

Talk of dual-fuel (primarily methane and diesel) trucks goes back years. But, although the attractions of significantly reduced running costs and emissions have arguably always been there, niggling technology issues, the UK's poor gas infrastructure and a perception that long-distance trucking is the only way to make them pay have conspired to limit take-up. More recently - and frustratingly for those wanting to get on board - the lack of accredited Euro 6 conversions caused vehicle availability to dry up.

But all that is now changing, and fast. Indeed, Euro 6 dual-fuel trucks are now here, with 6x2 DAF and Mercedes-Benz DieselGas (Prins) conversions being offered by rental giant Fraikin, no less (see panel p16). So, with more LNG/CNG (liquefied and compressed natural gas) refuelling stations coming on stream this year, along with National Grid's huge Isle of Grain LNG terminal, is it time for operators to reconsider?

Steve Carroll believes it is. And as senior technical specialist at Cenex (UK centre of excellence for low carbon technologies), which, along with Atkins, has been charged with analysing data from the government's two-year £23.4 million Low Carbon Truck trial, he should know. Certainly, latest data from that trial - run by the DfT (Department for Transport), OLEV (Office for Low Emission Vehicles) and Innovate UK, and published as we go to press - bears out his thinking.

So let's look at the detail, starting with the methane-diesel trucks (the vast majority). First, the basics: average gas-for-diesel substitution rate has been 44%, although with a range from 30-50%. Additionally, average overall combustion efficiency shows a reduction of 5%, compared to straight diesel. Together, those translate to maximum carbon emissions savings of

MOVING MAINSTREAM

With DieselGas geared up for 600 Euro 6 dual-fuel 6x2 tractor conversions per year and Fraikin now offering full service lease terms, is this technology going mainstream? Brian Tingham examines latest data from the Low Carbon Truck trial - and its implications

12% tank-to-wheel and 8% well-to-wheel (including fuel transportation costs, etc) and an average of 7% and 2% respectively.

Putting meat on those bones, Carroll suggests several reasons for the wide spread of gas substitution figures.

"Some of the variation was due to a few fleets still struggling to access reliable gas supplies - particularly those not running on designated routes that take them past LNG/CNG refuelling stations," he says.

However, most of the difference is

Low Carbon Truck trial data

The Cenex/Atkins Low Carbon Truck trial report covers findings from all 12 consortia, led by big names including Brit European, Culina Logistics, DHL, Eddie Stobart, Howard Tenens, John Lewis, Lenham Storage, Muller Wiseman, Tesco, United Biscuits and Wincanton, as well as gas suppliers, converters and universities. Specifically, it reveals overall performance data on 256 of the 317 dual-fuel trucks on the road at the close of 2014 - a mix of DAF, MAN, Mercedes-Benz, Scania and Volvo - most with third party conversions from Bioltec, Clean Air Power, G-Volution, Hardstaff (now in administration) and Prins.

Perhaps most importantly, the Cenex report covers correlated feedback from operators and drivers. The result: the most enlightening indicators to date about where modern dual-fuel trucks (LNG or CNG) fit best, in terms of real-life savings and operational caveats.

The only caveat: the data is already six months out of date. So it doesn't reflect Howard Tenens' experience with its latest Mercedes and DAF Prins-based Euro 6 truck conversions, nor Argos's observations from its Euro 6 Scania 340bhp gas trucks. Furthermore, information is averaged and anonymised, taking no account of operational variances, which clearly have an impact.

However, Cenex senior technical specialist Steve Carroll contests that the two-year Euro 5 truck datasets are so large, their validity is unassailable. The final report, in April 2016, will give more detail.

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Steve Carroll



Photograph: Simon Jones

down to the consortia’s dual-fuel converter choices. “Some systems are [cheaper] than others but then deliver lower substitution rates – and vice versa,” he says. And he explains that higher substitution ratios tend to come from systems more tightly integrated into the base vehicle.

The report shows a range of £11,500 to £33,000 conversion cost, with additional annual maintenance costs of £700 – and variable support from the converters. “So operators might achieve much the same payback period [easily sub-three years], but for some that’s driven rather less by consuming lower-cost fuel.” And, clearly, there’s a carbon emissions implication there.

