HERO OF ZERO

A disruptor company triggered a sea change in the mobile refrigeration industry, reports Richard Simpson

Diesel-powered truck refrigeration units first found themselves cast as the villains of urban air quality from around 2014 when the Dearman Engine Company launched itself on the cold-chain market in a flurry of publicity.

Rather than turning heat into kinetic energy by expanding combustion gas as a conventional engine does, the Dearman motor used the expansion of very low-temperature liquid nitrogen into gas instead. And it was particularly suited to the cold chain market because its exhaust gas was not only non-toxic, but also very cold. This additional cold could be harnessed as additional refrigeration, and would compensate for the relatively paltry torque output of the engine itself.

Part of the Dearman business strategy was to focus on the emissions produced by the then-current diesel fridge engines, although some of the negative claims made were questionable (for instance they appeared to ignore both the cyclical nature of the diesel motor's operation, with the engine typically running for only 15% of the time, and the tightening regulation of exhaust emissions from such engines). This approach won it glowing coverage from media outlets including the BBC and *The Guardian* newspaper.

But Dearman Engine Company found positive publicity was easier to get than paying customers. It went under in 2019 in acrimonious circumstances, having run out of cash after receiving millions in government funding. But it did trigger change in the cold chain industry and made operators and equipment manufacturers re-examine approaches to mobile refrigeration technology.

TWO APPROACHES

What emerged were two different approaches to powering mobile refrigeration units. One was to have a separate energy source cooling the load without using fossil fuel at all, and the other was to run the fridge unit as a parasite off the truck's main engine. The argument for the latter was that the extra load on the engine would produce only a tiny increase in fuel consumption, noise and emissions, while the former had the potential to produce no additional noise or emissions at all at the point of use.

Both have been given impetus by the ban on rebated 'red' diesel for the application, which came in last spring.

Perhaps the simplest form of refrigeration is eutectic (when a mixture of ingredients melts at a lower temperature than the melting point of any of the constituents). Carrier Transicold offers such a system in the VATNA. Plates containing R404A refrigerant gas are cooled at night using off-peak electricity to compress the gas, and their cooling capacity is used to preserve loads at below freezing during the day. It's cheap, simple and efficient but lacks the controllability and endurance of more sophisticated systems.

To achieve this, a source of electrical power is required on the vehicle. Advances in battery technology for electric road vehicles have produced batteries that can store a useful amount of energy and the means to top up their charge by recovering energy using regenerative braking. Not having an engine and fuel on board helps offset the weight and cost of the battery and regenerative system.

Battery-electric power is now offered by German trailer giant Schmitz Cargobull, which is unique in the sector for manufacturing its own axles and refrigeration units, in a full-size semi-trailer. Control electronics occupy the space taken by the engine on a conventional unit, the battery takes the place of the fuel tank between the landing legs and a wheel-driven generator is installed on the left-hand side of the trailer's middle axle. This is carefully controlled to minimise parasitic drag: for instance, it automatically deactivates when the truck is pulling away, and activates when the truck is in over-run condition and there is capacity in the battery to take the charge, or at speeds of over 70kph where rolling resistance is less than aerodynamic drag.

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The battery can also be charged via a conventional 'shore-power' link at the depot, and can provide four to five hours of refrigeration unsupported by the onboard generator.

Operational trials with a German supermarket indicate a fuel penalty for the tractor unit of one litre/100km, but a saving of two litres over the same distance from the fridge. The weight penalty is only 80kg over a conventional trailer with a full fuel tank, but the upfront cost premium is €35,000. Production of the trailer, pictured, right, starts next year.

Similar technology has been developed by others including BPW/Thermo-King and Valx/Carrier: both of these displayed at the CV Show in Birmingham this year. The BPW axle is unique in having regen units operating on each wheel-end of the axle to give symmetric retardation. Standard trailer tyres are specified. DawsonGroup already has trailers available using the Carrier system (pictured, p33) and TIP is claiming a 99% reduction in CO_2 from trials with Unilever in Holland.

DIRECT CONNECTION

Other solutions seek to use the power of the truck's engine in a more direct manner. Carrier offers an Eco-Drive power module running off the truck's PTO and featuring a hydraulically driven generator which in turn powers the fridge, with output independent of engine speed (pictured, right). DawsonGroup also has Volvo 18-tonne rigids fitted with hydraulically driven Hultsteins Ecofridge Slimline fridge motors on fleet, and claims operators can save around 2,520 litres of diesel a year against a conventionally driven fridge. Ecofridge units can be installed between the cab and body, under the chassis, or in the conventional position on the front wall of the body above the cab.

Operators looking to 'green' an existing fleet of fridge trailers and futureproof their tractor fleets can fit Hultsteins's Ecogen system. This can be installed on any tractor with a PTO on the back of the engine, and generates a 400V, three-phase supply that can be fed to any compatible trailer fridge unit to eliminate donkey engine running time while the tractor engine is running. Renault, Scania and Volvo trucks have a suitable DIN port for a PTO as a factory-fitment on their engines, and other makes can be equipped with one as either a line-fit option on a new truck or retrofitted to existing vehicles.

As an alternative to a PTO, Thermo-King can offer a hybrid solution, with an additional, liquid-cooled FrigoBlock alternator mounted on the front of the truck engine to power the fridge through an inverter as an alternative to running the fridge's own engine. An additional bracket to support the belt-driven alternator needs to be installed on the front of the engine, and space found for installation of the inverter.

Electric trucks, when they come, will pose another challenge. Mercedes eActros trucks to be revealed at the IAA show feature ZF ePTOs, which allow auxiliary systems such as fridges to be powered from the truck's traction batteries. However, this may cause an unacceptable depletion of range in some operations.

For example, fruit-and-veg merchant Reynolds chose an independent battery power source from CoolKit for an all-electric Renault Kangoo van to avoid this. Reynolds' Kangoo has a 12-volt Carrier Neos 100 fridge unit, which would be powered by the vehicle's alternator on a conventional van. It operates alongside an engineless Carrier Iceland 18-equipped 26-tonne IVECO Stralis, with both vehicles supplied by SHB Hire.

But does this all mean the Dearman engine reached the end of the road before its commercial journey even began? Perhaps not. A new company, Clean Cold Power UK Ltd, based in Croydon like its predecessor, is continuing to develop the technology. TE