

DASH FOR GAS

Gas trucks have a long and slightly disappointing history, but with the wind of technological and commercial change blowing strongly through the transport industry, their time is coming. Brian Tinham reports

Natural gas engines have been with us for almost a century. However, despite some notable uptake in a few niche bus and truck applications, in the UK they have languished in the transport equivalent of football's League One. Could their low-cost, clean, low-emissions credentials yet propel them to the Champions League? Maybe not quite, but, make no mistake, the wind of change is blowing through the commercial, operational, political and technical drivers. Add the improving LNG/CNG (liquefied/compressed natural gas) refuelling infrastructure, and the argument for gas vehicles is becoming more compelling.

So what's happening? First, commercially, there is the guaranteed 10-year fuel duty differentiator which, depending on the application and the price of diesel, can easily mean a two-year payback from cheap fuel, despite gas trucks' higher capital cost. Second, operationally, not only is LNG/CNG more widely available around major UK routes, but also, as OEMs see the potential for

growth, Euro 6 gas vehicles are emerging, and dealer workshops are being equipped (and technicians trained) to handle them. Third, with the government now under pressure from the Supreme Court to cut transport-related emissions in line with EU demands, there is surely the prospect of a return to financial incentives in the form of something like the former RPCs (reduced pollution certificates).

Sounds interesting? How about technical developments? Excluding dual-fuel (see next month), Iveco, Mercedes-Benz, Scania and Volvo lead gas trucks in the UK - all now offering Euro 6. However, although there are striking similarities, there are also differences, in terms of the engineering execution, power and torque ranges, as well as the sectors addressed and these companies' visions for the future.

Kicking off with Iveco, product director Martin Flach explains that its Daily van (3.5 to 7 tonnes) is fully Euro 6 gas enabled, with the 3.0 litre delivering 136bhp and broadly matching the diesel equivalent for torque. "Gas Daily vans have been available since the CV Show, and next up will be Eurocargo gas rigs [200bhp, 12- and 16-tonners], although not before early next year," he states.

That said,

spark-ignition (Otto cycle) gas variants of Iveco's heavy-duty Stralis (4x2 and 6x2 rigids, and 4x2 tractors) are already available at Euro 6, with Cursor 8 engines offering 270 to 330bhp and, again, torque closely matching the equivalent diesel. From the emissions perspective, they're a doddle: being virtually soot free, they don't require a DPF (diesel particulate filter), even at Euro 6, and, as with any spark-ignition engine, NOx control is via a three-way catalytic converter.

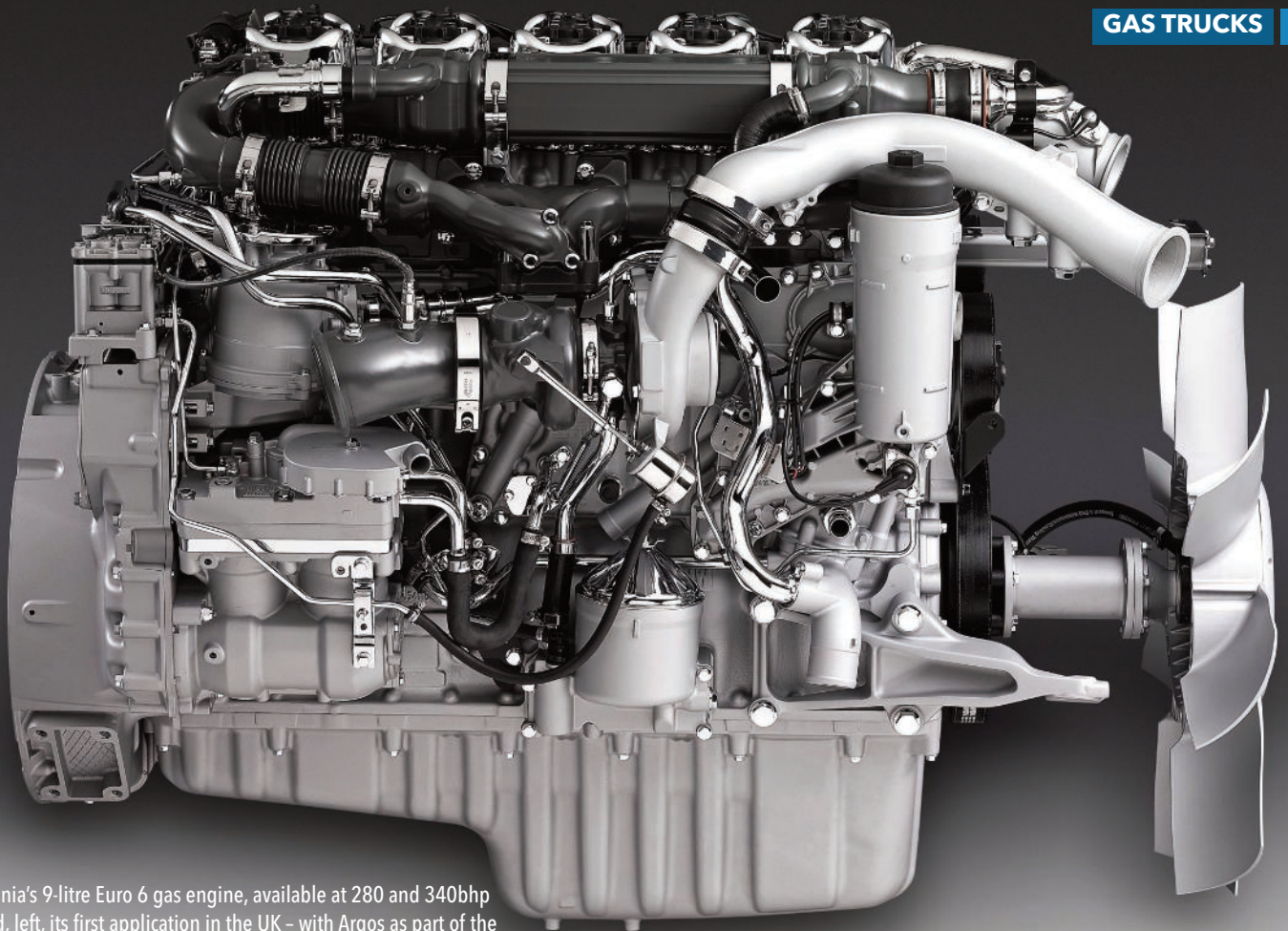
As for the transmission, they drive through manual boxes or Allison fully-automatics (not the preferred AS-Tronic: see panel) and are being pitched at the light end of heavy - 26-tonne rigids up to 32-tonne urban artics, all fitting the 10bhp per tonne sweet spot.