ENERGY EFFICIENCY

What about the energy efficiency drop? Carroll suggests that’s due to putting gas through engines optimised for burning diesel. But, again, the trial data shows this, too, is system – and integration depth – dependent.

But, importantly, it doesn’t mean operators noticed power or torque reductions. The report indicates no such problems. “If you buy more expensive, but more highly integrated [conversion] systems, the fuel efficiency is likely to be less compromised,” states Carroll. “Then you can expect lower running costs.”

Incidentally, the trial also confirmed that methane slip past the after-treatment needs to be taken into account on dual-fuel Euro 5 engines. The DfT is currently kicking off a separate study on this aspect, with AEA Ricardo and Millbrook. Work to date has entailed developing the test protocol capable of establishing which conversions work best.

Moving on to the used cooking oil (UCO) dual-fuel trial, now complete, the data leaves us in no doubt that fuel economy and emissions improvements are outstanding – provided you have



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ready access to the stuff. Average UCO substitution rate during the United Biscuits consortium's two-year trial was a staggering 87%, yielding carbon emissions savings of 83% well-to-wheel and even more tank-to-wheel. What's more, there were zero measurable combustion efficiency losses. The result: massively reduced running costs and an ROI that beats all others by a country mile – again, assuming you have ready access to refined UCO.

For the record, the trial involved 10 Mercedes-Benz Euro 5 Axor 44-tonners running with Biotec dual-fuel conversions. Those are licensed through Convert2Green in the UK, which is also responsible for the UCO refining process.

COOKING ON OIL

Carroll explains that the trucks run with a two-tank system, UCO being warmed to a constant 70°C (as opposed to L/CNG's cryogenic tanks) so that fluid viscosity matches that of diesel. "UCO's energy density also closely mimics diesel's," he says, "which is why these high substitution rates do not adversely affect truck performance."

Indeed, so successful was United Biscuits' trial that the snacks giant is now buying Euro 6 Actros trucks for conversion by Biotec, in Germany, where the company is also tackling other truck conversions. And, as an indicator of its confidence in dual-fuel,

Carroll states that, whereas with the trial trucks United Biscuits paid for extra third party warranties against any potential engine damage, for this second phase it has not renewed the policy.

UCO dual-fuel plainly has a serious future, and it can't be long before interest grows in conversions for other sectors, particularly those with clear environmental credentials and return-to-base operations – such as the RCV (refuse collection vehicle) industry.

Beyond the operating data, though, observations around gas cost/availability, driver feedback and 'green certificates' shed interesting light on dual-fuel practicalities. Looking at the former, Carroll points to a 20p/kg variance in L/CNG prices last year, broadly between refuelling stations in the south and north. "So some consortia moved their dual-fuel fleets to northern depots, where the trucks would see a higher percentage of motorway running [so improving gas substitution] and also where the gas was cheaper."

Why the price variance? Carroll puts it down to differences in gas production and transport costs. He points to one station due to be opened by the end of this year in Leyland by CNG Fuels, which will be connected to the high-pressure gas grid, so minimising compression costs. "That reduces their running costs, compared to L/CNG stations importing gas as a liquid and incurring all the processing costs."

Stations offering higher biogas content are similarly disadvantaged – and hence their higher prices. Note also that from an emissions perspective, grid-connected stations mean lower fuel carbon intensity. That said, as gas demand grows, these may turn out to be early market issues.

DRIVER FEEDBACK

What about drivers' views? Carroll says there are no surprises. "Drivers' feedback is very much aligned to the refuelling regime," he explains. "They rate dual-fuel trucks highly where they are deployed on repeatable routes that take them past reliable refuelling stations. But they are less positive if they have to go off-route. However, truck driveability is positive throughout and, generally, they like their environmental credentials."

That's good but, just as important, telematics system providers CMS Supatrak and Microlise have both now gone public with technical support for dual-fuel monitoring. "That's a very big deal for fleet managers and drivers. It means both get instant feedback on driving performance and gas substitution rates, and hence also cost savings."

As for green certificates, Carroll explains that, while they are available on the market now, allowing operators to purchase biogas, they are not yet recognised by DEFRA [Department for

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Environment, Food and Rural Affairs] in its greenhouse gas reporting protocol. "So, unlike in the bus industry, where operators can get grants for running lower-carbon buses against their green certificates, in the freight sector they can't," he asserts.

