The lean queens

Two concept tractor-trailer combinations unveiled recently have claimed massive advances in operational efficiency. How relevant are these claims to the realities of today's operators? Peter Shakespeare investigates

Every few years a concept truck breaks cover. Usually based on a conventional series production model, their fancy aerodynamics and a futuristic look are combined with claims of double-digit efficiency gains.

Over the last three years, we have seen concept trucks that address the very real issue of CO_2 emissions reduction. In May 2016, Volvo announced the results of a five-year Swedish-US Department of Energy design project, an articulated 40-tonne rig whose average fuel consumption figure was up to 30% lower than contemporary models (pictured above). The caveat to the claimed gains was that they were only for long-haul, which would be expected to be fully freighted out and back.

Technically, Volvo's concept truck achieved its efficiency gains in two ways: vastly improved aerodynamic efficiency and a lower kerb weight. In other words, it used less fuel than a conventional truck to move a tonne of goods.

Such projects are so significant because diesel will continue to play a strategic role in transport in the future. Bodies such as the European Road Transport Research Advisory Council (ERTRAC) generally accepts that, even by 2050 – when a large proportion of road freight transport is expected to be battery-electric powered – around 20%, the long-haul component, will continue to rely on the diesel-fuelled internal combustion engine.

The second example comes from the USA, where Shell collaborated with the AirFlow Truck Company and the The North American Council for Freight Efficiency (NACFE) on the 'Starship' truck, pictured p22. Based on a 15-litre Cummins-powered articulated combination, its cab was replaced with an aerodynamically-optimised bespoke carbon fibre alternative. Radiator grille shutters could be closed when engine cooling was not required to improve airflow. The trailer was equipped with side panels and a drag-reducing boat-tail. It also had a 5,000W solar panel array on its roof to power the truck's air con system, lights and other ancillaries (see also p24). Shell provided technical consultation on engine and driveline components, and low-viscosity Shell Rimula E+ SAE 15W-40 lubricants.

During a May 2018 US coast-to-coast run, the Starship's total average fuel economy stood at 8.94mpg. This may not be game-changing in European terms – as the latest Euro VI 40-tonners will comfortably average over 8.5mpg on long-haul work – but it beat the USA's average of 6.4mpg by a large margin.

Still, the Shell truck was not judged on mpg savings alone. During that journey, the 40 US ton truck carried a full 40,000lb load (20 US tons), attaining 178 ton-miles per gallon of fuel, a metric known as freight-ton efficiency (FTE). When converted to a European formula, which inverts the freight-mileage and fuel consumption terms, that figure would be 1.45 litres/100 tonne-km.

Shell argues that the FTE metric is a more relevant metric than mpg to judge the energy intensity associated with moving cargo from point to point, since it combines the weight of cargo being moved with the amount of fuel consumed. Those operators that tend to run empty on return legs, for example, would have a worse score. "Loading up freight is an energy-efficient way to transport goods, and it is cost-efficient, even if those goods are light. The more units are shipped, the lower the transport cost per item," says Bob Mainwaring, Shell lubricants

technology manager for innovation.

According to NACFE, if all two million trucks in the US achieved the same FTE, they would save an estimated 229 million tonnes of CO_2 emissions annually.

"We tracked payload, vehicle speed, elevation change and wind. The challenge to FTE is that, other than vehicle speed, it is hard to determine any of them in real time. So, we revert to mpg"

Mike Roeth

THE REAL WORLD

In reality, trucks are not only weight-limited; a large proportion of UK freight cubes out before it tares out, according to David Cebon, professor of mechanical engineering at Cambridge University and the director of the Centre for Sustainable Road Freight. So he argues that any measurement of freight efficiency would need to consider whether volume or weight is the more important aspect of any given load.

This is one of the reasons that David Morley, Bibby Distribution driver training and telematics manager, does not measure freight-tonne efficiency. He argues that comparing a volume-optimised operation and a weight-driven one wouldn't be meaningful, as each uses different types of vehicle combinations. "You wouldn't be comparing apples with apples," he says.

However, Morley admits that his own analysis of fleet operational efficiency does go beyond mpg. He explains: "We do measure our business CO_2 output as an overall, and we split it between transport and warehousing, so we can track our carbon emissions by type of operation. When we talk to our drivers about efficiency, we talk in terms of grades, not mpg. The reason for this is there a raft of things that affects consumption in a real operation. Make, age and type of vehicle, weather conditions, vehicle loading and route topography all have an impact.

"To make it comparable across all our diverse operations, we use telematics data that records driving style. The grades are from A to G (G being awful). As a minimum, we expect Bibby drivers to achieve a B-grade. That means we accept that, given all the variables, the consumption you achieve is as good as we can reasonably expect. And as fuel consumption is one of the biggest costs to our business, I can tell you there is a very discernible difference between an A- and D-grade driver."

Even Mike Roeth, director of NACFE, and champion of freight-tonne efficiency, has sympathy with that position. A NACFE study found that payload, elevation change, wind and speed are the four factors that have the greatest effect on mpg. But the barrier to developing a realistic FTE metric, he says, is the difficulty of determining any of those factors (but speed) in real time. Faced by that, fleets give up and go back to mpg.

COUNTING COSTS

Although Morley says that he can appreciate that measuring freight-tonne efficiency has some strategic value, he doesn't use it to manage his fleet partly because there is no cost term.

Fleet operators mostly acquire vehicles on operating leases. Although specifying additional aerodynamic fitments or bespoke vehicles may improve the fleet's freight-tonne efficiency, they are likely to add cost, too. That changes the value proposition of the lease, potentially to the point where it might cancel out any efficiency gains. Bibby does invest in more efficient equipment, but balances such choices against the financial rewards.

States Morley: "Government needs a measure that gives it a feel for what's going on in its national road freight logistics industry, and for that, [freight-tonne efficiency] makes sense. But within an operation, measuring cost per mile – which accounts for fuel consumption, maintenance, utilisation and damage to vehicles – gives us a better indication of how we are doing."

Despite the complexities of measuring freight efficiency, any attempts to do so will be made much simpler in less than two years' time, when a pan-European benchmark for commercial vehicle fuel efficiency is instituted: the VECTO (Vehicle Energy Consumption Calculation Tool) project, led by the EU's Directorate General for Climate Action (DG CLIMA). Designed to find a way of certifying heavy duty vehicles' CO_2 emissions, it will also offer operators an objective benchmark to real-world vehicle CO_2 emissions (and fuel consumption) on a wide variety of vehicle types and applications. TE

FURTHER INFORMATION

'A slippery business' (about VECTO) – https://is.gd/fikava

NACFE's 'Run On Less' project – https://is.gd/uwipuz

Volvo Concept Truck – https://is.gd/igegel