BIG can be beautiful

In his IRTE Conference keynote, Cambridge University's professor David Cebon presented a personal and thought-provoking perspective on the future for heavy vehicles. Brian Weatherley reports

David Cebon, professor of mechanical engineering at Cambridge University, took an unconventional approach with his IRTE Conference keynote – starting with the conclusions. Focusing squarely on global sustainability, he declared: "If you want to make a difference in freight vehicle technology and operations, you've got to consider the three 'P's – people, planet and prosperity."

Tackling the last 'P' first, he insisted: "When dealing with any kind of system for reducing fuel consumption and emissions [helping the planet], if you can't get the economics right, it's never going to be taken up. That's also the prosperity part." Likewise, under 'people', and referring to new technology and vehicles, he continued: "If you can't get the politicians – the voice of the people – on board, it's never going to work either."

With that rationale, Cebon proceeded to regale delegates with a rapid fire critique of fuel-saving and emissions-reducing interventions, starting with aerodynamics, lower rolling resistance tyres, weight saving, lighter chassis and more efficient engines. "All of these feature low barriers to adoption," he confirmed. "The technologies are also well known. Unfortunately, their benefits, in terms of saving the planet, are relatively small, usually less than 10%."

That said, ensuring that drivers have bought into your fuel-saving strategy is essential to making anything work well. "Driver training is very important," stated Cebon. "It's a low effort way to reduce fuel consumption. If you can get it to stick, you can expect 8–10%." Achieving that 'stickiness' can be a challenge, though, which is where driver feedback systems, based on telematics, can make a big difference – albeit with slightly elevated cost barriers.

What about alternative fuel? As more operators consider dual-fuel vehicles, Cebon confirmed that their potential for CO_2 savings could be 15%, but followed that with a serious caveat. "One of the problems with dual-fuel vehicles is methane slip, due to incomplete combustion. Methane is a potent greenhouse gas so, until that problem has been sorted out, dual-fuel will not be better for the environment than conventional diesels."

Cebon next delivered a pithy verdict on electric vehicles. "Electrification has high barriers to implementation and, until we decarbonise the grid, it doesn't deliver any significant benefit in terms of CO_2 emissions." Praising electric vehicles for their zero tail-pipe emissions fails to take account of emissions from power stations.

Nevertheless, there is potential for electric urban delivery vehicles. These have the benefits of low noise, and zero NOx and particulates, both of which are good for the environment. Diesel-electric and hydraulic hybrids can reduce emissions by 15–20% in stop-start operations, he confirmed, and they are "relatively low barrier technologies, though somewhat expensive".

FACT

The potential for dual-fuel vehicles' CO_2 emissions savings could be 15%

Moving on to platooning, while acknowledging that the concept has generated media attention, Cebon remained sceptical. "The barriers, in terms of technology, legislation and safety, are immense, while the fuel consumption and emissions benefits are so low that there really should be more careful thought when promoting them. And autonomous vehicles are even worse."

So what will make a real difference to road freight efficiency? Cebon is unequivocally in favour of longer, heavier HGV combinations – high capacity vehicles, or HCVs. "They offer 20–30% lower fuel consumption, reductions in the number of drivers needed and in costs. They also bring improvements in productivity and lead to reduced traffic congestion and road damage." Additionally, in countries where HCVs are in widespread use, they have significantly better safety records than conventional vehicles.

What's stopping their adoption? Returning to his three 'P's theme, Cebon insisted that the barriers are political. Illustrating his point with screen grabs from anti-truck campaigners, he told delegates the industry has a major PR battle on its hands. "Public opinion over lorries is not great so it's not surprising that politicians aren't enthusiastic about HCVs. But the industry needs to start doing something about this because it's one place where it is possible to make a real difference to fuel consumption and hence CO_2 emissions."

FULL RETURN LEGS

But there are other strategies, he said, citing the need for operators to tackle empty running more aggressively. "It's always beneficial to come home full," said Cebon, "because, if you're empty, you effectively use 70% more fuel per-tonne-km of work done. Compared with anything else, 70% is really big." And it applies to vehicles of all sizes.

If the public and politicians are to embrace HCVs, they'll need convincing they're as safe as, if not safer than, existing vehicles. To that end, Cebon presented videos showcasing technologies developed by Cambridge University's engineering

FACT
Prototype valves on an artic show 16% reduced stopping distance

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David Cebon

team that will be essential for HCVs – including a trailer steering system (developed with Tridec in the Netherlands), which overcomes the 'whip crack' effect caused by rapid lane changes.

Using the same technology, a trailer can also perfectly follow the prime mover's steering path, even to the extent that a double-trailer HCV meets existing UK turning circle regulations. Equally impressive was a hands-off computer-controlled reversing system shown guiding an experimental triple trailer combination in a straight line, then making a lane change while still backing – a task, said Cebon, that is impossible for a human.

Cambridge engineers have also been working on ways of speeding up HGV brake reaction times and improving wheel-slip characteristics. Key to their development is a novel EBS air valve based on a metal blade flexure between two magnets, claimed to open and close brake chamber air circuits 10 times faster than current technology. Cebon's team has tested prototype valves on an artic at MIRA and demonstrated a 16% improvement in stopping distance. "That's about five cars that wouldn't have been sandwiched on a motorway," declared Cebon.

Switching to vulnerable road users, Cebon next described an automated HGV braking system, also developed at Cambridge. This detects the presence of a cyclist on the nearside, predicts the likelihood of a collision on a left turn and automatically applies the brakes, if necessary. Explaining that the team used data from 19 fatal HGV/cyclist accident investigations, Cebon asserted: "We think that 15 could have been completely avoided by this system." A working version has since been created and delegates were treated to a video showing the system in action, automatically stopping a tipper before it could hit a dummy cyclist.

FACT
15 of 19 fatal HGV/cyclist accidents could have been avoided

"I would challenge those at TfL [Transport for London] and CLOCS [Construction Logistics Cyclist Safety] to make sure the technology they are encouraging is proven to prevent accidents. It is not sufficient that it helps the driver to see in his blind spot."

Concluding, Cebon told delegates: "Heavy lorries are here to stay and, for environmental and productivity reasons, they need to get bigger. More than anything, the industry needs to tackle political barriers in a coordinated way. While technology can solve vehicle dynamics issues, safety is a critical aspect of public acceptance so the industry must focus very heavily on it." ■