

Gas station

As natural gas-diesel conversions fall ever so slightly from grace, dual-fuel liquefied petroleum gas looks like its surprise replacement. Brian Tinham explains

Just as diesel and L/CNG (liquefied/compressed natural gas) heavy-duty conversions look uncomfortably likely to be consigned to the history books, so another dual-fuel engine technology pops out of the woodwork. And from a slightly surprising quarter, being none other than LPG (liquefied petroleum gas). Surprising only because it's been around for decades in the automotive sector, and has seen marginal uptake with HGVs in dual-fuel (with diesel) guise. However, offering only limited green credentials, it hasn't enjoyed serious attention.

Until now. All that is changing for four reasons. First, so-called bio-LPG is now scheduled to start arriving in bulk on these shores next spring, and that transforms its carbon saving potential. Second, although it's still early days, LPG-diesel Euro 6 engine conversions are increasingly available. And third, they're much lower cost than their L/CNG dual-fuel counterparts (circa £8,000 versus £24,000), meaning much faster payback.

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But fourth, incentives may yet be in the offing. Why? Because, in the wake of last month's High Court ruling in favour of environmental activists ClientEarth (not being appealed), the government is mandated to accelerate efforts to tackle air pollution. And as the finger of blame points largely at transport's emissions, low-NOx-emitting LPG now presents one of the most realistic, speedy and cost-effective solutions on the table.

LOW-COST SOLUTION

Quite simply, with some 1,400 LPG refuelling forecourts already established across England and Wales, the lead time and government investment implications are minimal. Compare that to L/CNG or an electric charging infrastructure. Couple that with £8,000 conversions, and you have a much cheaper and quicker fix than, for example, a heavy-duty vehicle scrappage scheme in favour of Euro 6. Indeed, bio-LPG has already been included within the government's RTFO (renewable transport fuel obligation)

scheme so will be covered by the RTFC certification regime.

What about L/CNG-diesel conversions, hitherto the darling of both enlightened truck operators and the DfT (Department for Transport)? As we go to press, publication of the latter's high-profile, £24 million Low Carbon Truck trial's final report has been delayed – although sources suggest that Cenex (the centre of excellence for low carbon and fuel cell technologies), which ran the data collection and analysis, submitted its findings months ago. That may be because the issue of methane slip (un-combusted natural gas making it past the after-treatment package) is proving more of a problem than anticipated.

Essentially, methane is an aggressive greenhouse gas – 86 times more potent than CO₂ over 20 years (34 over 100 years because of atmospheric decay mechanisms). So the world worries about it. Unfortunately, low levels of methane were detected in the tailpipe emissions of some L/CNG-diesel vehicles during the above trials. That triggered the DfT earlier this year to authorise a further study, in this case by LowCVP (the Low Carbon Vehicle Partnership).

Details are sketchy, but seven vehicles and technologies were tested at Horiba-



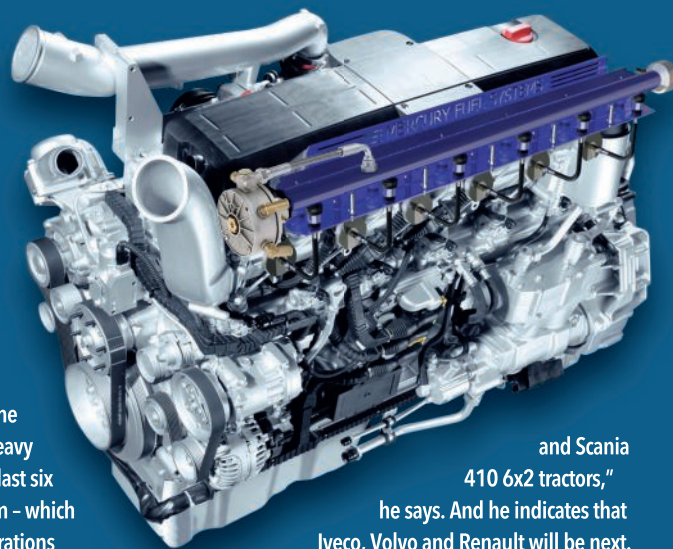


LPG-diesel technology

Mercury Fuel Systems, which has R&D facilities at Avonmouth and manufactures in Newton Aycliffe, has completed some 500 LPG-diesel dual-fuel heavy truck conversions over the last six years. Its Quicksilver system – which has gone through eight iterations from Euro 4 to Euro 6, according to sales manager Tony Dent – was the first multi-point, sequential fuel blending system designed to inject LPG in much the same way as diesel.

“The major development was from Euro 5 to Euro 6,” states Dent, explaining that, although mechanically similar, Quicksilver needs full software integration with much more sophisticated ECUs at Euro 6. As a result, conversions also have to be tailored to each vehicle OEM and engine type.

“That’s why we have our R&D centre,” he says, adding that it’s all about mapping new engine and vehicle types on its dynamometer rig. However, he concedes that timeframes are not trivial. “So far, we have about 10 Euro 6 conversions out there, including DAF XF 105 460



and Scania 410 6x2 tractors,”

he says. And he indicates that Iveco, Volvo and Renault will be next.

