



Innovative engineering

With a commitment to slash CO₂ emissions, dairy giant Arla has developed five new vehicle solutions to keep it on track. Brian Tinham talks exclusively to group fleet director Gordon Irvine

Following last month's unveiling of Arla's novel refrigerated combination trailer – which transports not only packed milk to supermarkets, but also bulk farm collections on the return leg – the dairy giant has gone even further. Speaking exclusively to *Transport Engineer*, Arla has revealed no fewer than four more innovative vehicle types, all aimed at seriously reducing fuel costs and the organisation's environmental impact.

Gordon Irvine, group fleet director, asserts that, together, they provide a portfolio of solutions to help Arla's logistics operation meet its commitment to cut

CO₂ emissions to the tune of 25% by 2020, against 2005 levels. Stating that this has been a significant challenge, he explains that a 'one size fits all' approach was never going to cut it and that these are the cream of the crop.

"We run more than 750 vehicles and trailers, with the tractor units and heavy rigids mostly MAN, Scania and Volvo. But although articulated combinations clearly offer the most room for improvement, our rigids also had to figure, because of access restrictions," he says. So, starting in 2010, Arla came up with five projects to cover all the bases: the bespoke combination tanker-trailer; a dual-fuel tractor unit; hybrid rigid; a long-haul curtainsider; and a bulk farm rear-steer rigid tanker.

Tanker trailer

Taking it from the top, the idea for Arla's combination trailer (*Transport Engineer*, November 2012, page 36) came out of an innovation competition for employees. "The suggestion involved eliminating empty running on long-haul distribution by slinging a tank under a conventional refrigerated trailer for farm collections on the return journey," recalls Irvine.

"It wasn't, of course, that simple, and one of our challenges was a requirement to use existing technology. But we're now at the prototype stage, with a base trailer that's not dissimilar to an average refrigerated double-deck vehicle and a tanker inside also not dissimilar to one on our rigid tankers. However, the packaging is completely different."

Arla approached long-term suppliers Gray &

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Gordon Irvine



Adams and Crossland Tankers. “Both thought I was crazy, but engineers can’t resist a challenge, so they were soon onboard.” In detail, the result is a step frame, double-deck tri-axle trailer, 12.3 metres long and 4.4 metres high. The tank sits low in the bottom deck, with a conventional top profile, but stepped to keep the centre of gravity low, even when empty. It’s also fitted with a Carrier Transicold Vector 1550 refrigeration unit, with the electrically-driven compressor and fans – one of the first in the fleet to meet the PIEK standard for low-noise operations.

That’s coupled to a lightweight Scania G400 6x2 day cab tractor unit with the reduced size midlift. Irvine agrees that any of his three OEMs could have built the tractor, but says the Leeds dairy, where this trailer is based, is a Scania house. Power for the milk collection pumps comes from the tractor’s PTO-driven hydraulics.

Looking at operating costs, Irvine concedes that pulling the combination trailer is only a little less costly than a standard artic and tanker. “But we only need one motive unit, instead of two for the route. So fuel and driver costs are substantially down – and hence also CO₂ emissions. Trials so far have been sufficiently encouraging for us to place orders for another 19 to replace existing fleet units.”

As for the numbers, the combination trailer carries 88 roll cages of finished product out and 19,000 litres of raw milk back. That compares with 108 roll cages on a standard 13.6 metre trailer and 27,000 litres on artic tankers running at 44 tonnes. “So there is a small loss, but that’s more than offset, in terms of fuel

and emissions, by the efficiency,” says Irvine, who suggests that payback will be well within the eight-year trailer lifetime.

Dual-fuel tractors

That timeframe is probably comparable to Arla’s dual-fuel tractor development, which is based on LNG (liquefied natural gas) substitution, using Clean Air Power’s (CAP) conversion on a Volvo FM 13 440 Euro 5 tractor unit with I Shift transmission. “We concluded that LNG provided the best balance of CO₂ reduction against cost of deployment – including packaging LNG tanks on our three-axle tractors,” comments Irvine.

“So we bought two identical spec Volvos, taking one as standard and the other with the retrofit CAP package, and ran them head to head in a pilot. We were looking for a 48–52% average LNG substitution rate and a 15% reduction on CO₂, while also delivering a business case – meaning it would pay for itself in about three years.” And that’s despite the conversion cost of £25–30,000.

The trial proved the theory and Arla subsequently ordered 10 more similar Volvo tractors. “We now plan to acquire another 10 and will build the fleet as we gain confidence – given that the type of operation varies the results,” comments Irvine. “Heavier laden, long-distance haulage works better than urban, so we’re selecting routes that create the best benefit. Having said that, even some of our urban deliveries are giving satisfactory results. So we’re less concerned than you might think – as long as they’re not based in London and stuck in traffic.”

As for refuelling, Irvine explains that the pilot project used the public infrastructure. However, since running 11 units on day-to-day operations, Arla has been working with Chive Fuels and now has its own station at the Ashby-de-la-Zouch dairy. He also says that, although packaging is a challenge on these tractor units – particularly given their SCR (selective catalytic reduction) after-treatment – reconfiguring the space and moving to a smaller integrated diesel and Adblue tank did the trick. “We have 200km of residual range on diesel, which is also used in start-up, cold running and idling.”

Hybrid refrigerated rigids

Moving on to Arla’s hybrid rigid, Irvine says this arose following consultation with Volvo. “As a strategic partner, Volvo is tasked with delivering longer-term technology solutions. One of these was the LNG dual-fuel tractor, but the other was this hybrid rigid.”

