Back to the future for BUS AND COACH

With an operating life of more than a decade, and facing stringent emissions regulations being imposed in city centres, bus fleets are being forced to consider retrofits to keep running, finds Steve Banner

After peaking at 8.6 million in 1939, London's population is soon set to surpass that figure and is now forecast to rise to 10.3 million people by 2030. The challenge of accommodating their demands, in terms of transport, goods and services falls to, among others, Glen Davies, programme manager at TfL (Transport for London).

Retrofit emission control systems that will bring older trucks up to Euro VI may be woefully thin on the ground, but there is no shortage of packages for buses. Nor need they necessarily rely on AdBlue, says Lars Tinggaard Johannesen, product manager at Amminex Emissions Technology (pictured, left). "The approach we use is somewhat different," he smiles.

The Danish company has developed something called ASDS – Ammonia Storage and Delivery System. Instead of AdBlue, it uses ammonia held as a solid in removable and replaceable cartridges which is released into the exhaust system as a gas. "The dosing unit is the only moving part," he says.

"Each cartridge has twice the volumetric capacity when compared with AdBlue," he continues. "The cartridges aren't pressurised, and they operate at room temperature. Nor is there a weight penalty. Each cartridge weighs 16kg which equates to around 20 litres of AdBlue."

Early UK adopters include Metroline, which initially had ASDS retrofitted to 55 Euro V buses it was operating in London to bring them up to Euro VI. It is now installed in around 250, says Johannesen.

"We've fitted ASDS to Metroline's Volvo B9s and to its ADL Enviro200s, Enviro400s and Enviro400Hs," he says. "On average, they've achieved a 91% NOx conversion rate."

Last year, London mayor Sadiq Khan announced the launch of a TfL retrofit initiative costing a hefty £86.1m to upgrade upwards of 50% of the capital's buses to Euro VI. Around 5,000 vehicles are being affected, and the aim is to ensure that the capital's entire fleet of buses complies with Euro VI as a minimum by September 2020.

To clean up their act, pre-Euro-VI buses are being fitted with upgraded exhaust systems supplied by one of five suppliers appointed after a competitive tender process. They are Amminex, Eminox, Baumot, Proventia and HJS.

Johannesen's observations were supported by a short video clip featuring Metroline's group engineering director, Ian Foster. "Changing a cartridge takes no more than 30 seconds and you don't get problems with AdBlue pumps," he observes. "Furthermore, I can check the level of NOx reduction on my phone for that day, that week, that month or that year."

ASDS has built-in sensors that measure engine-out NOx levels as well as NOx levels in the exhaust pipe. Data is sent continuously to a server so it is possible to say exactly how much NOx has been removed. "We can provide a NOx tracker so that you can see emission levels and you can receive a text if a cartridge is empty," says Johannesen.

Foster stresses that Metroline is not scared of new technology. "We'll be rolling out a hydrogen bus next year," he states. Hydrogen buses built by Wrightbus and Van Hool are already in service in London with Tower Transit, and hydrogen refuelling facilities will be installed in Metroline's Perivale garage.

Installing ASDS can sometimes be a challenge, says Johannesen. "Each of our retrofit teams can convert a vehicle a day," he says. "However, we can be in a situation where we have a bus that is the same make and model and built in the same year as the one a team was working on previously, and with a consecutive VIN number, yet the wiring loom follows a different route. For that reason we may have to try to relocate some of the vehicle's original components.

"We also have to work with the bus's onboard diagnostics system," he continues. "Everything may look okay, but there can sometimes be a problem after a month or so." What Johannesen is highlighting is a lack of standardisation. "It means

FACT

In 2017, Transport for London launched an £86.1m tender to upgrade 5,000 buses – 50% of its fleet – to the Euro VI standard

FACT

Millbrook Special Vehicles has just finished installing a Euro VI engine, start-stop gearbox and electric cooler in a 2009 bus

"We can provide a NOx tracker so that you can see emission levels and get a text if a cartridge is empty"
Lars Tinggaard Johannesen

that every time you do a retrofit, it's the first time," he remarks.

One of the big advantages claimed for ASDS is that it works particularly well in bitterly cold weather. Retrofit packages that depend on AdBlue sometimes fail to function as efficiently as they should at low exhaust temperatures; and temperatures can be low when a bus departs from its chilly garage first thing in the morning having been stationary all night. The company has even seen NOx reduction levels as high as 98% at -15°C.

Amminex has forged close ties with Eminox on this side of the North Sea. So, the Gainsborough, Lincolnshire-based business is offering ASDS alongside its own AdBlue-based SCRT emission control technology.

Johannesen does not deny that replacing cartridges is more expensive than replenishing AdBlue reservoirs. "They add £500 to £800 per vehicle per year to your operating costs, but you don't have to worry about fixing AdBlue pumps," he says.

Buses fitted with ASDS will get through 1.5 to 2.3 cartridges a week, he adds. "The system works best in low-mileage applications," he observes.

ENGINE SWAP

While retrofitting an exhaust emission control system is likely to be the option chosen by most operators of pre-Euro-VI diesel buses under pressure to make their vehicles compliant with the latest emission standards, there is another way of achieving the same goal; remove the existing engine and slot in a Euro VI diesel instead.

Millbrook Special Vehicles (MSV) has just completed the first Cummins RePower bus conversion of this type.

"It was on a 2009 ADL Enviro400 with 200,000 miles on the clock," says MSV business development manager Andy Brooks (pictured, centre). "It had a 6.7-litre Euro V engine, a ZF EcoLife automatic gearbox and a hydraulic cooling pack."

The diesel was replaced with a Euro VI 6.7-litre, an EcoLife box with stop-start and an electric cooling pack to reduce parasitic losses from the engine. "It means that a fuel saving of up to 8% is achievable," he adds.

The bus has subsequently been taken over the wide variety of surfaces the Millbrook Proving Ground offers, including speed humps, and subjected to kerb strikes – a common occurrence with urban buses. Testing should soon be complete.

The exercise was a bit more complicated than simply whipping one set of components out and dropping in another set, says MSV principal engineer Richard Hudson (pictured, right). "Once we'd taken out the old engine and gearbox, we carried out a 3D scan of the engine bay and converted it into CAD data so that we could carry out the necessary design work," he says.

Use has also been made of Millbrook's variable temperature emissions chamber, which can carry out fuel economy and emissions tests at temperatures from -25°C to +50°C.

The chamber is 26.5m long, 6.5m wide and 5m high; even the largest buses and trucks can be accommodated. ■