEB incentive to galvanise the low carbon bus market in Scotland.

The LowCVP has also focused on identifying the low carbon technologies and fuels most suitable for buses, seeking to understand the barriers to growing the market, and devising appropriate incentive mechanisms.

Through research in 2014 the LowCVP showed that ongoing fiscal incentives were required to encourage further uptake of low carbon buses. Support was needed for the purchase of new kinds of bus technologies and accompanying recharging/refuelling infrastructure.

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**BACKGROUND**

**London leads**

London has a well-developed strategy for improving air quality by 2025, including the implementation of an ultra-low emission zone (ULEZ) by 2020, retrofitting of buses and licensing new taxis to be zero emission capable from 2018. Transport for London (TfL) has led the way in trialling and adopting low carbon and low emission bus technologies.



# Green Bus Technologies in service

- LowCVP developed Low Carbon Emission Bus (LCEB) certification in 2009.
- New Low Emission Bus (LEB) **defined by LowCVP.**
  - Tests, Carbon, GHG, Emissions, Range, Energy
- **Wide variety** of technologies and solutions for operators and local authorities.
- **Mix of options** for local authorities and bus operators to provide low cost mobility while reducing greenhouse gas emissions.



Biodiesel



Hydrogen



Battery



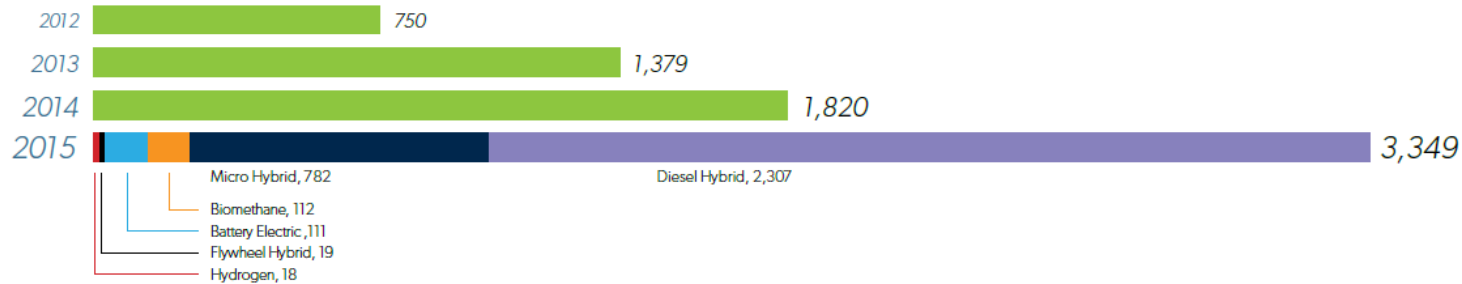
Natural Gas / Biomethane



Plug-In Hybrid

# Green Buses across the country

- Low Carbon Emission Buses are not just prototype/pilot demonstrations, they are proven and **perform financially as well!**
- Proof of this with **over 3,000** Low Carbon Emission Buses (LCEBs) in operation today.
- **25% of new bus registrations** in 2015 in the UK were Low Carbon Emission Buses.



