Raising the bar

While DAF might have taken more time than most to bring its full Euro 6 engine line-up to market, the firm has not been idle. Ian Norwell reports from its Eindhoven engines seminar

Race? What race? The run-up to the Euro 6 emissions introduction deadline of 1 January 2014 has seen the usual group of combatants in the fray and a familiar pattern played out. Mercedes-Benz always seems to win: Daimler wheeled out its first Euro 6-compliant power unit back in March 2011, a full 33 months ahead of the drop-dead date. Compliant chassis soon followed but – with little or no government incentive to buy early and a significant chassis price-hike for all truck makers on the cards – any advantage the German giant might have gained from its early release is a moot point.

When I questioned DAF's XF product and service manager Wil Helmes at the later Birmingham CV Show, he was remarkably relaxed. He made the calm observation that DAF believes the time up to the deadline is better spent refining the engine offerings. However, the two different approaches do have a little of the tortoise and hare about them.

Right: DAF's engine plant in Eindhoven, where the units produced will be diesel-only for the foreseeable future

Diesel developments

And so to DAF's engine plant at the Eindhoven truck factory. DAF had invited Prof Dr Franz X Moser, from AVL List (the Graz-based powertrain systems development specialist), to outline his company's thinking around engine technology. And he was unequivocal. "For the foreseeable future, there is no alternative to diesel-based power units for heavy commercial applications," he insisted.

Moser cited the extreme power range of diesel engines – from marine engines producing more than 30,000kW, down to more modest truck and car motors in the mere low hundred kW. Describing diesel engine developments of today as "already in the past", and the split of lifetime costs between vehicle, driver and fuel on heavy-duty trucks being an even third for each, he then predicted a three-pronged approach for the future.

First, downsizing, already underway for most engine makers, harnesses even more robust structures and materials, and ever-higher injection pressures to squeeze more power from a smaller swept volume. Secondly, hybridisation and electrification should bring benefits up the gvw range as development progresses. And thirdly, waste heat recovery will be targeted for increased thermal efficiency. With the average truck diesel lurking at or below 45% efficiency, Moser offered the prospect of more room for improvement than some might think.

"Technologies that were not viable 10 years ago have now become so, with the increased cost of fuel," he explained. However, further emissions busting would not be the big deal. "The question of emissions is basically solved [by Euro 6], and further severe tightening of the legislation seems to be neither meaningful nor necessary." Moser did acknowledge that carbon dioxide emissions will almost certainly be the next target, but suggested that there is potential for a 20% improvement in the mid- to long-term anyway.

Either way, with the professor's science having

baffled some of the brightest minds in the audience, DAF's spritely chief engineer Ron Borsboom stepped forward and took the wraps off the truck maker's new Paccar MX-11, 10.8 litre engine. This will replace the 250–360bhp PR engine, currently used in DAF's CF75 product, and also be an additional engine for XF users. The 440bhp version of the MX-11 will slip between DAF's MX-13 offerings, he said, so giving new XF fleet operators four outputs to choose from, instead of the current three.

MX-11's 290–440bhp spread is also seen as ideal for DAF's CF85. The lower three outputs (290, 330 and 370bhp) are destined for distribution work, while the upper pair (400 and 440bhp) are for mainstream haulage fodder. A horizontal version of the MX-11 will also be available for bus application. All in all, it may be no surprise that most of the innovations here spring from the MX-13 seen on DAF XF test trucks late last year, but, vitally, they now bring similar new efficiencies to this important sector.

Better by design

As for the detail, while fleet engineers may be concerned about the idea of smaller engines with higher outputs, they should be reassured by some changes in materials and construction. The MX-11's CGI (compacted graphite iron) blocks are cast in Brazil and shipped to Eindhoven, while the heads are cast in Germany. The extra rigidity gained has been used to good effect by, for instance, integrating the pair of common rail injection pumps into the block.

However, the 2,500 bar injection pressure, required to meet Euro 6, does not allow the fuel pump's dedicated camshafts to be composite or assembled, as is the case with the DOHC (double overhead cam) top-end. First seen in this class of engines on Daimler units last year, the hollow tube and separate lobes assembly for the overhead camshafts provide a good example of where weight reduction – in this case of a rotating mass – is saving energy, both in terms of a drain on the engine's output and the vehicle's tare weight. Fuel and, by default, CO_2 emissions will be positively influenced.

For the rest, it's about multiple similar incremental gains. And maintenance and durability issues have not gone unaddressed, either. The entire wiring harness, for example – a notorious VOR weak spot for second life chassis – is now routed in a network of corrugated box-like tubes, injected with foam to effectively solidify the wiring's environment.

What about Borsboom's views on the Euro 6 emission levels? "We may have gone too far with these extremely low values and given ourselves less room for manoeuvre on CO_2," he said. And he, like many others, believes that any further reductions in particulates or NOx are beyond the capabilities of most current measuring equipment. TE

Ron Borsboom: "We may have gone too far with these extremely low [Euro 6] values and given ourselves less room for manoeuvre on CO_2"

Euro 6 presented a wide range of challenges for DAF's engine development team

Engine assembly plant: right first time philosophy

DAF's Eindhoven truck assembly operation is also home to a €50 million engine manufacturing facility. Engine plant manager Hein Wernaart was singing from the same hymn sheet as his colleagues when he described the task of the 34 engine test cell operators. Commenting on how emissions have been progressively reduced from Euro 1 levels, he declared: "We have become world champions at measuring almost nothing."

The OEM's HDLC (heavy duty load cycle) engine tests run for up to 4,500 hours before engines are dismantled and inspected. Durability testing is particularly aggressive, with constant load and transient cycles replicating 150,000 hours in service and putting engines under sufficient stress to consume 70 litres of diesel per hour, as opposed to the 17 litres they drink in service.

Noise pollution also needs restraining and a semi-anechoic chamber, equipped for frequency analysis, was able to detect our guide's head as the source of this particular emission when he entered the room. With an engine on the screen, colour-mapping gives away the noise-generating 'hot spots' in a way that no amount of craning one's ear or dangling microphones ever would.

It's clear that DAF's experience of EPA10 and EPA13 emissions regulations in the US (for its Peterbilt and Kenworth brands) has resulted in some transatlantic data traffic and it underlines the value of a product portfolio that spans a continent or two. Wernaart's closing sentiment was clear: "We don't want our customers to do the testing. It's better that we get it right, right here."