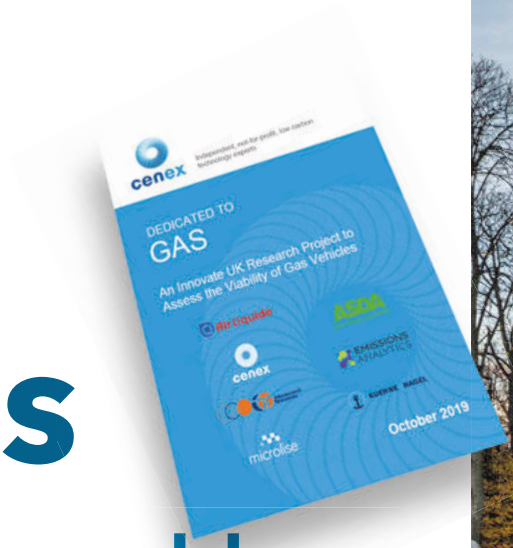


Are **gas** trucks better than **diesel**?

Transport consultancy Cenex has published results of a publicly funded two-year, 20-vehicle trial of gas trucks. It is said to be the UK's first to test Euro VI-compliant vehicles factory-fitted with gas engines, reports Will Dalrymple

Dedicated to Gas: Assessing the Viability of Gas Vehicles (*www.is.gd/sadeko*) found that they can offer a lower total cost of ownership over diesel assuming the same air quality performance. Although the upfront purchase cost is more than that of diesels, the relatively low price of gas more than makes up the difference under the right conditions. (That is partly thanks to a government fuel duty benefit for gas, only 40% of that of diesel, and in place until at least 2032.) Gas can also offer environmental benefits over diesel – particularly if the supply includes at least some part derived from waste.

Moreover, two aspects of gas trucks found to be relatively worse than diesel are likely to improve with time, according to the authors. First is their range, which was found to be generally worse than diesel (see table, below). However, the authors point out, greater refuelling infrastructure can mitigate this relative disadvantage. The trucks' range was affected by the fact that one of the two fuel types tested, CNG, remains in gas form and hence retains lower energy per volume than LNG or diesel.

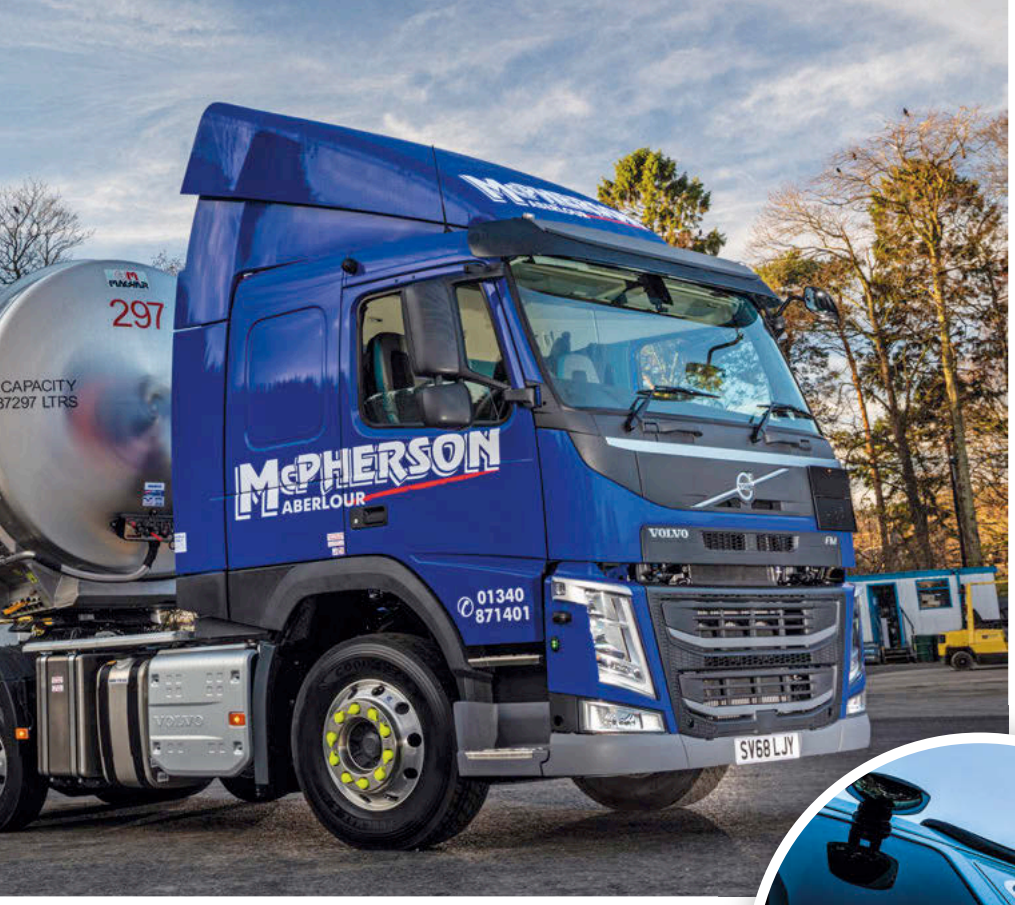
Second was their maintenance performance. Gas trucks had slightly more unplanned driveline maintenance events than diesel trucks, and in all truck types both planned and unplanned faults took much longer to repair. The authors speculate that both factors point to the lack of market maturity of gas drivelines in the UK – as the systems become more popular, those figures would improve, they predict.