What’s involved for operators? Dent says lead times are typically three weeks, while the conversion itself – including fitting injectors, piping, automatic fuel switching equipment and LPG tank(s), as well as the software integration – takes two days, either at Avonmouth or the customer’s own workshop.

As for ROI, Dent reckons the conversion costs £6,000–£8,000 and suggests payback for trucks covering 120,000km per annum is 10–16 months. As diesel prices rise, that will improve.

What about warranty? Dent concedes that the OEMs will not cover converted truck engines but adds that Mercury offers comprehensive alternative drivetrain warranty. “The first year is free, and then we offer five years’ unlimited mileage warranty at very competitive prices.”

MIRA and Millbrook. They included: four dedicated gas Euro 6 trucks (a 40-tonne Scania, 40-tonne Iveco Stralis, an 18-tonne Scania and a 7-tonne Iveco Daily CNG); a Mercedes-Benz Euro 5 Axor dual-fuel LNG-diesel (Hardstaff conversion) donated by KBC Logistics; a Euro 6 DAF 44-tonner LNG-diesel (Prins conversion) from Howard Tenens; and a DAF 460 Euro 6 LPG-diesel truck (conversion by Mercury Fuel Systems).

Although LowCVP’s final report has also not yet been released, information seen by this journal suggests that existing L/CNG-diesel systems do exhibit methane slip – certainly enough to increase their total greenhouse gas impact. Which explains why professor David Cebon FRA (who heads up the Centre for Sustainable Road Freight) said at September’s IRTE Conference that in their current form these conversions do not offer a solution to global warming.

That’s not the only shock though. LowCVP’s study also appears to show that, while methane slip is not an issue for dedicated natural gas trucks, efficiency losses (compared to benchmark diesel) are high enough to make their overall greenhouse gas impact much the same as Euro 6 diesels – although all-important NOx and particulate emissions



are far lower. Meanwhile, small Euro 6 diesels (designed for sub 7.5-tonners) emit dangerous N₂O (nitrous oxide) in sufficient quantities to increase their greenhouse gas impact by 1–2%.

Even dual-fuel LPG-diesel engines did not come through unscathed. While, unsurprisingly (given the chemical composition of LPG), no methane slip was detected and efficiency losses were low, the relatively low LPG substitution rates recorded yielded only modest greenhouse gas benefits (5 tonnes carbon equivalent per 100,000km), according to LowCVP. That said, bio-LPG will significantly improve on that judgement. And, either way, NOx emissions are down and fuel savings of 10–15% are being bandied about.

Hence the attraction of this dual-fuel conversion. And not just to a bruised government looking for quick and sustainable emission wins, but also to commercial operators. Particularly those contemplating running freight into the proposed CAZs (clean air zones) and London's upcoming ULEZ (ultra-low emission zone).

Two big names that have gone the LPG-diesel route are Calor and Noble Foods. Calor first – which, as a major LPG supplier, put its money where its mouth is and converted a substantial proportion of its tanker fleet. “We are currently running 26 44-tonne trucks in our primary distribution fleet on Mercury's LPG-diesel technology – 25 at Euro 5 and one Euro 6,” confirms Calor fleet asset manager David Brown.

Those are DAF 410, 430 and 460, Scania 420 and MAN TGA18-480 tractors at Euro 5, while the Euro 6 unit is another DAF 460. “We are now in our third year of using diesel/LPG conversions and



have experienced no warranty issues. Additionally, the conversions and marginal maintenance on-costs are more than covered by our fuel savings,” he adds, stating that average savings per vehicle have been £3,396.

GROWING GAS FLEET

“We have also just placed an order to convert two of our Euro 5 12-tonne cylinder delivery vehicles, which operate in London and Birmingham, plus a new 3.5-tonner at Euro 6. We have done this as real-world, independent testing has shown significant NOx reductions on urban and regional cycles, and we need to ensure that our existing fleet will be able to operate in the government's proposed CAZs.”


Moving on to Noble, transport director Michael Tucker says that, since changing to LPG-diesel on its fleet of 43 (now 50-plus) DAF XF 105 460s back in 2011, the firm has reduced its annual fuel bill by 14%. “Dual-fuel has given us the best of both worlds: lower fuel bills and lower CO₂, with maybe further capital savings in the future,” he says, adding that LPG represents around

30% of the total fuel consumption.

“The results have exceeded our expectations ... and our initiative could be copied fairly easily,” he continues. “It's cost effective, and involves little capital. Our success was due to having the right trucks, the right monitoring, and the right drivers. We began double-shifting six days a week, and the proportion of cheaper LPG usage rocketed.”

Tucker says he's surprised more operators haven't switched to LPG-diesel. “The payback is under 12 months – and we had one truck pay for itself within eight months... The next landmark will be when we fit dual-fuel technology to Euro 6 vehicles. The benefits there could be even better.”

As Calor looks to 2017 and the prospect of shipping in 20,000 tonnes per annum of bulk bio-LPG (processed off-gas from the Dutch BioDiesel plant in Rotterdam), Calor's head of strategy and corporate affairs Paul Blacklock believes the writing is on the wall.

“It's clear that the OEMs are progressing with dedicated natural gas HGVs, but these will be beyond the pocket of many operators looking to improve the environmental and running cost performance of their fleets. That is where LPG-diesel technology comes in – especially for operators seeking to comply with the proposed CAZs.” 

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