Cleaner COLD

As London mayor Sadiq Khan focuses relentlessly on vehicle emissions, Sainsbury's is leading the charge in transport refrigeration with a zero-emission trial. Brian Tinham talks to developer Dearman

Late last June, Sainsbury's was revealed as the mystery "major UK commercial operator" that would be first to field trial a refrigerated truck chilled by a liquid nitrogen (LN) fuelled engine. The landmark zero-emission unit – developed under the Innovate UK-funded CoolE project – was to operate from the retail giant's Waltham Point depot, we were told, delivering goods across London.

This trial matters. Why? Because most auxiliary diesel TRUs (transport refrigeration units) are acknowledged to be heavily polluting, since they are not subject to EU exhaust regulations. So, given that the new cooling unit promises not only to exceed Euro 6 but to eliminate CO_2, NOx and particulates, it offers a once and for all solution.

Where are we now? In fact, by the time the Sainsbury's news broke, a second-generation LN engine system had been supplied by 'clean-cool technology' specialist Dearman, along with partners Air Products, Dawsonrentals, Hubbard and Solomon. It had been installed on the chassis of a Mercedes-Benz Antos, leased from Dawsonrentals. After commissioning, the truck had completed independent testing at Horiba MIRA, verifying EMC (electro-magnetic compatibility), etc. It had also been approved by the VCA (Vehicle Certification Agency), and been delivered to Sainsbury's ready to roll.

Dearman chief technology officer Nick Owen describes the installation as a near copy of the TRU developed for the earlier CoolE project, but subjected to "a detailed tidy-up". Key components were relocated on the chassis rails, he explains, and the system integrated and re-engineered for real-world operation.

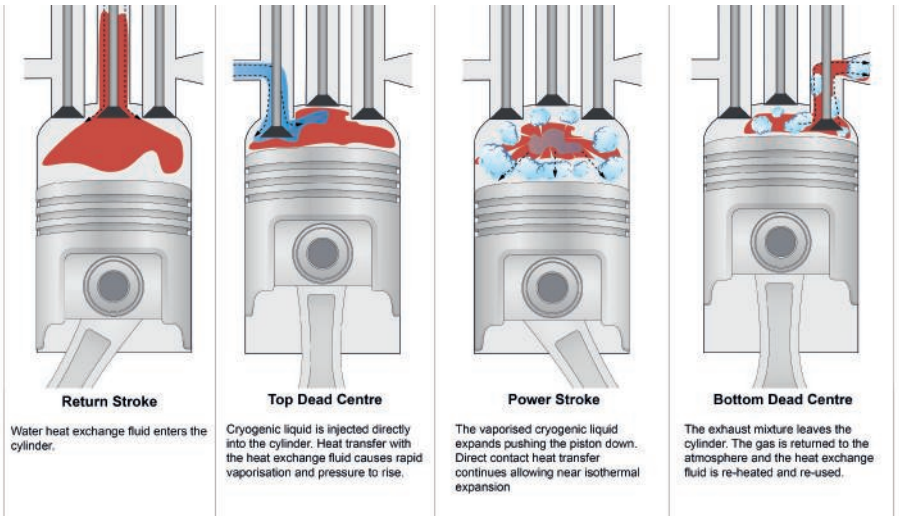
He also states that the Horiba MIRA air curtain – again developed under CoolE, to minimise icing of Dearman's ultra-cold evaporator (*TE*, July 2016, page 26) – was not implemented. "We're still considering that technology for scenarios where there are frequent door openings," he reasons.

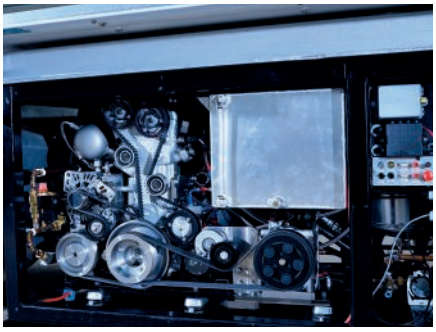
Sainsbury's has since started by testing the technology on single-drop missions, first delivering frozen and then chilled loads across London. It will next move on to multi-drop operations.

EXCELLENT PERFORMANCE

So how are trials going? Dearman commercial director David Sanders (formerly director of innovation at the Carbon Trust) says it's too early to talk about carbon savings, although "they will be substantial". He explains that, to date, Sainsbury's testing has been about proving reliability and performance.

He reports that the truck is performing at the high end of expectations. "The





Taste the difference

Sainsbury's estimates that during the initial three-month trial, its zero-emission truck will cut CO_2 by up to 1.6 tonnes – the equivalent of more than 14,500km in a family car. It will also save 37kg of NOx and 2kg of particulate matter, compared to a conventional TRU (transport refrigeration unit).

"We recognise the importance of reducing emissions, which is why we're working hard to cut carbon by 30% between 2005 and 2020," comments Paul Crewe, head of sustainability for Sainsbury's. "This trial with Dearman is just one of the innovations we've introduced. Their zero-emission system is really exciting: to be running a liquid air engine quite literally means our cooling is running on thin air."

Drivers like it, too. Dearman commercial director David Sanders reports that they find the new TRU just like any other – neither better nor worse. "Drivers don't have to think about it. And, if it works better in terms of temperature control and pull-down, Sainsbury's [and the planet] gets the benefit."

first few weeks have demonstrated that the technology works very well, in terms of achieving rapid pull-down times, and ensuring accurate temperature stability and control. In fact, it's better than conventional equipment. It's also very quiet. So the strengths we predicted are showing through."

And his assertions are backed by data, says Owen, who explains that instrumentation throughout the engine, thermodynamic equipment, LN injection system and the truck's compartment is logging all events. "On-board telematics also mean we can see what's happening here at our base in real time, and watch for developing problems."

So far, there haven't been any. Instead, the data has been helping Dearman's team to improve calibration around, for example, the control algorithms. "Our system needs to be able to handle the differing demands of chilled versus frozen payloads, matching power to the duty cycle. We're learning how to tweak the controls in a way you just can't in the laboratory."

What about refuelling? Owen explains that Air Products provided the temporary LN refuelling bay, which sits alongside Sainsbury's diesel pumps at Waltham Point. "Fuelling is designed to be automatic and the next iteration will use a nozzle to make the experience as intuitive as possible," he says. And he adds that, although the process currently takes 45 minutes, that will more than halve with the development of a re-specified tank, man enough not to trip safety systems at higher fuel flows. "The current tank was sized for a worst case scenario so has around five days' capacity. For a normal duty cycle, we would go for two days," he adds.

So what does the future hold? Sanders says Dearman has another generation of hardware in development, taking on board lessons from the trial as well as laboratory work aimed at lightweighting and design-for-manufacture. Those should see the light of day before the close of 2017 ahead of full-scale production in 2018. In the meantime, he says five more cold chain operators have signed up for trials this year – four UK and one continental – although he won't reveal names.

"They will use the next generation of equipment, which will look more like finished product and fit within a Hubbard TRU enclosure. We're still proposing to sling our equipment under the truck, but we can also mount it above the cab... Going for our under-chassis approach makes servicing easier and eliminates working at height issues."

No prices are available, but Sanders insists that Dearman will be "substantially competitive" against diesel TRUs. TE