Although early versions were far too expensive to meet Arla’s criteria, Irvine says his engineers worked alongside Volvo’s and that, with improving battery technology, that changed. “We now have this Volvo FE 300 6x2 26-tonner – as far as we know, the UK’s only Volvo parallel hybrid refrigerated vehicle – which has the ability to meet high environmental standards,

Arla's newly-engineered vehicle fleet: designed to shave 25% off CO₂ emissions by 2020



while reducing operating costs by about 13–15%.”

Irvine explains that Arla also worked with Thermoking on the refrigeration solution, making sure that its environmental credentials weren't compromised by a diesel fridge. “Thermoking developed the fridge, which has a direct drive off the truck timing case. It wasn't that easy, though, because, being a hybrid, the engine isn't always running. So then it uses a eutectic holdover system [mains power overnight] to keep the cargo cold.”

Sounds good? Irvine concedes that the battery and eutectics in the roof mean a weight penalty of 700kg, but adds that it's worth it. “That means we can only carry 60 roll cages, as opposed to the usual 65, but that's offset by the fuel advantage.”

However, he also admits that capital cost is still punitive and that, while battery technology and prices are improving, standard diesel-engined rigs are much cheaper. “The truth is we'll probably be lucky to break even. But the whole idea is to participate in moving the environmental agenda forward. And we're learning from the experience all the time.”

Long-haul trailers

Talking of which, what about the long-haul, high efficiency curtainsiders? Irvine explains that, as part of Arla's emissions commitment, the organisation is currently building the world's largest fresh milk dairy, in Aylesbury. “So we will need to transport large volumes of product as efficiently as possible from there to a secondary distribution centre in Hatfield, Herts, to serve London and the south east.”

Hitherto, Arla would have used standard, heavily-

insulated trailers, with a capacity of 108 roll cages for inter-site work, not least because they also provide for flexibility. “But, because we're investing in our future, and the volumes will be significant, we decided to examine other configurations, from double decks to drawbars, before we fixed on a new insulated curtainsider as the optimum solution.”

So, what's new? Irvine explains that, on a reefer, roll cage stacking has to follow a defined pattern. “But we wanted to carry more roll cages, and load and unload them much faster.” In fact, the new curtainsider can carry 117 roll cages in rows of six, with three sideways across the back. “We chose that configuration, because it would make handling very swift and lend itself to future automation.”

Making that work from an engineering perspective, however, was down to a partnership with bodybuilder Cartwright. “There were three things we wanted to validate on the prototype,” explains Irvine. “Could it accommodate the load? Could it adequately restrain the load? And could a curtainsided body retain the temperature integrity we require? Well, trials from our Lockerbie depot confirmed all three, with assistance from Bruntingthorpe Proving Ground, which tested the load restraint design, in line with VCA [the UK's national vehicle approval authority] requirements.”

In brief, Cartwright's solution is modelled on its Cheetah aerodynamic trailer, with roof profiling and side skirts. Then, to enable through-loading and automation, the trailer has no side pillars, although the curtains conventionally insulated. As for the fridge, that's the same specification as used on Arla's combination trailer – another Vector 1550.

“We are seeing like-for-like fuel improvements already – and that's despite carrying a heavier payload at 44 tonnes. Our MAN TGS 440s 6x2 tractor units are delivering an average 0.26 mpg fuel consumption uplift.”

Rear-steer tankers

And so, finally, to Arla's new rigid for milk collection – a project that has been as much about rationalisation as improvement. Irvine explains that the dairy firm has evolved its bulk tanker specification over time, from 16 tonne two-axle rigs to three-axle tankers and artics. One of the goals here was to fix on just two vehicle types – a 44 tonne combination with Tridex mechanical rear steer on the final axle, for farms

“We are seeing like-for-like fuel improvements already” Gordon Irvine, Arla group fleet director





where access is unrestricted, and a rear steer rigid for the rest.

Looking at the rigids, Arla has now added 17 new four-axle 32-tonne tankers to its fleet, all with rear steer on the rearmost axle, which have together replaced 22 time-served three-axle tankers. Of the 17, 12 have been built on Scania P260 8x2 chassis and the remaining five on MAN TGS 26 360s.

"We wanted MAN trucks for our Lockerbie operation, which is a designated MAN site, and Scania trucks for the others," explains Irvine, adding that Crossland built 10 of the tanks, while Danish

VM Tarm was responsible for the remaining seven.

"The tank design is interesting, in that we've gone for a compound section that maximises carrying capacity within the width envelope and the reduced length, which was specified for manoeuvrability. As a result, the profile fits within the dimensions of the cab – as opposed to conventional tankers that are typically one or more metres higher. And the centre of gravity is now as low as possible."

As for on-board pumping equipment, Arla has moved to a small positive-displacement priming pump, backed by a large centrifugal unit, capable of shifting over 50,000 litres per hour – about twice as much as its earlier vacuum pump fittings. "They're driven by a hydraulic PTO and controlled by our bespoke milk collection and measurement system, which is now used throughout the organisation.

"The new tankers carry around 19,000 litres per vehicle, instead of nearer 16,000 litres on comparable three-axle rigids. So we save fuel and emissions by collecting more milk without returning to base. Additionally, we can collect faster on the farms, which translates to fewer vehicles." **TE**



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