

# Decarbonising waste collection

The first electric dustcarts are nearing market availability across the UK. Their development is thanks to strict emissions requirements, on one hand, and the initiative of a few entrepreneurs and small manufacturers on the other. Will Dalrymple reports

While the least battery-friendly commercial vehicle application might be long-haul trucking, where the weight of the batteries displaces the economic and environmental benefits, there may be another power-hungry job closer to home. Imagine a duty cycle that sustains extremely high levels (50-70kWh) of parasitic loads, and power requirements that ramp up toward maximum at the end of the shift.

Welcome to the world of the refuse collection vehicle (RCV), whose hydraulic bin lifts and waste compactors drain energy all day long, continuously accumulating refuse that must be driven back to base at the end of the shift. "It's effectively a machine on wheels, rather than a vehicle with a machine," states David Wykes, Horiba MIRA chief engineer, advanced technologies.

Unlike long haul, however, there is keen municipal interest in electrified RCVs, thanks to clean air pressure from government in the form of low- and zero-emission zones. For this reason, several manufacturers – and others – are developing small series production of electrified RCVs, to launch this year and next.

In fact, electric RCVs have been around for some time, in several forms. RCV bodybuilder Geesinknorba has

sold more than 130 Hybrid Plug-In RCVs (first introduced in 2003) that employ lead-acid batteries, and some 125 Li-on Power hybrids launched in 2013. The former, which was intended to be shut off often during the round, is claimed to reduce fuel by 15%, but requires overnight charging.

The latter's 600kg battery is still 900kg lighter than its older sibling. While driving between pick-ups, the vehicle's engine charges the battery through an on-board generator linked to the PTO. (The company says that trucks running shorter routes might need to top up the battery with a nightly recharge.)

Fully-electric RCVs can also be supplied piecemeal, as an all-electric driveline retrofitted to an end-of-life chassis. Driveline manufacturer Magtec exhibited just such a model, on trial in the London borough of Greenwich, at last year's Cenex-LCV exhibition.

Waste management company Veolia has commissioned from Magtec four such vehicles for domestic rubbish collection. It will retrofit 26t gvw chassis at the end of their life with a drivetrain powerful enough to tackle a 25% grade with full load. Two, expected by the end of the year, were funded partly by an Innovate UK grant to Sheffield City Council, as part of a two-year trial project. Two others are being built for London.

Turning to new-build vehicle manufacture, RCV maker Dennis Eagle is nearing market launch of a radical new approach to RCVs, after eight years of research with vehicle R&D organisation Horiba MIRA. Two projects, Hi-UCV (hybrid integrated urban commercial vehicle) and UVR (urban vehicle range), aimed to achieve a 50% decrease in CO<sub>2</sub> emissions, among other goals.

Wykes says: "One of the major barriers to take-up of electrification in the commercial vehicle world is the additive nature of the electric powertrain, which is heavier and takes up more space. They don't want to lose volume and mass, because that restricts payload, and then the vehicle is less commercially viable."

## THE MAJOR INNOVATION

Instead, the project went in a different direction, he explains. "The major innovation was combining the chassis and body into a single unit. It is very car- or van-like. By doing that, they gain access to volume and mass that otherwise wouldn't be used." Dennis Eagle has parlayed that extra carrying capacity to downsize the trucks. That means its former 32t 8x4 becomes a 6x2, and its 6x2 shrinks to a 4x2. Says Wykes: "Lightweighting is the fundamental way to save CO<sub>2</sub> emissions; if the truck is lighter, it takes less fuel to drive."



## ZF'S ELECTRIC RETROFIT PARTNERSHIP

Drivetrain component manufacturer ZF Aftermarket has teamed up with engineering firm In-tech to convert bus fleets to electric drives, initially in Germany, and later throughout Europe.

A vehicle can be converted with In-tech's bridge technology, called e-troFit, in four weeks, with ZF Aftermarket providing the necessary components. This timeframe, says ZF, is a significant advantage given that delivery lead times for new all-electric buses can be up to 18 months.

Helmut Ernst, head of ZF Aftermarket, says: "The markets won't be ready to provide the necessary volume production of electrically driven vehicles until 2025."



The project, which wound up in March 2018, has produced five pre-production vehicles, now out on customer testing. Three units have been made of a 'light' 16t gvwr 4x2 model that can carry 1.5t more than a standard 18-tonner, thanks to its new body, and powered by a 4.5-l engine (a smaller production diesel isn't commercially available). A second variant is a CNG-powered 26-tonner vehicle that is targeted to reduce CO<sub>2</sub> by 15%.

The third is an 18t hybrid range-extended model that includes an E-axle designed by Horiba MIRA and manufactured by fellow project partner GKN, as well as new Nissan Leaf battery technology. (On that vehicle, MIRA was responsible for the battery and powertrain control. This year, it has also opened a £2 million Advanced Battery Development Suite.) All three powertrains can be swapped between bodies.