HIGHER POWER

But there's more to come. Iveco seems set to mirror Cummins Westport's development, which last year saw its 11.9-litre spark-ignition ISX12G gas engine launched at 400bhp. "When we can offer larger displacement, higher horsepower CNG engines - say 420, 450 or 480bhp - and a conventional two-pedal AMT, this could become mainstream. We're actively looking at that development now," states Flach.

Moving on to Mercedes-Benz, the German giant launched its Euro 6 Econic NGT (natural gas technology) at 18 and 26 tonnes in Sweden last August. This vehicle uses Mercedes' six-





Scania's 9-litre Euro 6 gas engine, available at 280 and 340bhp and, left, its first application in the UK - with Argos as part of the Innovate UK Low Carbon Truck Trial and the Magna Park consortium

cylinder M936G engine, based on its OM936 7.7-litre BlueEfficiency single-stage turbodiesel, delivering 302bhp and 1200Nm torque. In brief detail, you're looking at a near identical cylinder block and head, but with a new asymmetric turbocharger, modified piston combustion cavity, and new charge-air ducting, spark ignition and fuel mixing systems, including exhaust gas recirculation - in the same footprint.

Again, the Econic NGT drives through a six-speed Allison auto box, albeit with new eco software (Fuelsense). However, since we're talking Econic, Mercedes is clearly targeting the low-entry cab, stop-start RCV (refuse collection vehicle) market where full autos are standard fare. That said, with the potential for 8/6 x 4/2 city-based tippers and similar trucks under CLOCS (Construction Logistics Cyclist Safety), plus the emissions and noise advantages of gas, uptake could yet spread.

As for Scania, it takes the title for the world's first Euro 6 CNG/LNG-powered truck to enter service - with Swedish operator Bring Logistics in June 2013.

Power is delivered by Scania's 9-litre, spark-ignition 280 or 340bhp (1,350 and 1,600Nm torque respectively) engine, driving through a manual or Allison fully automatic. Like Iveco, Scania sees its current gas trucks as fulfilling roles in light heavy-duty return-to-base distribution (range circa 450km), and its gas trucks are available as P and G series 18–26 tonne rigids and urban tractors (4x2) up to 28–32 tonnes.

ARGOS FACTOR

Argos was famously the first taker in the UK, with five 340bhp 4x2 Scania CNG tractors delivered last March, each plated at 40 tonnes gtw, as part of Innovate UK's Low Carbon Truck Trial. "Argos's new gas-powered Scania trucks will be transformational in terms of CO₂ emissions and their impact on air quality in the coming years," states John Baldwin, managing director of CNG Services, which leads the Innovate UK Magna Park consortium with Gasrec, Argos, DHL Supply Chain, Culina Logistics and Eddie Stobart.

However, according to Scania

specialist sales executive David Burke, Scania's aspirations for gas trucks go much further than the current 340bhp cap. "We're looking to develop six-cylinder, 13-litre 410–460bhp Euro 6 CNG/LNG variants for long-haul next year," he reveals. "They will run on our R-Series two- and three-axle tractors." He also suggests that construction vehicles could well follow - and that the expensive Allison box and retarder will be complemented by Scania's Opticruise two-pedal transmission, in the 9-litre and larger engine variants.

