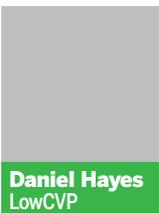


# Buses leading way on the 'Road to Zero'

Buses are leading in the adoption of low carbon bus technologies and fuels, ahead of any other road transport sector in the UK



Daniel Hayes  
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▶ The Low Carbon Vehicle Partnership's Bus Working Group has been collaborating with the Department for Transport to develop low carbon/ emission bus policy for over

10 years, facilitating the UK's adoption of over 2,000 low carbon buses with supporting infrastructure. The LowCVP has also worked with Transport Scotland to ensure that funding streams are compatible across the UK.

## 'Kick-starting' the market

In 2007, the LowCVP worked with government and industry to develop the Low Carbon Emission Bus (LCEB) standard. Any bus that could achieve a 30% reduction in well-to-wheel greenhouse gas emissions compared to an equivalent diesel gained a Low Carbon Emission Bus certificate.

The emissions performance was measured over a test cycle known as the Millbrook London Transport Bus cycle on a rolling road (chassis dynamometer) over the equivalent of the 159 bus route in London, which originally ran from Brixton to Oxford Circus.

The limit of 30% was chosen as this was the performance of diesel-hybrid buses compared to a standard diesel vehicle. At the time, such hybrids were also the most promising available technology for the reduction locally polluting tailpipe emissions. Hybrids provide fuel savings by capturing and reusing braking energy. Hybrid technologies came in a range of different types by storing the braking energy in different ways, including flywheels, batteries and even hydraulic systems.

Some other technologies also met the LCEB target, including battery electric buses, hydrogen buses and gas buses running on 100% biomethane.

Once a model had achieved LCEB status, a certificate of its emissions performance

was created, and a manufacturer was able to provide this to an operator as evidence of the expected performance in the real world. However, these new low carbon technologies were more expensive than the standard diesel and so the LowCVP worked with government to develop two key funding streams to support the rollout of these new emissions saving buses.

A series of Green Bus Funds (2009-2015) were created to 'kick-start' the market and help make up the capital cost difference between new, more fuel-efficient, technologies and standard diesels. Over six years, the Department for Transport awarded just under £90m over four rounds of funding, which saw over 1,200 LCEBs in operation by 2015.

The second key element was support for the operating cost of these new operations to ensure the new buses were at least as financially attractive to run as standard diesels. The government helps to reduce the cost of bus operations through the Bus Service Operators Grant (BSOG), by providing operators with roughly one-third of their fuel costs (typically

diesel). A new BSOG LCEB incentive was created (at six pence per km) to make sure that the new, lower emission technologies were equally supported as standard diesels.

The LowCVP estimates that by 2015, these buses saved around 70,000 tonnes of (well-to-wheel) greenhouse gas emissions, the equivalent of removing 150,000 cars from the road doing an average of 10,000 miles a year.

## Beyond tailpipe emissions

A key aspect of the UK's low carbon bus certification procedure is the inclusion of greenhouse gas emissions associated with a fuel or energy's extraction, production and delivery to the vehicle as well as any direct emissions from the tailpipe. These upstream - or indirect - emissions, also known as well-to-tank emissions, are vital in assessing any new technology's full impacts. (Particularly critical in the case of electric vehicles where emissions at the tailpipe are zero, of course.)

The LowCVP lists the UK well-to-tank emissions factors that are used when calculating the well-to-wheel greenhouse gas emissions of buses on the bus section of its website. The LowCVP is also working towards a full life cycle analysis of vehicle operations, where emissions associated with the manufacture of vehicles and their components are also included in their overall impacts.

## Air quality challenges

Air quality pollutants from road vehicles have been an issue for several decades, but concern has increased in recent years as stronger evidence of its impacts on human health have emerged. Poor air quality caused by increasing traffic levels in cities and towns across the EU saw the introduction of Euro standards for light and heavy duty vehicles. These standards were introduced to ensure that new vehicles were cleaner than those that came before, with the introduction of three-way catalysts for petrol vehicles and particulate filters for diesels. Changing to ultra-low sulphur fuels was also a component of measures to reduce air pollutants as it contributed to the formation of acid rain.

The EU set targets for reductions in average concentrations of harmful pollutants for EU member states to reach and by 2015. These have highlighted that several (mainly urban) areas across the UK have been exceeding the limit for nitrogen dioxide (NO<sub>2</sub>). Buses, due

## HIGHLIGHTS

- ▶ **Around 80% of new buses in 2018** were utilising some form of fuel saving.
- ▶ **15% of the UK bus market** is using some form of low carbon technology or fuel (over 6,000 vehicles; 40,000 using lower carbon fuel).
- ▶ **4.2% of new buses in 2018 were zero emission**, compared with 0.6% of vehicles in the passenger car market.
- ▶ **Over 4,000 diesel-hybrids** are operating across the UK
- ▶ **UK has the second largest zero emission fleet in Europe**, second to Netherlands - over 300 in operation.
- ▶ **All 225 gas buses** are running on 100% biomethane



to their high frequency in city centres were identified as contributing significantly in some areas to these high levels of NO<sub>2</sub> emissions. The latest Euro 6 standard for heavy duty vehicles uses selective catalytic reduction technologies with urea dosing to remove significant amounts of NO<sub>2</sub>; up to 95% in some cases, compared with Euro 5 models. Euro 6 buses are now some of the cleanest vehicles on a per kilometre basis; and, of course, much, much cleaner on a per passenger basis.