Dennis Eagle previewed another, full-electric model at Munich's IFAT show in May (pictured). The 26t gvwr 6x2 rear-steer featured 300kWh batteries, a 200kW electric motor, 19m<sup>3</sup> body and split bin lift. At the time, Kevin Else, managing director of Dennis Eagle,

remarked: "Aside from replacing the diesel engine with an electric drive system, we have made minimal changes to the vehicle design, helping to ensure ease of maintenance, as well as product familiarity with drivers and crews."

Elsewhere, the company credited "innovative battery optimisation algorithms" with overcoming the challenges of the 'eCollect' duty cycle's increasing load.

It is predicted to go into production by the end of 2019.

### FILLING A GAP

Another up-and-coming electric RCV manufacturer is effectively a start-up. Electra Commercial Vehicles is a new arm of fleet management company NRG Fleet Services. Group managing director Sid Sadique explains how the company came about. He says: "At NRG, our job is finding solutions to customers' problems. Last year I was asked every day about this. When I approached the manufacturers, they told me that their models won't be ready until 2020-2022. So I started to develop my own."

Part of the problem may be the specialised nature of the application; RCVs are just one of many uses of 18-



and 26-tonne 4x2s, and the UK is just one of many markets in Europe that its truck makers supply.

So, looking to make all-new trucks, Sadique at NRG started to draw on the manufacturer contacts built up over 20 years as a truck rental business and operator (and, more recently, dealer, having bought Mercedes-Benz truck dealer Sparshatts of Sittingbourne, Kent). Market research highlighted the presence of what he called 'boffins and cranks' – inventors working with grant money on prototypes. The trouble was not only their reliance on a fixed, single-source funding stream, but the gap between those and series production. He was also disappointed with the specification of some of the models he encountered, whose parts often seemed to be chosen for their low price.

So at Electra he set about building a quality supply chain, using Tier 1 suppliers to provide the essential components such as drive motors, battery packs and inverters. Chassis manufacturers such as Dennis Eagle, Mercedes-Benz special trucks, IVECO and Isuzu have all agreed to assist Electra in producing full-electric chassis. Assistance comes in various guises from supplying glider chassis (factory-built

chassis with no engine, gearbox and exhaust systems), to technical drawings and CAN-Bus access.

"If it wasn't for a collaborative approach, we couldn't have done it," Sadique says. He adds that he is not establishing Electra as their competitor: he fully expects some of the bigger brands to launch electric RCVs in three or four years. When they do, Electra will shift toward repowering older models.

#### PROTOTYPE UNVEILED

In the meantime, the first unit, a 26t gvw Eonic 6x2, was shown in January 2018 with GeesinkNorba under the branding Li-on Power Pro (though that is not an exclusive partnership). The 3,900mm wheelbase rear-steer vehicle (pictured above) was fitted with GPMIV 21m<sup>3</sup> body and Terberg OmniDEL split bin lift. It comes with 200kWh battery pack; the total powertrain eats up about 500kg of payload. Trials suggest the battery will last for a full shift.

That model was built in Holland, which has a capacity of 12 vehicles per week (one conversion takes about 100 worker-hours). But the company was establishing production at a Blackburn, Lancashire location over the summer. Sadique claimed in May that the



## PANELTEX DEBUTS 7.5T CAGE TIPPER

At the smaller end of the scale, Paneltex is preparing series production of a 7.5t truck that comes with a Martrans caged tipper body suitable for council rubbish removal fleets. "A decade of collecting data in operation has helped us design and prove a vehicle that is not merely a zero-emission truck, but a usable, comfortable, robust alternative to a diesel vehicle for urban/suburban logistics and distribution," the company says.

The truck is a 4x2 Isuzu N75 chassis cab with 3.8m wheelbase. It is powered by a Magtec P180 motor and drive system and P182 motor controller. Peak power is 150kW; peak torque is 2,380Nm from a lithium phosphate battery pack. Top speed is limited to 50mph; range is quoted as 80 miles with an 80kWh battery pack.

Energy-saving features include regenerative braking (as well as mechanical braking) and an electric water heater for cab air heating.

Box body and fridge versions are also available.

company had amassed a large order book. That was built up partly through taking a wider view: through another business he plans to harvest old truck batteries and deploy them as an energy storage bank for the local community.

Also, he's not selling them. Trucks are leased based on a total cost of ownership model that assumes a seven-year lifespan based on a conventional RCV obtaining 3-4mpg on average. Contracts typically last five to eight years.

Electra's production also extends to other types of CV, including box bodies with electric fridge equipment, crane droppers and airport cargo vehicles. **TE**