Carroll explains that this issue - widely recognised as a barrier to gas vehicle uptake - was the subject of a consultation process late last year. "We are still awaiting the outcome," he says, adding that the international

greenhouse gas reporting protocol allows operators to declare emissions savings on a market or location basis. "At the moment, we're restricted to locational declarations, meaning there is no recognition for market mechanisms, such as green trading."

So what's the current verdict for dual-fuel trucks? Probably 'good, but could do even better'. If you're still wavering, don't expect individual system and truck performance data to emerge from the Low Carbon Truck trial. That is not being

promised - although an analysis by operation type (mileages, speeds, journey types, etc) will be revealed in April next year.

For now, the issue is understanding that, while there are clear savings to be made, not all dual-fuel systems or trucks are the same, so you need to ask questions. But do ask them: dual-fuel trucks pay for themselves in spades, even with currently low diesel prices. Fraikin's latest move on leasing is certainly testament to that. [TE](#)

Making dual-fuel fly

There is little doubt that natural gas is the fuel for the future - global gas supplies exceed those of oil by orders of magnitude. However, when it comes to making it the truck fuel for today, there are at least three requirements: a workable gas infrastructure, reliable technology and viable truck finance.

Looking at the former and reading between the lines, the Cenex report concedes that refuelling stations have been slower to come on stream than hoped. By the close of 2014, just four of the proposed 16 new stations and six of the nine upgraded stations were in place. But Cenex senior technical specialist Steve Carroll is confident that the remainder will be opened - one of the drivers being that when the Low Carbon Truck trial ends, funding ceases. So we can expect three new motorway LNG stations, the Teesport LNG and Scunthorpe CNG stations plus the other new sites and upgrades being built by Gasrec, Biomethane, CNG Services, etc, within months.

Why the delays? Ben Sawford, chief commercial officer at Gasrec, says the hiatus caused by the lack of Euro 6 dual-fuel vehicles meant no one was investing - causing some gas infrastructure firms to withdraw. "But we're now putting that infrastructure down in areas where logistics companies are most active," he says. And he points to the growth in uptake at the M1 Crick L/CNG station, with operators including Argos, BP, Brit European, DHL, Howard Tenens, Jaguar Land Rover, John Lewis, KBC, Kuehne & Nagel, Lenham Storage, Sainsbury and Tesco all current users (60% LNG, 40% CNG).

He also points to rapidly improving gas supplies, not only from Gasrec's own landfill sites, but also National Grid's Isle of Grain terminal, due on stream now, docking the world's largest sea-going LNG tankers and providing bulk fuel for the freight industry.

How about Euro 6 dual-fuel technology? Well, according to Will Putter,

commercial director at DieselGas (formerly Prins), it's very much here. "We've got two Mercedes Actros - one 10.8-litre 430bhp and the other 13-litre 450bhp - out there, and a DAF 13-litre. I'm waiting for a Volvo FH 450bhp tractor for DHL and we've already been asked for a MAN. It should be straightforward."

Furthermore, he indicates that substation rates on Euro 6 are higher - 55% average but up to 68% on motorways. "Even with diesel prices low, that means 7p per mile saving. If it goes back up, that's easily a £10,000 a year fuel saving for any operator covering 100,000 miles a year. At around £21,000 conversion cost, that's a two-year ROI, and year three is profit." And he adds that the

company could quickly double its current production capacity of six conversions a week. "If growth goes well, we want to be converting 50 trucks a month."

Making any new technology fly, though, also requires conventional finance - and a glance at the DieselGas website shows fleet services giant Fraikin offering dual-fuel 6x2 tractors on 60-month, 100,000-miles-per-year terms at £2,198.65 a month. Fraikin sales and marketing director Jeremy Heron sees the dual-fuel offer as embryonic, but adds that the company positions itself as a "progressive vehicle fleet management business ... looking to help customers understand how they can take advantage of driving to a more sustainable fleet".

Customer development director Colin Melvin adds that Fraikin is happy with developments to date and has already modelled DAF and Mercedes-Benz dual-fuel DieselGas conversions. "We can provide full leasing arrangements, including the vehicle, full service R&M including conversion costs and tyres and residual risk, as per our existing leasing model."

"The technology is alive and we are now engaging with our customers ... and are ready to embark on trials," confirms Heron.