How about Volvo Trucks? Well, to date this Swedish OEM has followed the Mercedes model, launching the FE CNG low-entry chassis cab last August, and targeting RCV and stop-start local distribution operations. Speaking at last year's launch, John Comer, product manager for Volvo Trucks, said: "The FE CNG is primarily aimed at centrally-operated municipal and refuse operators, working from transfer stations where there is renewable methane."

Its existing rendition, now in series production, is based on a 9-litre,

Reading Buses has been using gas-powered Scania/Alexander Dennis Enviro 300 buses since April 2013. Indeed, one of these beat the world land speed record for a service bus in May this year. Its Bus Hound 'powered by cow poo' gas bus was clocked at 80.78mph on the Millbrook high speed circuit



Westport spark-ignition Euro 6 CNG-powered engine, delivering 320bhp and 1,356Nm maximum torque, yet again mated to a six-speed Allison auto. Truck options are 19-tonne 4x2 or 19.5–26 tonne 6x2 rigids.

However, all eyes remain on Volvo for its delayed diesel-initiated (not spark ignition) Euro 6 gas truck, widely expected to be pitched at the 450bhp mark, and ideal for trunking. Tony Owen, Volvo's key account manager for low-entry cabs and gas trucks, concedes that this much-trailed development is taking a long time, but adds: "Volvo FH and

FM rigids and tractors are in field trials in Sweden now." He's coy about engine sizes and a release date – save for saying it won't be this year – but confirms that it is based on new, high gas substitution injector and engine technology.

That said, it seems certain the technology partner is Westport, well known for its work on a system that injects gas directly into the cylinders, instead of the plenum, along with a circa 5% diesel charge. The engine then runs on a compression ignition cycle which, in turn, initiates the gas burn – much as current dual-fuel conversions, but with a

far higher gas ratio. As a result, Volvo's new beast will harness what amounts to a fairly conventional diesel engine married to a heavily-modified top end.

In short, when it comes, it looks set to offer the best of all worlds: robust diesel technology, heavy-duty power and torque, but low fuel prices and emissions. "This gas engine will be a world beater," insists Owen. "If LNG availability is good, then I'd like to think we'll be selling thousands of them." And asked about the likely transmissions, he adds: "There is no reason why we can't use our I-Shift." So, another revolution.

How do you feel about gas trucks' viability now? Well consider this: "If you're currently spending, say, £60,000 a year on diesel, the gas equivalent would be about £45,000," says Iveco's Flach. "So, if your vehicle costs, say, £25,000 more than a diesel equivalent [which depends largely on the required range and hence gas tank sizes and numbers], payback is just under two years." And they offer obvious emissions and noise advantages. Not bad, eh? [IE](#)

The transmission conundrum

To date, virtually all the vehicle OEMs have offered only manual or Allison fully automatic transmissions – fine for RCVs (refuse collection vehicles) and buses, but not to all truck operators' tastes. Why that choice? It's because of the way gaseous fuel is injected. Mostly, that's into the charge air stream in the intake manifold or plenum, some distance from the cylinders – as opposed to diesels' direct head injection. As a result, there is nothing like the precision torque response available with modern multi-injection diesel engine control systems.

That, in turn, makes it difficult to synchronise gas engines to the requirements of industry-preferred AMTs (automated manual transmissions), and hence their absence from the options list. As Allison marketing director Manlio Alvaro explains, AMTs typically require a shift phase of some two seconds, during which time engine torque has to be reduced twice (before and after shifting) along with speed control for synchronisation. That's no problem for a diesel, but it's not feasible on most current gas engines.

Allison full-power shift auto boxes, however, don't require any torque or speed control during shifts. And there's another factor: gas engines typically deliver lower clutch engagement torque than diesels, as well as lower torque density, which, incidentally, also reduces the effectiveness of engine braking. "That's the other advantage of our torque converter," explains Alvaro. "First, it

allows the vehicle to be launched at higher engine speed and hence torque. But second, it multiplies that torque at launch, because of the geometry of the pump-turbine-stator hydraulic coupling, which transmits engine energy to the driveline as reduced speed but higher torque."

Allison also argues that its Continuous Power Technology maximises CNG engine efficiency, because higher average drive power equates to improved fuel efficiency. Indeed, it applies the same logic to diesel engines. It's a moot point, particularly when it comes to stop-start operations encountered in city and urban environments where torque converters are widely accepted as thirsty beasts. That said, when the box locks up in top for trunking, fuel efficiency is comparable to that of AMTs. Either way, if you want automatic on a spark-ignition gas truck, then you're going to have to think fully automatic.

Hence Allison's spectacular success with high-profile developments such as: Spain's Aucar-Trailer Policar 16-tonne urban distribution artic-cum-rigid demounts, which run with Allison-equipped Iveco Eurocargo 300bhp gas tractors; the Turkish Konya Metropolitan Municipality bus fleet transformation, where 60 Allison-equipped 280bhp TCV Karat CNG vehicles now cover the city; and the Berliner Stadtreinigung project, where 150 Allison-equipped Mercedes-Benz Econic CNG RCVs now run on plentiful biogas.