Multi-fuel dream

The debate over dual-fuel diesel and LPG or CNG/LNG rumbles on, with a few high-profile operators and fewer truck manufacturers coming on board. Brian Tinham examines recent developments that may yet see engine conversions reaching the mainstream

It's more than a year since this journal reported that Hardstaff had taken delivery of a further 31 new Mercedes-Benz tractor units, running on its own, much publicised, dual-fuel diesel and natural gas (methane) system. At the time, we speculated that "the cause of alternative fuels may be gathering pace" – with the additional five Actros 2544s and 26 Axor 2543s demonstrating this haulier-turned-technology firm's serious faith in its development.

But, far from accelerating, take-up of multi-fuel engined trucks remains lacklustre. And that's not just the case for Hardstaff's OIGI (oil ignition, gas injection), developed with Mercedes-Benz. The same is true of Clean Air Power's (CAP's) CNG/LNG (compressed natural gas/liquefied natural gas) and diesel conversion. It's also the case for G-Volution's LPG (liquefied petroleum gas) and diesel system, currently available for MAN trucks, and Prins' alternative, also LPG, with Volvos.

The industry just isn't biting. And that's despite what is now proven technology, backing from some major manufacturers and unequivocal enthusiasm, from those that have taken the plunge, over the clear cost and environmental benefits of replacing a large proportion of punishingly expensive diesel with cheap gas.

So what's stopping operators from getting onboard? Well a couple of points come to mind.

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Nick Elliott, Lafarge

One is history, particularly with LPG, where horror stories of damaged engines still cause concern. The second is set-up costs, particularly with CNG/LNG (and their bio versions), both in terms of the conversions themselves (currently around £25,000 apiece) and investing in workable gas provision, given the currently poor gas infrastructure. Yes, natural gas is cheap, but no, you can't get it, is the fear.

Let's briefly look at the technology. All such systems are broadly similar, being designed to vary the amount of alternative fuel injected into the engine (the substitution rate), depending on operating conditions and engine load, under software control. With Hardstaff's OIGI, for example, starting from cold and moving off, power is supplied by 100% diesel. Then gas is introduced from around 620rpm and, as the vehicle reaches cruising speed, gas substitution reaches 70%. CAP's system is much the same and, most important, both also work without interfering with the engine's ECU (electronic control unit), meaning that other vehicle control systems, such as braking, are not compromised.

Today's LPG and diesel offerings are close in concept, albeit using a different hydrocarbon gas. But there are two further major differences: conversion costs are much lower than CNG/LNG dual-fuelled engines, at around £9,000 per unit, and gas provision is also cheaper and easier. That said, plenty of folk in the transport industry remember the aforementioned early days of LPG enrichment – with effectively souped-up trucks failing as a result of overstressed engines. Mud sticks and hence, perhaps, much of the caution around all multi-fuelled engines.

Game-changing conversion

One company, and indeed one man, that has now proved beyond any reasonable doubt it's time to move on – certainly with LPG/diesel – is Lafarge Aggregates and Concrete, and its national transport manager Nick Elliott. He accepts that LPG/diesel has a chequered past, but explains that he started to take notice when G-Volution's Optimiser became a UK finalist in the Shell Springboard scheme for innovation. For him, that gave it credibility that earlier systems lacked – aided by the firm's explanation that its technology in no way soupes up the engine, instead intercepting communications between the ECU and the injection system, and mixing the lower cost fuel with diesel, according to demand.

Elliott's conversion was, however, no overnight matter. He describes himself as conservative – which makes his story all the more compelling – and states that he spent much of 2010 considering the LPG/diesel proposition.

"Quite apart from understanding the concept of interfering with the engine and reassuring ourselves about warranty, we needed to be convinced that the mileages covered would be enough and that the duty cycles involved in our operation would be right to make it pay back," he explains.

That wasn't trivial: hitherto, experience with operators such as Maiden's of Telford had revealed very fast payback (just 16 months), but that was with MAN TGA 26/440 tractor units covering nearly 300,000km annually on double-manned, high volume trunking. Elliott wanted to use the conversion on tractor unit and tipping trailer combinations running at 44 tonnes, but only covering between 95,000 and 100,000km. And not just on motorways, but a mix of roads – meaning that the engine would not always be cruising.

