

Is the European Commission's VECTO project the best way to help drive down truck and bus fuel consumption, and CO<sub>2</sub> emissions? Brian Weatherley talks to Cummins Engines

# Carbon dating

**D**espite massive cuts in emissions from heavy-duty diesel engines since Euro 1 started more than 22 years ago, one by-product of combustion has stubbornly refused to be tackled. That is the arch greenhouse gas carbon dioxide.

According to the European Commission (EC), "CO<sub>2</sub> emissions from heavy-duty vehicles [HDVs] rose by 36% between 1990 and 2010 – mainly due to increasing road freight traffic. Projections indicate that, without action, HDV emissions would still be close to current levels in 2030 and 2050." And the EC adds that this is incompatible with the goal of reducing transport's greenhouse gas emissions by 60% below 1990 levels before 2050, as set out in its 2011 Transport White Paper and Roadmap.

So what's being done? According to Cummins Engines' environmental management director Peter Williams, the good news is that – notwithstanding a few Euro 6 fine-tuning issues (page 26) – the EC's myopic focus on NO<sub>x</sub> and particulates has now ended, so CO<sub>2</sub> is back on the agenda.

"It's a good feeling, certainly for the manufacturers, that there's no need for another stage beyond Euro 6. Air quality emissions are under control and as long as the EC can convince itself that the urban operation of

vehicles is robust, I think they'll find there's no need for a Euro 7. So, looking forward, the focus is shifting to fuel efficiency and particularly CO<sub>2</sub>."

Interestingly, though, Williams also reports that the EC is insisting that CO<sub>2</sub> reduction be market-driven. Fuel is a cost, goes the argument, so operators will inevitably want to drive down consumption and hence, indirectly, CO<sub>2</sub> emissions. Making that happen, however, requires better information so that vehicle purchasers are better informed.

## Carbon efficiency number

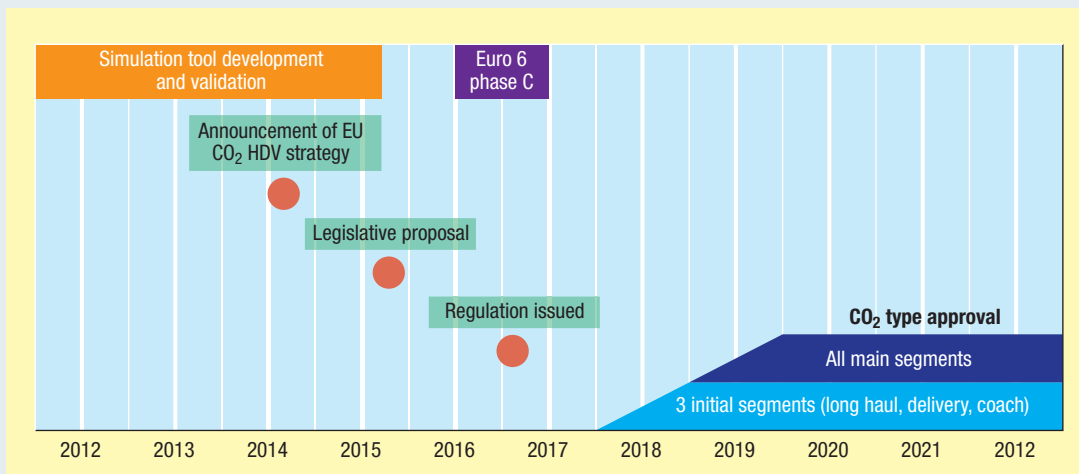
That's where VECTO (Vehicle Energy Consumption Calculation Tool) comes in. In simple terms, the EC wants to create a database of trucks, buses and coaches according to fuel-efficiency rating, and thus CO<sub>2</sub> footprint – measured, for example, in gm/tonne, m<sup>3</sup>/km or gm/passenger-km. VECTO would award vehicles a number, similar to energy ratings on white goods. But creating that database, which would be used as a vehicle specification and purchasing tool, will be anything but simple.

"The first stage is improving knowledge," explains Williams. "The thinking is of two uses [for VECTO]. The first is as a sales tool – so in the dealership, people will configure their vehicles and understand

## Timetable for cutting CV CO<sub>2</sub>

Based on its VECTO computer simulation program, Brussels says the Commission intends to propose legislation this year that requires CO<sub>2</sub> emissions from new HDVs to be “certified, reported and monitored”. Following its initial proposals, firm legislation could appear around 2016, being implemented by 2018 and focusing initially on segments such as long-haul and delivery trucks and coaches.

