Saving the PLANET

It's not just about environmental preservation, but good old-fashioned efficiency improvements and cost savings. Brian Tinham reports on professor David Cebon's sustainable freight findings

Selecting the right vehicles, and reconsidering logistics and transport strategies in light of available evidence are the keys to sustainable transport: meaning reducing fuel consumption and CO_2 emissions. So said professor David Cebon FRA, who heads up the Centre for Sustainable Road Freight – the industry, academia and government partnership based at Cambridge University and Herriot Watt University.

Tackling the subject of vehicles and routes first, he told delegates that fuel consumption is always dependent on drive cycles. By way of explanation, he turned to a graph showing power consumption – first, for a truck accelerating from rest to 56mph and covering 10km under cruise control, and second, another covering the same distance at an identical top speed, but with four stops.

"You can see that average power is much higher in stop-start mode than when the truck is running in steady state, simply overcoming rolling resistance and aerodynamic drag," he said. The obvious conclusion: fuel consumption is significantly greater for each high-power acceleration phase.

"We can plot distance per stop against energy required by the vehicle per cubic metre-km of freight carried," he continued. "And you can see that fuel consumption is a factor of two greater for the multiple stops scenario, than a truck free-running on the motorway."

Not only does that explain the largely unavoidable higher fuel figures for multi-drop, urban vehicles against their long-haul counterparts, but it also parameterises the CO_2, fuel and cost impacts of congestion on busy highways. "The average impact of trucks stopping and starting on UK motorways is 3,000 gallons of extra fuel, or 30 tonnes of CO_2, per mile of motorway per day… So congestion has a dominant effect on fuel consumption and hence operational efficiency and costs," stated Cebon.

And he made the point that policies that result in night-time delivery restrictions therefore exacerbate urban pollutant emissions, while also pushing up fleet freight costs. "Night-time curfews effectively maximise traffic congestion, which is not great for reducing CO_2." And for long-distance, he added: "If you have to stop your truck once on the motorway it dissipates 12.5 megajoules of energy. That's enough to overcome all the benefits of aerodynamic interventions for the previous 70km."

FUEL PERFORMANCE

Moving on to which trucks fare best on fuel performance in terms of cubic metre-km of freight carried, Cebon used a 44-tonne artic as the benchmark, and stated that transferring its load to two 26-tonners results in 40% greater fuel consumption. "So if you can avoid putting loads on to separate smaller vehicles – which may happen for city logistics – you save fuel. Similarly, if we go to even higher-capacity vehicles, operators would save about 25% of their existing fuel bill. So bigger is always better, as long as it's full."

That said, technology interventions do make a difference, so Cebon compared current and future options, illustrating their potential with a graph showing ascending CO_2 performance on the vertical axis, and barriers to adoption (technical, economic and societal) on the horizontal axis. Pointing to the bottom right corner, which he described as "no-brainers", he stated that aerodynamics (10% savings), low rolling resistance tyres (sub 5%), tyre pressure monitoring, lightweighting and improved refrigeration for temperature-controlled transport are "things we've just got to do".

Moving on to driver training and feedback, he acknowledged that implementing schemes fleet-wide isn't easy. Hence their position further to the left of his graph. "But, if you do it, projects consistently deliver about 10% – and telematics also offers alternative opportunities." Similarly, working on routing strategies – not only to minimise miles but also to avoid congestion – delivers "significant" additional fuel savings.

Back on technology, Cebon criticised dual-fuel vehicles, pointing to issues with methane slip that can undermine their greenhouse gas credentials. Dedicated gas trucks, he said, are better, with biogas best as it is a virtually clean fuel. "However, barriers to adoption are almost infinite because you would need enough biogas for everybody, which is never going to happen." Better, he suggested, to commit biogas to the national gas grid and hence help decarbonise that, leaving gas trucks to run on commercial methane.

What about electric vehicles? "From a CO_2 perspective, they're about the same as diesel today, because of the UK's mix of power production."

FACT

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Prof David Cebon

Future improvements might change that, he said. However, hydrogen power he described as "a disaster".

Turning to hydraulic hybrids, electric hybrids and exhaust heat recovery, he put these in a future category, while for platooning he said the main benefit was that drivers can have a snooze. "You hardly improve aerodynamics at all and there's a whole lot of barriers," he said. And he added that autonomous vehicles are "pointless for greenhouse gas reduction" and deliver nothing better than driver training does, but with significant barriers.

"Let's not waste precious resources on hydrogen fuel and autonomous vehicles. They're a waste of time from the transport sustainability perspective," said Cebon. For him, high-capacity vehicles offer the best and simplest solution. "The barriers are political, not technical, and the benefits are 20–30% reduction in fuel consumption, and hence also greenhouse gas emissions, per freight task."

So much for technology; time now for logistics. Illustrating his point with a graph revealing energy per tonne-km of freight, he showed that fuel consumption effectively increases by 70% if a truck's outward journey is full, but it returns empty. "You're doing no useful work on the way home, so energy per tonne-km goes up 70%. So, although there are many situations where it's unavoidable, if we can do something about the empty running we can avoid, there's a lot of fuel to be saved."

BACK-HAUL SAVINGS

And referring to a study at the Centre for Sustainable Road Freight, reviewing 10 major logistics operators' data, Cebon revealed that back-haul collaboration with partners could potentially have cut £77 million worth of movements – equating to 62 million km and 58,000 tonnes of CO_2. "But you can't come back full on every load: if it's a fridge, for example, then you need another refrigerated load at the right time. So there's a whole bunch of constraints. But there are pairing opportunities and they are worth a lot of fuel."

Similar opportunities include co-loading, where part loads from individual suppliers are consolidated at regional or urban logistics centres on to single vehicles for delivery to supermarkets or distribution centres.

As for real savings, regional consolidation centres, he said, look good, offering a theoretical 18% fuel saving – although reducing to 4% taking account of detailed truck movements. Urban consolidation centres, however, are much better, yielding up to 28% fuel and CO_2 saving.

Incidentally, that latter figure, he said, rises to 29% for night-time deliveries – underlining the power of re-timing and re-routing deliveries.

In conclusion, Cebon told delegates that the biggest bangs for their buck right now are to be found in reviewing routing, driver training with feedback, high capacity long-haul vehicles, and seeking-out back-haul, consolidation and co-loading opportunities. ■