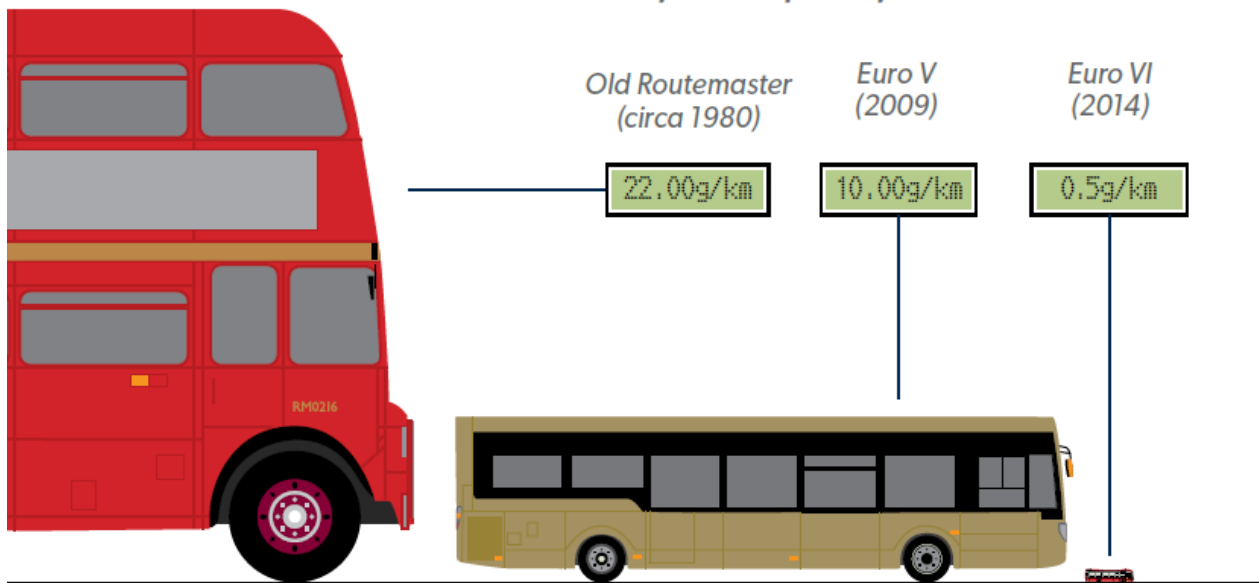
<http://www.lowcvp.org.uk/initiatives/leb/Home.htm>  
for more information.



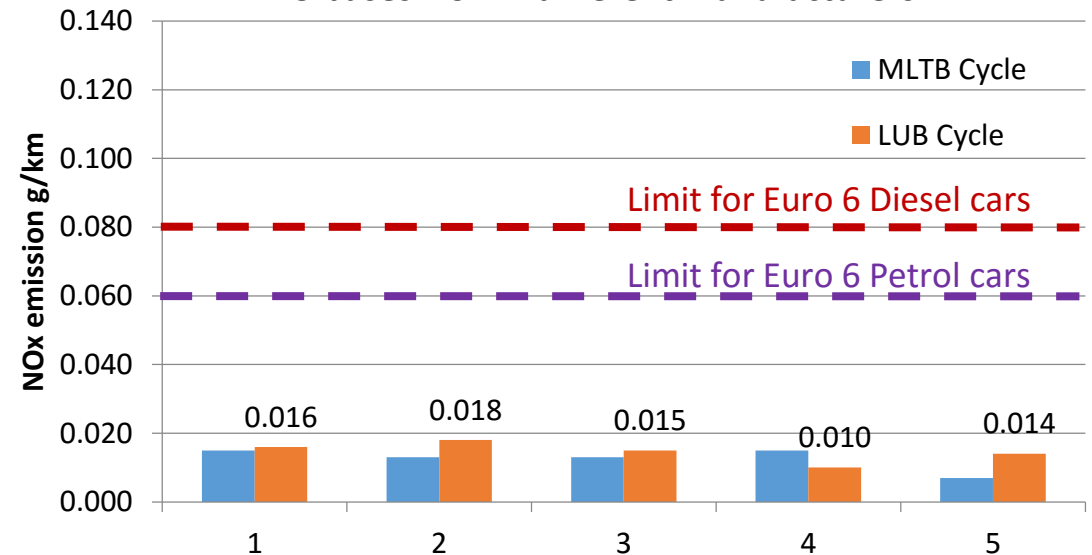
# Green Buses are Clean Buses

- The future is now – today’s generation of Euro VI standard buses are key to tackling air quality issues in towns and cities.
- LowCVP UK Bus Test Cycle shows **all Euro VI technologies showing very low NOx performance in the real world.**

*A Euro VI bus emits 95% less NOx than a Euro V ... and a fraction of that of an old Routemaster*



**NOx emissions from new Euro VI Diesel Buses  
5 buses from 4 different manufacturers**





# Green Buses are Efficient



## Decrease Congestion

Better use of road  
space



## More Fuel Efficient

Lowering Costs for  
Operators and reducing  
GHG emissions.



## Greater Mobility

Low cost solution for  
increasing access to  
transport



# The Bus of the Future – is today's Low Emission Bus

- The UK is now a **world leader** in providing low carbon and low emission bus solutions.
- **A wide variety of proven technologies and fuel** solutions are operating and on the market today.
- The LowCVP continues to help accelerate shift to the low carbon transport; developing policy, supporting collaboration and facilitating connection between industry and government.

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