Less is MORE

Truck manufacturers facing increasingly strict CO_2 rules are aiming to reach the new targets through a thousand small tweaks, rather than focusing on a few big changes to their engine designs, finds Steve Banner

Truck manufacturers will soon be obliged to plug dynamometer emissions data from their engines into the European Commission's VECTO – Vehicle Energy Consumption Calculation Tool – so their estimated in-service CO_2 output is displayed for all the world to see (and also see pp10-12). They are painfully aware that a high CO_2 figure equates to high fuel consumption, and no haulier wants to buy a thirsty truck.

They are also conscious that there is no magic formula that will enable them to achieve CO_2 reductions running into double figures at a stroke. Instead, they are having to knuckle down and achieve single-figure cuts – sometimes measured in fractions of a percentage point – here and there, in the hope that all those minor reductions will add up to an impressive whole.

"It's evolution, not revolution," observes DAF's UK marketing manager Phil Moon.

Key CO_2-cutting measures include downsizing and down-speeding. "Spin a reciprocating mass at a lower speed and you're going to waste less energy," he observes. It was a point DAF made at the Busworld 2017 show in Kortrijk, Belgium. A combination of down-speeding and faster rear axles is enabling DAF's updated MX-11 (shown above) and MX-13 engines for bus and coach as well as truck applications to offer fuel savings of up to 6%, visitors were told. Both engines now deliver their maximum torque from 900rpm and can spin at around 1,050rpm at cruising speeds (see also ***https://is.gd/acedel***).

Torque is up by between 50Nm and 200Nm, and power is up in almost all cases by from 14 to 20bhp to maintain driveability and avoid traction falling away.

Pushing horsepower up means that the 10.8-litre MX-11 can now offer up to 444bhp. That makes it suitable for applications that might previously have employed a 12.9-litre engine producing 454bhp, delivering the same amount of torque, says Moon. "So you're saving two litres of displacement and getting better fuel economy," he points out.

One way in which CO_2 and fuel usage is likely to be reduced further is through the use of continuously-variable rather than fixed oil, steering and coolant pumps, he says: the route DAF has gone with its MX diesels. Ensure that oil pressure, for example, is always aligned with the engine's requirements and you will save energy – possibly up to 1.5% if continuously-variable pumps are used throughout the engine.

ELECTRIC PUMPS

Such pumps are likely to be powered electrically in the future, in a bid for greater efficiency, Moon adds. More items could be driven in the same way if truck electrical systems are boosted from 24V to 48V.

"48V electrics would be expensive, but would for example give you the ability to open and close valves electrically, and do away with the camshaft," says Martin Flach, UK product director at IVECO. This would provide a significant weight saving.

Many of the other steps manufacturers could take are also pricey and may not make financial sense at present either. However, they could bring significant benefits over the next few years in light of the CO_2 levels that are set by regulators, how strong a manufacturer's desire is for VECTO virtue and what happens to the price of diesel.

"So far as Euro 7 is concerned, all we've got at the moment is vague talk

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Martin Flach

about CO_2 limits with no specifics," says Flach. (If cars and vans are anything to go by, those cuts may be steep. Last month, the EC proposed cutting emissions for new vehicles in 2030 by 30% compared to 2021 levels: ***https://is.gd/unohur***.)

Flach adds: "Depending on the target that is set, we could see Rankine cycle waste heat recovery systems becoming more important and used to generate electrical power to run ancillaries."

Proposed future Euro 7 emissions legislation is likely to give them further impetus. Euro 7 CO_2 compliance may also mean higher peak cylinder pressures, says Andrew Banks, chief engineer, engines products division, at Ricardo.

Higher compression ratios may be necessary, too. And, for example, DAF's new MX-11 and MX-13 engines have higher compression ratios than before.

Both measures should help engines achieve faster, cleaner combustion.

The fuel used has a key role to play, too, says John Comer, UK product marketing manager at Volvo Group. He highlights the role of paraffinic diesels. "HVO [hydrotreated vegetable oil], in particular, has a lot to offer," he observes. Produced from renewable raw materials such as vegetable and animal fats, it reduces CO_2 emissions by between 30% and 90%, depending on the raw material, he says (see also ***https://is.gd/ovucad***).

"GTL (gas-to-liquid) fuels are worth considering, too, and in many respects represent the best way of getting gas on to a truck," says Comer. "Furthermore, they can be classed as renewable if they come from a biogas." Certas Energy now offers Shell GTL from Horsham, Sussex (pictured), plus Ashford and Liverpool.

Daimler has embraced HVO and GTL along with biomass-to-liquid (BTL) and coal-to-liquid (CTL). Last year saw its latest generation OM 470 and OM 471 engines approved for their use, so long as they comply with EN 15940. Such an approval means that there is no need to change the injection process, fuel lines or seals, and engine performance and torque data remain the same.

Stop-start systems, similar to those increasingly fitted to vans, could bring CO_2 and emissions cuts. But constantly restarting one of IVECO's 12.9-litre Cursor 13 engines would be rather more demanding than restarting a light commercial diesel.

"You're talking bigger batteries, alternators and starter motors, so you're adding cost," Flach observes. It all adds weight, too. "Fit a hybrid system, however, and you can use the electric motor to restart the diesel," he says.

Hybridisation's value was highlighted by the 2012-2015 CO_2RE project, a European-funded initiative with the aim of demonstrating how CO_2 output can be reduced substantially through improved powertrain efficiency. Its findings showed that hybridisation could cut fuel usage – and thus CO_2 – by an impressive 12.9% over a real-life operating cycle. The figure was achieved using an engine-in-the-loop testing regime in a test cell, however, and reflected the potential improvement of a Euro VI over a Euro V engine.

TIGHTER EMISSIONS RULES

Euro 7 may also see the size of particles cut from 23nm to 10nm, requiring finer particulate filter pores. Detecting and counting such minuscule particles will prove a challenge.

NO_2 – nitrogen dioxide – looks set to be limited for the first time, says Banks. "NOx could be cut by between 50% and 75%," he adds.

Cutting NOx means further improving the efficiency of the engine's SCR (selective catalytic reduction). And heat, among other factors, has a big influence on how effectively it operates.

Maintaining a high exhaust temperature is a particular challenge on stop-start urban distribution work. To address this issue, DAF's new LF City 7.5-tonner, the first Euro 6 DAF to be produced without EGR – exhaust gas recirculation – and designed for urban delivery runs, includes a new element. It is fitted with a waste-gated turbocharger featuring a short, insulated downpipe running down the side of the five-speed manual gearbox, ensuring higher after-treatment inlet temperatures. TE