



saves up to 25t of GHG over either a new diesel or battery-electric. Over seven years (the normal replacement cycle) the electric repowered vehicle will reduce GHG emissions by 72% compared to a new diesel (equivalent to 294 tonnes of CO₂), and this includes the greater emissions of the repower at end-of-life, as the scrappage of two drivelines must be accounted for, as well as generating the electricity to charge it. Even so, the diesel vehicle produces three times as much GHG per km as an electric. Additional benefits attributed to the electric RCVs include a reduction in toxic exhaust pollution output.

In terms of capital costs, the cheapest option was a new diesel truck at £175,000. An electric retrofit would cost £352,000 and a new battery-electric £425,000. The relatively high cost of the retrofit can be attributed to the extra work entailed in stripping out the old driveline, chassis refurbishment and the fitment of a new body and bin lift. Figures are based on 2019 prices. Operating costs over seven years are estimated at £136,044 for the diesel vehicle, with the electric trucks each costing £94,409. The report concluded that a retrofit RCV has the lowest financial cost and highest overall emissions savings of all three options.

PRODUCTS FOR SALE

Magtec offers repowering of Dennis Eagle 6x2 RCVs and other makes and models. The EV drive system consists of a 200kW motor powered by five battery packs, each consisting of 12 cells, giving

a 300kWh capacity – sufficient for up to 16 hours' operation prior to needing a recharge, which takes around seven hours. Thanks to the compact design of the motor and the lithium-ion batteries, there is no impact on vehicle weight or payload.

Erskine says: "In Sheffield, the vehicles are running for 14- to 15-hour shifts, then making it back to the depot with range to spare, where they are recharged using electricity generated from the depot's incinerator. Regeneration braking is very effective in Sheffield's hilly terrain.

"Batteries account for a significant part of conversion costs. We have one battery pack under the cab and mount the other batteries on each side. With the heavy diesel engine gone, we need to get as much weight as we can on the front axle, but the battery capacity can be adjusted to suit the operation. Our EV drive systems allow the batteries to be daisy-chained, and we can easily adjust the battery capacity to suit operational requirements because we make the batteries.

"Our batteries are not thermally-managed, as generally our market doesn't require heated or cooled batteries. We have vehicles operating in Marrakesh [Morocco] and Denver [Colorado, USA] without issue. There are more theoretically-efficient battery types available, but they require their own temperature-control system, which immediately make them less efficient than ours in use." **TE**

"Even with the current electricity prices, the electric vehicles are saving us £2,000 a month each in fuel, AdBlue, and maintenance/engineering costs.

"Running diesels in 100% urban conditions means trouble from emissions-control systems. Euro VI works brilliantly on motorways, but we struggle to get everything hot enough to work in town.

"Charging is an issue. We have installed two 44kW DC ABB chargers for the vehicles, but at other depots the grid is already saturated. In the summer we are going to install chargers at our energy-from-waste plant so the vehicles will be collecting their own fuel!"

Turning to their introduction, he admits that there was some resistance to the vehicles from crews

when they were first introduced, centring on range anxiety and the trucks being quiet. He adds: "But the drivers are now confident, following education and training. The trucks often come back with 50% charge left, and the crews enjoy the reductions in noise and fumes."

Declining battery capacity can be an issue as EVs age, and Yendluri has an interesting viewpoint. He says:

"Our batteries have held up well, but we always keep them at least 20% full, which means a four-hour rapid-charge between shifts. Fleet managers could choose between buying 40 vehicles and nursing the batteries to last 10 years, or buying 20 vehicles, working them twice as hard and exhausting the batteries in five years, then looking to replace and repurpose the original batteries."

Repowering RCVs

One of the arguments against moving too fast to zero-emissions trucks is that scrapping good diesel-engined vehicles before their time is wasteful and environmentally unsound. This is particularly true in the refuse collection market, where even an 'all-bells-and-whistles' spec Euro VI 26-tonner seems pushed to make £20,000 in the used market at seven years old – quite a drop from its new cost of perhaps £175,000.

There are good reasons for this: local authorities and their contractors are usually specific in their bodywork requirements, depending upon factors including whether the same vehicle is required to collect segregated recycling as well as waste, and the type of bin lift required. And an increasing number of local authorities are announcing intentions to go carbon-neutral: shying away from new diesel vehicles that may stay on the fleet for a decade.

In the mainstream truck market, repowers of existing vehicles, whether they come with more modern diesel engines to meet the latest emissions standards, or alternative drivelines, seem to have never taken off. But experience in the RCV market suggests

'Greening' a refuse collection fleet doesn't necessarily mean investing in new vehicles. Richard Simpson explores the repower option

that a trick may be being missed.

South Yorkshire company Magtec has been plugging away with the idea of converting used diesel trucks to electric power since 1992. "We've been a little bit too far ahead of the curve, on occasion," admits Jim Erskine, head of commercial sales and marketing, "but there's now sufficient interest in our technology for us to have productionised it across a variety of different product lines."

Five years ago, Magtec led an Innovate UK-funded project which saw four end-of-life 26-tonne diesel Dennis Eagle RCVs repowered with fully electric drivelines and bodywork. Two were put to work by Veolia in densely populated Westminster (pictured, right), and the others in hilly and less densely populated Sheffield. Their performance was monitored by Microlise telematics.

One of the first findings was that the purchase of new vehicles, whether diesel or electric, is costly in both financial and environmental terms. Analysis revealed that, in terms of greenhouse gas (GHG) emissions at manufacture, a new battery-electric RCV was 20% worse than a diesel. However, repowering an existing diesel vehicle (reusing the chassis-cab)



THE WESTMINSTER EXPERIENCE

Edward Yendluri (pictured) is contracts manager at Westminster City Council, and has managed the repowered RCV vehicles since the trial started.

"There are three key factors to running them successfully," he explains: "The reliability of the vehicle, the ability to charge rapidly

from the grid, and getting operational staff buy-in.

"Our two original vehicles are still in service four years after they were repowered.

Their availability is not the best, as there are difficulties in getting them



to communicate with the chargers.

"A 10-year-old Euro V vehicle is not the best place to start with a repower: the electronics in a Euro VI vehicle are much more sophisticated.

Magtec has been brilliant with its continued support, but we decided

not to repower any more Euro V chassis, and have gone for new battery-electrics from Dennis Eagle and Electra. To anyone contemplating a repower, I'd say choose chassis that are four or five years old."

But Yendluri remains enthusiastic about the project: "We replaced the body and refurbished the chassis at the time of the repower, and the exercise has doubled the chassis life.