Safety in NUM8ER5

Fleet engineers choosing from the array of supposed money-saving interventions now have evidence-based, independent data on tap. Brian Tinham reports from the Centre for Sustainable Road Freight

When it comes to fuel-saving measures, it's a jungle out there, with developers of everything from aerodynamic kits to lighter weight chassis and bodies all vying for your money. Which, if any, to choose? Now, however, operators wanting to maximise fuel and emissions savings, while minimising costs for their particular vehicles and duty cycles, have two reasons to be cheerful.

First, the Centre for Sustainable Road Freight (SRF) has launched software dubbed SRF Optimiser – accessible free online via the FTA (Freight Transport Association) – which helps fleet managers to prioritise interventions against verified cost/benefits. Plug in your own data and you can compare preferred options, and others, in terms of decarbonisation potential and payback period.

But second, that same independent academic- and industry-based consortium has gone public with a selection of R&D project outputs. And the results are impressive – leading to firm guidance on costs, effectiveness and likely timeframes for key transport technologies and logistics strategies.

Both are powerful resources, but the latter is particularly interesting – and not just because of the detailed findings and underpinning research insights. On the one hand, there are some surprises that

may refine operators' thinking. But, on the other, early adopters of certain SRF-developed and -endorsed technologies are so confident of their money-saving attributes, they are now pushing ahead with wholesale fleet conversions.

EVIDENCE-BASED

Why? Because they've seen for themselves the value of evidence-based, real-world tested (not just theoretical) interventions backed by in-service trials. That's particularly the case, for example, around aerodynamic refrigerated semi-trailers, which most of us must have assumed were a done deal by now. However, SRF's work reveals that re-optimised designs – all the way from aero kit profiling to the positioning of under-chassis equipment – makes a significant difference. Waitrose and Warburtons are among converts, and both are now specifying SRF-adapted vehicles from Gray & Adams.

Taking it from the top, late last year SRF released information on seven of its projects, graded according to fuel-saving potential, cost of implementation and readiness for adoption (see graphic right). Trailer aerodynamics, for example, gets one and a half stars (meaning up to 7% fuel improvement), a single pound sign (circa £5,000 to implement) and three ticks (ready now). Dual fuel C/LNG (compressed/liquefied natural gas) and diesel achieves no stars (no realistic savings), four pound signs (too costly) and a 'do not implement at this time' monica. And urban delivery trucks achieve four stars (20% benefit), three pound signs (not cheap) and one tick for availability – meaning sometime in the next decade.

So let's dip into a few, starting with that aerodynamic trailer. Professor David Cebon FRA, who heads up the SRF team at Cambridge University, explains that arriving at the new designs was founded on wind and water tunnel testing under the government's Low Carbon Truck trial.

"There's a lot of fluff around CFD [computerised fluid dynamics] modelling, but we know wind tunnel methods absolutely work," he explains.

"The trick is to optimise only the elements that fit the criteria – and then pick the operations where you get payback"

Professor David Cebon

"The same goes for water tunnels as long as the fluid conditions are hydro-dynamically similar. So our project team was able investigate flows around vehicle models using very precise laser-based particle velocimetry. That gave us the ability to really tune our designs for minimum drag in a way that nobody could achieve with CFD alone."

The output? Cebon states that critical to its improvement was remodelling the trailer rear end. "In our final design, we've tapered the outer insulation towards the rear to a precise angle that gives the best drag performance." That's not all though. Side skirts, the rear underrun guard and under-chassis peripheral equipment, such as air tanks, have all been re-optimised and/or repositioned.

"That gave us a 14% reduction in aerodynamic drag as measured against unmodified vehicles," he says, adding that Waitrose's long-term trials proved the predicted 7% improvement in fuel efficiency at highway speeds. "And we've done all this without changing the load capacity or the rear door access… Having a really clear understanding of how air flows work made this possible."

The bottom line: on-costs for the SRF design are £4,500 over a standard trailer, so ROI for trunking mileages is circa two years. With projected lifetimes for reefers up to 10 years, that's a lot of payback. Designs are available from SRF.

Moving on to light-weighting, there are examples of composite trailers that, although winners from a fuel-saving perspective, failed because they were too expensive. So Cebon explains that SRF focused on components and assemblies that could pass the alternative materials production economy test, yet cut weight.

"Top of that list were trailer decks, chassis beams, side wall sandwich panels and wheels, with some potential also from composite running gear," he says. "Light-weighting all that can get 1,500–2,000kg out of a 13.6 metre single-deck. So, if your operation doesn't gross out, there's a very compelling fuel-saving argument."

Looking in detail, he states that SRF's preferred floor is a novel sandwich panel involving glass fibre with a balsa wood core, although there are other options. Then, for chassis beams, the obvious choice is high-strength steel, but in moderation to control costs. What about glass fibre running gear? Well, while weight savings are available, they're costly so, for now, these remain a judgement call.

SUMMARY OF RESULTS

Project output	% Fuel saving	Cost of implementation	Implementation strategy
Trailer aerodynamics	★ ½	£	✔✔✔
Dual-fuel engines	⃠	£ £ £ £	⃠
Logistical measures	★ ★ ★ ★	£ £ £ £	✔✔
SRF Logger	★ ★	£	✔✔✔
Urban delivery vehicle	★ ★ ★ ★	£ £ £	✔
SRF Optimiser	★ ★ ★	FREE	✔✔✔
Trailer light-weighting	★ ★	£	✔✔

★ = 5% reduction in fuel consumption

£ = An implementation cost in the order of £5,000

✔✔✔ = Implement now ✔✔ = Implement over 5 years ✔ = Implement over 10 years ⃠ = Do not implement

PICK AND CHOOSE

"The trick is to optimise only the elements that fit the criteria – and then pick the operations where you get payback," asserts Cebon. He gives the examples of double-deck trailers in grocery distribution and walking-floors in bulk haulage. Looking at the former, saving 1,000–2,000kg means an additional three to six roll cages.

"Since each additional roll cage equates to a 1.5% fuel saving, there's a clear 4.5–9.0% potential." His opinion: applying lightweight composites to selected trailer components, as described, could be implemented rapidly and costs are small. "As fuel prices rise, this is going to become increasingly attractive."

Finally, what about SRF's view on urban delivery vehicles? Well, we're not talking trivial: Cebon suggests swapping 26-tonne rigids for artics pulling 13.6-metre semi-trailers. "Our electro-hydraulic, path-following steering is the key here – for one, two or all three trailer axles. That's what enables much larger payload vehicles to negotiate the urban environment."

But SRF's other main enabler concerns the addition of hydraulic regenerative braking on the trailer axles. "Steered trailer axles with regenerative braking, using hydraulic hub motors on each axle, is the way to go," says Cebon, explaining that the hub motors offer far greater power density than flywheel or electric alternatives.

"Commercially available hydraulic motors can be operated at up to 200bar, so energy storage is significant – although they're probably too expensive right now. But steering systems are available and offer a huge bang for your buck. As long as you're running full, you can expect effective fuel savings up to 30–35%. Add in the regenerative braking and that rises to 35–42%."

Which is nothing short of massive. TE