

Going the extra miles

Rising from obscurity, the series hybrid is viewed by some people as the most flexible means of complying with the inevitability of zero emissions zones. Peter Shakespeare reports

Over 7.5 tonnes GVW, most of the major OEMs appear to favour development of full battery electric vehicles (BEV) based on technology already proven in bus products. Daimler's FUSO eCanter and Mercedes eActros, and Volvo's 18 to 26-tonne 'Electromobility' project, currently lead the BEV field. And MAN has announced it will put a heavy battery electric truck into series production in 2019. In terms of range, Daimler claims its eActros urban distribution truck has a range of up to 200km on a full battery charge; the eCanter's range is around 100km.

Vehicle range and payload productivity have been, and will continue to be, major factors that influence how BEVs stand up to commercial scrutiny. But battery nirvana is still 10 to 15 years away, even though significant advances in battery chemistry are delivering higher energy density cells and enabling faster charging, according to Greg Harris, the head of commercial special projects and new technologies at Horiba MIRA.

The issue with BEV ranges has seen a renewed interest in the series hybrid, a technology dismissed by all the major European truck OEMs. Harris maintains that this, also known as the range-extended battery electric vehicle, will become the best option

to deliver the range flexibility for BEVs that need to operate in and out of zero emission zones, until pure electric vehicles can deliver the productivity and performance required.

He contends: "Only range extended hybrids can operate at zero emissions within urban zones and then have the ability to move between them, using range extension. We are still a long way from seeing breakthrough battery technology and all-electric fleets. Legislation has a glide path, so in the medium term we are looking at reduced emissions across the board, not zero emissions. Maintaining flexibility is important."



In its most basic form, a series hybrid uses an internal combustion engine (ICE)-powered generator to supply electricity direct to one or multiple traction motors. Super-capacitors or lithium-ion batteries are used to manage power demand. Plugged in and charged while the vehicle is not in use, their power is replenished on the move by regenerative braking and a generator powered by a small ICE. In theory, range can be extended up to the capacity of the fuel tank the vehicle carries.

Compared with a parallel hybrid (where both the electric motor and the engine supply power), these range-extended battery electric vehicles



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Ford



initially required larger batteries, making them heavier and more expensive to produce. They also employed other complex technologies and power management systems.

Several series hybrid commercial vehicles are coming to market soon. Horiba MIRA was the lead partner in a £10 million project to develop a complete 20-tonne series hybrid vehicle for Dennis Eagle, pictured in inset. Harris says: “MIRA designed a new battery system, using the latest Nissan nickel-manganese-cobalt cells [pictured above and below], and an ISO26262 vehicle control system and software that addresses new functional safety requirements. It also designed the powertrain, driveline and a lightweight monocoque chassis, which reduces the weight and productivity penalties associated with series hybrid technology.” He explains that Dennis plans to put the hybrid vehicle into series production, but will use the chassis as the basis for a broader future vehicle range, utilising different powertrains.

Below 7.5 tonnes, one of the most popular vans in the UK, the Ford Transit Custom, is currently being tested in

series hybrid form. Twenty units are being trialled in London by fleets including Kier, Mears and Morrison Utility Services, Speedy Plant and Clancy Docwra and parcel delivery firm DPD, in advance of series production next year. The plug-in hybrid driveline consists of

a 50kW electric motor and 1.0-l EcoBoost petrol engine as range-extender. Ford says the vehicle can run full-electric for 31 miles and 350 miles or more on a full tank. The OEM says: “Series hybrid configuration removes

the need for a more complicated transmission and enables a smaller internal combustion engine to be used.”

The technology is also known in bus markets. A decade ago, Wrightbus developed the new London Routemaster, a series hybrid design employing a Siemens ELFA traction unit and Cummins 4-cylinder diesel.

Turning to trucks, Chelmsford-based Tevva Motors is about to put a range extended 7.5 to 14-tonne electric truck (pictured, left) into production. Emiss in Holland and Transpower in the USA have also developed series hybrid trucks.


Tevva sales and marketing director David Thackray contends that OEMs are shunning series hybrids, because of their continued reliance on the ICE. “The OEMs are waking up to electric vehicles; but in terms of marketing them, pure BEVs make a simpler case than range extended electric vehicles, because the latter still require an internal combustion engine,” he says.

“It is also my view that the OEMs have lagged behind fully developing electric, because they have untold billions invested

in internal combustion. If they were to suddenly pour all their R&D budgets into fast-tracking electric, they may not see the financial returns they need.”

Tevva estimates the potential UK market for range extended BEVs up to 32 tonnes GVW is around 25,000 vehicles. Thackray says any day cab vehicle that returns to its operating base at night so it can be charged could work as a plug-in range extended hybrid. In terms of a business case, operational data from Tevva’s 7.5-tonne vehicle suggests that the vehicle needs to average a minimum of 80km a day to realise the savings from running on grid electricity. On battery only, energy cost is £0.06 p/km. With range extension, the current vehicle’s 100bhp 1.5-litre engine is said to offer an extended range of 310 miles with a 60-l fuel tank; it burns 10.7-l of diesel per hour powering the 161bhp electric motor.

Incidentally, CO₂ emissions from series hybrid range extender engines can be mitigated. Dearman has developed a liquid nitrogen-fuelled APU (auxiliary power unit) and Emiss in Holland is using natural gas to fuel its range extender.

The rise of the series hybrid is still in its infancy. If the spokespeople for the technology are correct, there could be a significant market for it. And one that the mighty OEMs are currently choosing not to exploit. 

FURTHER INFORMATION

Bus drivetrain developments – <https://is.gd/inequh>

Borismaster or Saunamaster? – <https://is.gd/doquru>

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Super-capacitors for energy storage – <https://is.gd/xagayo>