These conclusions come in the context of lots of complexity. Four OEMs offer at least one truck with a Euro VI gas engine: IVECO, Scania, Volvo and Mercedes-Benz (see *www.is.gd/ciweda*); the report did not specify which were included in the trial, but confirmed that three truck brands were tested.

Most engines that burn gas are spark ignited (SI), as are petrol engines. The

TRIAL SUMMARY: GAS VEHICLE PERFORMANCE COMPARED TO DIESEL EQUIVALENTS

NUMBER IN TRIAL	VEHICLE DETAILS	AVG SPEED (kph)	PAYLOAD (% OF MAX)	MPGe	% DIFF MPGe GAS VS DIESEL	RANGE (km)	% DIFF. RANGE GAS VS DIESEL
10	CNG SI Artic 40t 4x2 Diesel (CNG SI Artic)	53 62	26% 19%	7.9 10.9	-28%	700 1,150	**-39%**
4	CNG SI Rigid 26t 6x2 Diesel (CNG SI Rigid)	59 59	20% 25%	10.4 12.2	-15%	850 1,300	**-35%**
4	LNG SI Artic 40t 4x2 Diesel (LNG SI Artic)	64 64	34% 25%	9.2 10.9	-16%	1,600 1,100	**45%**
2	LNG CI Artic 40t 4x2 & 44t 6x2 Diesel (LNG SI Artic)	58 56	41% 40%	8.9 9.2	-3%	700-900 1,100	**-36 to -18%**



only exception, which was included in the trial, is the Volvo G13C LNG (pictured above), which uses a compression-ignition (CI) engine as well as small amounts of diesel (10%); see *www.is.gd/imizun*. Because this CI generates a better compression ratio, it extracts more power from the fuel, so is more fuel efficient than SI.

In the event, the four types of trucks studied were: CNG SI rigid, CNG SI artic (that is, tractor), LNG SI artic, LNG CI artic.

For TCO, the study charted the relationship between three key variables: gas prices (£0.60-£0.85/kg), annual mileage (60,000-200,000km) and ownership period (three, five and seven years) across both fuel types. Both CNG SI models and the LNG CI artic generally offered better TCO than diesel after five years and above 120,000km/year at every gas price. However, the TCO case for the LNG SI artic required either greater ranges, longer ownership or lower gas prices to break even with diesel.

In terms of greenhouse gas (GHG) emissions, all of the trial vehicles used 100% biomethane – gas derived from the decomposition of organic matter. That produced greenhouse gas emission reductions of 80% compared to diesel. On the other extreme, use of all-fossil natural gas yielded reductions ranging from 13% (LNG CI artic) to -4%, that is an increase of 4% over diesel, on the CNG SI artic. However, all four vehicle types would have made a GHG reduction of at least 17% running a 25% biogas blend, the authors state. That leads them to conclude that the government should mandate blending biogas into normal gas at a 1:4 ratio.

In terms of air quality, NOx emissions of gas trucks were found to be about the same as diesels. None of the models tested was found to let methane slip (escape), which contributes to the greenhouse effect, and had been an issue in previous generations of Euro V dual-fuel engines.

Although the trial average speed was 55-65kph, that took in different types of loading and urban, rural and motorway driving cycles. The trial found that fuel economy suffered at low speeds. That is partly because of the way that truck engines are designed, and because of the energy drain caused by constant acceleration in urban stop-start environments.

STATIC TESTS

Fuel performance was also measured off public roads. First was a static half-hour dynamometer test of a single axle at 50% payload using the World Harmonised Vehicle Cycle, which includes urban, rural and motorway sections. Second was a set of Horiba MIRA track trials at 60% and 100% of payload with a PEMS monitor fitted to the truck, which was taken through three drive cycles: long haul, regional delivery and urban delivery. The results were expressed in terms of miles per gallon of diesel gas equivalent (MPGe), and charted (see table) in comparison to diesel.

The authors also found that the gap in fuel performance between gas and diesel reduces as the payload increases, and as trucks move from urban to motorway cycles. Although, of course, fuel economy suffers as the payload increases, the authors point out that increasing the average fill is the most efficient way to reduce fuel consumption and GHG output per unit of payload. For one truck, the LNG CI artic, long-haul energy consumption was actually lower for LNG than diesel at 100% payload, at slightly over 40MJ/(100km*tonne load), the lowest long-haul value across all vehicle and fuel types. It was nearly so in the 60% payload case, too, at just over 60. In other models, diesel won out at 100% fill at all duties, followed in all cases by gas with 100% fill.

In addition to Cenex, other project partners were operators Asda, Howard Tenens and Kuehne + Nagel, gas supplier Air Liquide and data providers Microlise and Emissions Analytics. The report was funded by Innovate UK as part of the wider Low Emission Freight and Logistics Trial (LEFT). TE