In response to the air quality challenge, the LowCVP worked with industry and the Department for Transport to develop a new Low Emission Bus (LEB) standard for buses, supported by a capital grant scheme called the Low Emission Bus Scheme. An LEB saves 15% well-to-wheel greenhouse gas emissions compared to a Euro 5 diesel equivalent and, importantly, must also have a Euro 6 certified engine or equivalent emissions. This ensured that the new Low Emission Bus scheme would fund vehicles that provided both a reduction in greenhouse gas emissions and extremely low levels of harmful air pollutants. Certificates of LEB performance are available to download from the LowCVP website, ensuring transparency and allowing operators to compare vehicle and technology performance.

The Low Emission Bus Scheme had two rounds from 2015-2017, distributing £41m to local authorities and operators across England, resulting in over 400 LEBs and supporting infrastructure being funded. The Scottish Green Bus Fund rounds 5-8 have also adopted the LEB standard, funding 350 LEBs over three years.

The details of the scheme, alongside a breakdown of different technologies and certified LEB models, are all detailed in the Low Emission Bus Guide, available to download from the LowCVP website. This guide details key processes and challenges presented by new bus technologies as well as presenting performance data from Low Emission Bus certificates. The guide will be updated with new funding developments such as the Ultra-Low Emission Bus Scheme.

### Ultra-Low Emission Bus Scheme

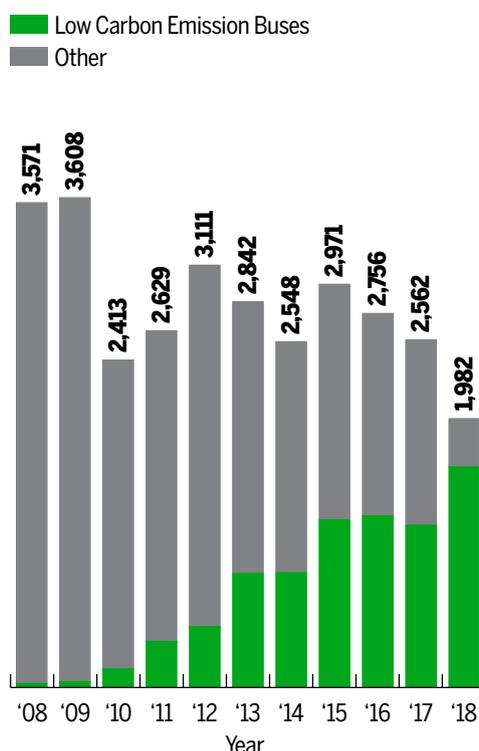
With air quality continuing to be a high political priority, the DfT has asked the LowCVP to further develop the Low Emission Bus accreditation scheme to encourage more

zero emission mileage from vehicles and to better understand the emissions performance of that latest Euro 6 diesels. LowCVP conducted a diesel test programme on behalf of the DfT, testing Euro 6 buses over the new UK Bus Cycle. (This is a further development of the Millbrook London Transport Bus cycle, which now requires that all ancillary loads like lighting and heating are active during the test.) The test cell temperature is also lowered to 10°C to ensure emissions after-treatment selective catalytic reduction systems are proven to work in colder temperatures (more typical British conditions compared to the balmy 18°C for the previous test).

A new baseline was created and LowCVP's Bus Working Group defined an Ultra-Low Emission Bus as one that saves 30%

### MARKET IMPACTS: LOW CARBON EMISSION BUS REGISTRATIONS AND TOTAL BUS REGISTRATIONS, GREAT BRITAIN, 2008-18

As part of its support work to the Department for Transport, LowCVP monitors low carbon bus registrations in the UK. The chart below demonstrates how, over the last decade, the UK bus industry has embraced low carbon buses to the extent that over 80% of new registrations had LCEB certification in 2018.



## “The UK bus industry will require significant support from a wide range of partners”

well-to-wheel greenhouse emissions compared to a Euro 6 diesel (and which also needs a Euro 6 certified engine if the technology has an internal combustion engine).

In February 2019, the winners of the Ultra-Low Emission Bus Scheme were announced, with £48m funding 263 Ultra Low Emission Buses (ULEBs) and supporting infrastructure across England and Wales. This includes battery electric and hydrogen buses for Manchester, Newcastle, Newport, Cardiff, Crawley and many more locations.

### Driving for ‘Net Zero’

Looking forward, there is strong momentum for city centre operations to be performed by zero emission vehicles. London, Copenhagen, California and the Netherlands have all set target dates for fully zero emission bus fleets. In the UK, the challenges for bus operators in a world of increased congestion, internet shopping and affordable private transport are clear. Despite these pressures, the UK bus industry is leading other road transport sectors towards the zero emissions revolution.

In 2018, 4.2% of new buses registered produced zero emissions, significantly higher than the passenger car market (2.7%). If this good progress is to be sustained - and accelerated - with the number of passenger journeys falling year-on-year, the UK bus industry will require significant support from a wide range of partners, including grid suppliers, town planners, the farming and construction industries. It will need to embrace new - some as yet unknown - new opportunities.

The LowCVP will continue to support the industry, sharing best practice, facilitating discussions and delivering initiatives to help the UK reach the 2050 Net Zero target. ■

 Passenger Transport is a media partner of the LowCVP's Annual Conference on July 8, Westminster: 'Future Fuels on the Road to Zero'. [www.lowcvp.org.uk/events/conference](http://www.lowcvp.org.uk/events/conference)