



# Cost cutting

Available and emerging technologies are proving themselves eminently capable of reducing fuel consumption and emissions – but at what cost? Brian Tinham reports

**T**rials in Stratford-upon-Avon of the UK's first full-size battery-powered bus, the Optare Solo EV, have apparently convinced operator Johnsons Coach & Bus Travel that all-electric vehicles could have a place in its fleet. The trials, which concluded in August, compared the operation of the EV with that of a diesel equivalent on the Stratford Park & Ride service and the results were impressive.

Victoria Johnson, who managed the project, reports massively reduced fuel costs. "Electricity used in overnight charging cost £7.30, whereas the cost of diesel for a bus covering the same duty cycle was around five times that, at over £36," she says.

**Optare's all electric battery-powered bus in action: trials show massive fuel savings**

And she adds that, with the EV covering 65 miles a day on up to 13 round trips, the batteries still had around 20% capacity remaining. Permanent charging arrangements, particularly for layovers, "would enable that mileage to be increased significantly," she suggests.

John Johnson, managing director of the bus company, comments: "Although much data has still to be analysed, and we did identify infrastructure issues, our initial findings show a convincing case for the EV on this particular type of service."

It's not the first time Optare's all electric bus has appeared on UK streets. Durham County Council was the first local authority in the UK, with three Solo EVs being operated by Veolia on its Durham Cathedral service. These units were acquired with grant aid from the government's Green Bus Fund (now with second round £15 million funding up for grabs until October), which makes up the cost hike over equivalent diesel-powered buses. This county council estimates that using these buses will save 42 tonnes of CO<sub>2</sub> emissions a year.

All well and good, but no-one is forecasting a wholesale move to electric buses – not even Optare's optimistic commercial director Glenn Saint. Like others, he concedes that electric buses are likely to slot in behind electric-diesel hybrids on the technology uptake curve, with diesels still the mainstay for several years to come.

So what does experience look like with today's hybrids? Ian Tarran, engineering director for UK bus at Arriva, says its five Wrightbus and five Volvo diesel-electric prototypes – operating on the ultra-heavy Route 14 out of Wood Green for over a year now – have shown less compelling results.

Both hybrids have smaller engines than standard diesels. The Wrightbus units have 2.5 litre engines in



a series arrangement, driving a generator that, in turn, powers the electric motors. Volvo's configuration involves a 5 litre engine (compared to the 9 litre power plant at Euro 4 and 7 litre at Euro 3) in parallel hybrid with the electric ISAM unit.

Tarran reports that, although progress was initially slow ("not solely due to problems with the buses or hybrid technology"), early difficulties have been resolved. He cites, for example, drivers trying to restart the stop-start engines before pulling off from bus stops, thus causing system lock-out. "A simple modification, with a green light that tells the driver the engine is ready to go, was enough," he explains.

Currently, the Volvo fleet is being taken back to the manufacturer and modified to production status. Arriva has now ordered another 20 for delivery by the end of this year – which tells you something about the company's confidence. In fairness, Tarran says that both firms' buses performed well, but Arriva plumped for Volvo's bigger backup.

### Environmental limits

That said, he reckons there's still some way to go to prove the environmental improvement argument – at least with hybrids on heavy inner city duty cycles. "They've met the expectations that TfL [Transport for London] set for us – at least 20% better than standard buses at Euro 3. But we now have Euro 4 engined buses from Alexander Dennis and Wrightbus, as well as some Euro 5 buses – all of which are significantly better than Euro 3 anyway.

"Our hope is that ongoing developments in hybrid technology at Volvo will deliver better fuel and hence carbon emissions benefits. Volvo has spent millions of euros on the technology ... and we believe the production buses will be better," says Tarran. "The other point is that, if we put these buses out with the regional companies, then the fuel efficiencies might well be much better."

Certainly, TfL's wider hybrid trials, which started back in 2006, demonstrate better fuel performance, with initial tests showing a 31% reduction in fuel consumption and CO<sub>2</sub> emissions, even compared to

**London's Arriva hybrids have done the business, but the gains aren't yet great**

its Euro 4 diesel fleet. TfL also claims significant air quality and noise improvements with both single deck and double deck buses. Indeed, London Buses operations director Mike Weston is on record stating that, as the cost of hybrid technology decreases with increasing production volumes, while fuel prices continue to rise, "hybrid buses will be commercially viable by 2015" – and that's despite the current capex premium of around £100,000 a vehicle.

He also reckons that, by 2012, TfL will have 300 hybrid buses in service, following which all new buses will be hybrids. Incidentally, he states that the organisation will be introducing five zero emission hydrogen fuel cell buses to the fleet later this year.

What about CNG (compressed natural gas) and biomethane, so popular elsewhere around the globe? If the addition of CNG engines to Optare's range of EcoDrive low carbon units for the European market is anything to go by, the only thing getting in the way will be the lack of a gas infrastructure.

Saint describes the development as an early benefit of its partnership with Ashok Leyland in India, announced in July. Ashok has already delivered 6,000 CNG buses to Indian bus operators and has developed the country's first one-litre-per-cylinder, six-cylinder CNG engine, employing multi-point fuel injection. That 5.7-litre turbocharged and inter-cooled unit (H6TI 'H') combines a power rating of 180hp at 2,400 rpm with low emissions, and is said to achieve similar emissions levels to the best diesel Euro 5 and EEV engines. Given that CNG itself produces around 26% lower carbon emissions, it's not difficult to see the potential attraction.

But cutting costs and emissions is not only about new driveline technology. Arriva's Tarran is one among many who suggests focusing attention on driver and technician training, too. He credits EcoManager (manufactured by 21st Century and now being fitted across Arriva) with helping to achieve significant fuel savings by providing driver assistance and feedback from telematics.

"We've been running it in Liverpool for about two and a half years, and the best performing garage is achieving about 8% saving across the fleet. We map the vehicle for greatest fuel efficiency, using a trained driver on the route, and then the system's in-cab display tells other drivers when to ease off the pedal, so that the auto transmission changes up," he explains. Subsequently, data from the bus is downloaded to a server, and drivers and supervisors can see how they performed against their peers.

As for technicians, Tarran points to work started by Arriva Southern Counties, which is now being rolled out into the shires. "It's all about training our technicians to even higher competence levels, so that, for example, faults are diagnosed more quickly and fixed first time, every time – rather than doing something and sending the buses out to see how they go. That improves uptime and economy." 