It's not in the multi-drop league, widely accepted as not worth the investment (because LPG substitution rates are too low), but it wasn't a no-brainer. Further, adding LPG tanks looked likely to result in a 160–170kg payload penalty, which

Coca-Cola Enterprises: cooking on biomethane

Gas-and-diesel engines are one thing, but Coca-Cola Enterprises (CCE) has gone the whole hog, with a fleet of 14 gas-powered 21-tonne Iveco Stralis 6x2 rigids – bringing a hitherto slow burn choice among continental bus operators to the truck world. CCE's decision follows a year-long trial of a compressed biomethane (CBM) variant against an identical standard diesel Stralis, in conjunction with Cenex, the government-funded Centre of Excellence for low-carbon and fuel-cell technologies.

That trial found that the gas-powered Stralis led to a 60.7% saving in well-to-wheel greenhouse gas emissions, compared to the Stralis with an EEV (enhanced environmentally friendly vehicle) diesel engine. It also cut NOx and PM (particulates) emissions by 85.6% and 97.1% respectively. And Darren O'Donnell, logistics asset manager at CCE, confirms that reliability was comparable to the conventional equivalents.

"Our investment in [these] trucks and a permanent CBM refuelling station at our depot in Enfield is not a token gesture," states O'Donnell. "It's testament to our confidence in this technology and our commitment to reducing the carbon footprint of our fleet. The environmental benefits of CBM have been proven by the trial and we hope other fleets will be inspired."

Why not dual-fuel? "We have avoided dual-fuel conversions, given the low substitution rates generally seen in urban applications," he says – although he accepts that they work economically in higher mileage applications. That said, O'Donnell concedes it would be hard to justify gas trucks on cost saving alone. "Driven by a higher acquisition cost and a lower residual value, the financing costs for the gas vehicle increases by 53.34% over the equivalent diesel," he says. "Other running costs increase by 6.8%, due to slightly higher R&M and slightly increased RFL [road fund licence]."

Nevertheless, refuelling costs are 12.76% lower than diesel and that includes write-down of CCE's gas station investment over the six-year vehicle contract period. If the gas infrastructure in the UK was more advanced, that figure would be far more favourable. So it's true to say that if, or when, CCE renews its gas vehicle fleet in 2018, the economics will be unassailable.

However, O'Donnell is clear that, for now, for most operators, the lack of a gas infrastructure and/or relatively low mileages both knock this kind of project on the head. "The more mileage you do, the more viable [gas trucks] become, because the payback is the difference between gas and diesel prices... Our mileages in London are low, at around 35,000km per annum. As a result, the all up running costs are 15.29% higher."

What about range? "We can get 400km, but we've had to hang extra tanks on the trucks to achieve that. The additional weight doesn't matter to us. We only plate these vehicles at 21 tonnes, so we have five tonnes in hand anyway."

matters when you're hauling sand and gravel. "We had to mitigate that, so G-Volution worked on compact tank designs and we offset some of the weight by reducing the diesel fill, without impacting the overall range," says Elliott. And he confirms that not only is the weight penalty now negligible, but also that even on MAN mid-lift tractors, with all the wet kit fitted for the tipping trailer hydraulics, space is not a problem. "You wouldn't know it was there," he says.

But there was still another consideration. "Diesel is everywhere, but LPG is not and CNG is even worse. We didn't want to waste any benefit of cheaper fuel having to drive 15 miles each way to get it." That, however, was quickly resolved, with Flogas offering to provide a skid-mounted station adjacent to its diesel pumps, such that drivers could fill up with diesel, move forward 20 metres and fill up with gas.

So Elliott decided to have one of Lafarge's year-old MAN tractor units converted in November 2010. "When it was ready, we got into this truck,

and went for a drive around Manchester and the motorways fully freighted," he recalls. "The guy from G-Volution was in the cab, switching the system on and off with his laptop, and the driver and I couldn't tell the difference – even when we were doing 30mph up a steep hill and pulling hard. That's when I thought, 'yes, we've made the right decision, and we are going to cut costs and carbon emissions'."