“These are the ones they’ve validated on the [VECTO] tool so far,” explains Cummins’ Peter Williams. And he adds: “They’re looking to have some impact from 2018 onwards. What we’ve heard is there will be a gradual process as the fleet gets turned over. They’ve got a plan for 2030 to see some reductions... So it’s quite a long-term process.”



what the CO<sub>2</sub> output would be, compared to another dealership offering a similar vehicle. If CO<sub>2</sub>, or fuel consumption, is a primary driver for vehicle selection, then making that information available to purchasers is likely to drive a reduction [in CO<sub>2</sub>].” Brussels, not unreasonably, expects fuel economy to remain high up the agenda for new truck buyers.

The second application for VECTO, however, will be by EU governments to track CO<sub>2</sub> emissions in their own back yards, by monitoring new vehicle registrations and mapping them to CO<sub>2</sub> efficiency. “That’s what they are keen on, so [member states] can report on whole fleets,” explains Williams.

So what data will be required for VECTO to come up with any vehicle efficiency and CO<sub>2</sub> numbers? “The engine will be represented by a fuel map,” reports Williams. “That’s from an engine on a test bed running at fixed speed and load conditions, measuring the amount of fuel it uses and CO<sub>2</sub> it produces.” Next is tyre rolling resistance data, based on information currently available through mandatory tyre labelling. Then comes arguably the most contentious part of all – vehicle aerodynamics. “There is a defined process for measuring the air drag of the vehicle – essentially just coast-down to work out the drag,” explains Williams.

Given the plethora of bodywork and trailer types on the market, that’s clearly going to be a challenge for VECTO’s developers at the Technical University of Graz, who may well opt to use generic, rather than real, trailer and body types for their calculations.

Either way, last but not least there’s transmission and driven axle efficiency data.

With all those elements in VECTO, what should come out is a vehicle efficiency number indicating lowest CO<sub>2</sub> outputs for truck, bus or coach buyers to choose against. That’s the theory, but the question is, who will validate the VECTO input data supplied by the vehicle manufacturers and bodywork/trailer-makers? One suggestion is national type approval agencies, though that’s yet to be decided.

### Legislative proposals

For engine makers like Cummins, confirming the fuel map element is straightforward. “We run the fuel map at the point of type approval for the engine, so it’s when we do a certification,” confirms Williams. Likewise, tyre rolling resistance data is already available, while air drag information will presumably come from body manufacturers. But this is going to involve considerable work.

Unsurprisingly, Europe’s truck and engine manufacturers are keen to see the EC’s legislative proposals for VECTO when they appear later this year (panel above). Meanwhile, Williams already believes there are ways to make it more robust. In particular, rather than provide one overall vehicle efficiency number, he wants engine fuel map data available separately from the CO<sub>2</sub> efficiency data drawn from other vehicle technologies.

That makes sense, not least because it would expose which engines burn least fuel. And Williams

## Euro 6: you think it's all over?

Brussels is looking to tighten in-service conformity testing for Euro 6 engines through improvements to PEMS (Portable Emissions Measurement Systems). Through PEMS, Europe's engine makers are required to conduct real-life, on-road compliance trials, using operator vehicles, monitored around representative test routes.

"It's something we have to run through the useful life of the vehicle [typically defined as 700,000km or seven years for a heavy-duty, long-distance truck]," says Cummins' Peter Williams. "It's also a type-approval deliverable, so we have to run PEMS tests at the point of certification," he adds. Clearly, as no manufacturer can demonstrate whole life compliance at the start of a new engine introduction, PEMS testing provides ongoing confirmation.

Now Brussels wants more stringent PEMS testing, focusing on cold start and urban operations and payloads. It's also considering changing the make-up of the obligatory test routes. "Every aspect of the PEMS methodology is under scrutiny. They want to ensure that it delivers what it says on the tin," explains Williams.

points to the US, where CO<sub>2</sub> engine data is already split out within the EPA 2014 emissions standard. And with standalone engine CO<sub>2</sub> information, buyers

would know the ultimate limit. "You've got a deliverable ceiling, and know that engine will always be under it. It allows the regulator to then set a trajectory for CO<sub>2</sub> reduction. And, if the test cycle is robust, representative of real life and used in the World Harmonised Test Cycle [as per Euro 6], I think ... that's a good method of measuring CO<sub>2</sub>."

The GEM vehicle simulation tool in the US already uses this approach, and Williams sees something similar working in Europe. "You could have an engine standard for CO<sub>2</sub>, as well as a standard that focuses on the vehicle. The way the US model works is you have a generic engine and that drives the vehicle technologies."

While accepting that the current VECTO model, based on a basket of data, could still work, Williams believes an approach where all components are listed individually is the way forward. "It's important that vehicle purchasers understand what the CO<sub>2</sub> output is. And from a regulator's perspective, it would give them the ability to drive engine CO<sub>2</sub>. We're saying the regulation can be made more effective by adding an engine-focused element or engine plus transmission-focused element, so that VECTO [reveals] the most effective unit for the most effective vehicle." **TE**

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