And the top line figures: "We saw a 5.5ppm [pence per mile] reduction in fuel costs. Assuming an annualised 96,000km, that's £3,330 per annum on fuel – giving a 31–33 month payback, based on a capital cost of £9,000 – and 4.31 tonnes of carbon. Also, the equipment can be taken off and bolted onto the next truck at end of life – so there's another saving... So last autumn, we converted a second vehicle and we intend to do more."

Now Elliott is looking at Lafarge's fleet of DAF trucks – common in construction, alongside Scania and Volvo trucks – with a view to retrofitting those. That project may take some time. G-Volution is running tests with its Optimiser installed on a nearly new MX diesel engine on a dynamometer at Huddersfield University, but don't expect an immediate launch. "The idea is that Lafarge will be the guinea pig, working with G-Volution and hopefully DAF," says Elliott.

Back to the future with CNG

So much for LPG-diesel: CNG-diesel experience has also moved on, certainly at operator Howard Tenens (Transport Engineer, September 2012, page 12). Catherine Crouch, group CRS director, explains that early success with CNG tanks mounted under its trailers was initially supplemented by further tanks on the tractor units, giving a range of more than 700 miles for long-distance haulage.

However, since then Howard Tenens has been through a "major development programme" with Hardstaff and Mercedes-Benz, developing a bespoke 6x2 Axor capable of a dual-fuel range exceeding 400 miles. "Historically, that could only be achieved with LNG. But we repackaged the rear end of the tractor unit, essentially moving the diesel and AdBlue tanks, and installing a vertical exhaust, to make space for the CNG tanks," she explains.

"We're committed to CNG, because, looking to the future, carbon-neutral biomethane will be injected into the grid from anaerobic digesters. So this will become the most sustainable fuel for the transport industry... LNG still has to be transported, so there will always be a carbon impact."

The prototype vehicle started operations last August and the firm now has 12 thus-converted Axors, as well as its original 10, out of a fleet of 80 HGVs and 150 vehicles altogether. But Howard Tenens is not standing still. "We see dual-fuel technology as still evolving on both 6x2 and 4x2 tractor units, so we'll continue to assess alternatives. I'm sure our future fleet won't be the same as today's."

Meanwhile, the haulier is already operating its Andover-based dual-fuel trucks on biomethane, increasing its carbon savings from 973 tonnes to 3,197 tonnes annually. Also, the firm has added to its original quarter of a million pound CNG station in Andover with another two at its Boston and Aveley depots – all of which are open to other operators wanting to trail or run on dual fuel using CNG.

As for the future, Crouch is convinced that the transport industry can continue to clean up its act by using biomethane, instead of CNG, LNG or LPG. "We are seeing a 15% carbon reduction from running dual fuel on CNG, but that increases to 60% on biomethane," she explains.

"The economic benefit is based on the differential in fuel price, which is part fuel cost but primarily related to duty. We and other users are hoping that the government sees biomethane as the fuel of the future for the haulage industry and commits to maintaining that differential. Then operators can invest in dual-fuel vehicles and the infrastructure with greater confidence."

With the Technology Strategy Board's Green Truck Fund – set up to encourage investment in the gas infrastructure and demonstrations of low-carbon vehicles – due to announce winning projects at the end of August, she may well be right.

The IRTE Conference 2012

Get the full stories: All three operators cited in this feature will be present at this year's IRTE Conference, at Gaydon 13 September – forming the expert panel in the session on alternative and multi-fuel (CNG/diesel and LPG/diesel) engines. Find out for yourself how they are achieving significant and sustainable cost savings, while also massively improving their green credentials. And learn how they are overcoming challenges, such as OEM warranty, vehicle type approval, payload penalties, tractor space, gas availability – and upfront costs that suppliers don't always mention.

Catherine Crouch, (above) group CRS director, Howard Tenens

Nick Elliott, (middle) national transport manager, Lafarge Aggregates & Concrete

Darren O'Donnell, (left) logistics asset manager, Coca-Cola Enterprises

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