

STOP AND GO

Automatic stop-start systems that kill the engine in queues or when the traffic lights are at red while making it easy to restart are almost commonplace on diesel light commercials, finds Steve Banner

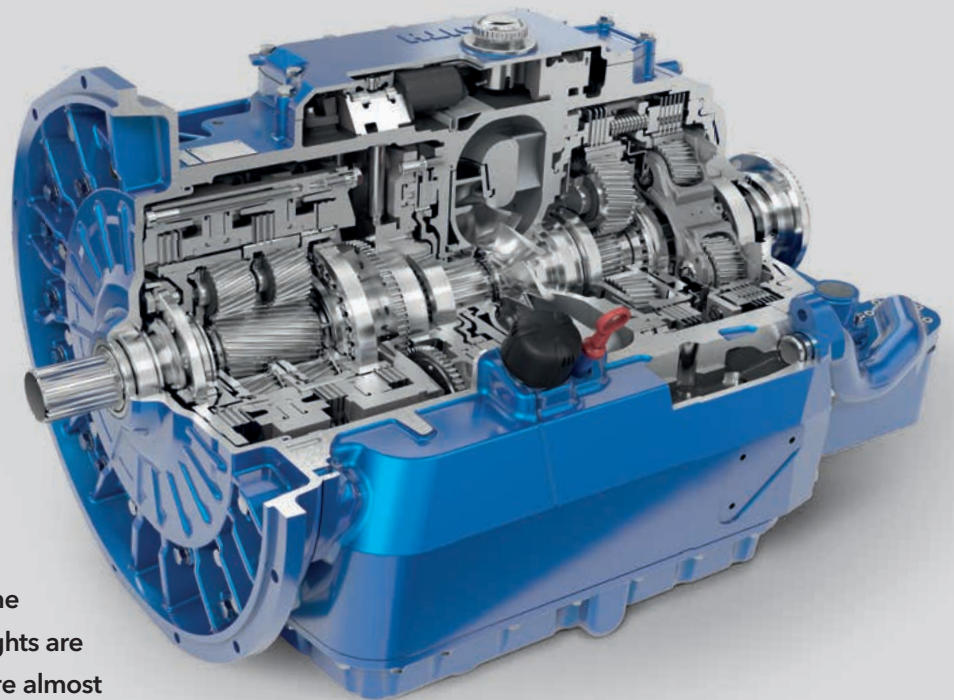
Such systems cut fuel usage and the vehicle's CO₂ footprint as well as emissions of harmful substances such as NO_x and particulates. They are widely fitted to diesel urban buses for the same reasons, says Cummins communications director, Kevan Browne.

"The majority of Cummins-powered buses sold in the UK are equipped with stop-start," he reports. "However it tends not to be fitted to buses used on rural, semi-rural or long-distance intercity routes." Their duty cycles means that they do not stop and start frequently enough to make installation worthwhile.

Introduced by Cummins when its first Euro VI engines appeared, and an option, it is especially effective on urban services, he points out. "The studies we've conducted show that stop-start can save 8.5 minutes of idling time an hour and provide a fuel saving of up to 8%," he says.

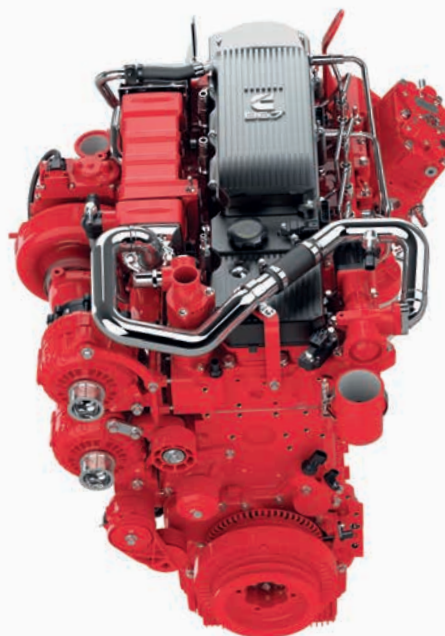
"That can equate to a saving of up to 2,000 litres of diesel and 5.0 tonnes of CO₂ annually on routes with an average of 20 stops an hour," he adds.

Constantly stopping and starting a heavy-duty diesel engine installed in a bus that works seven days a week can cause premature wear and tear.



Upgraded components have to be fitted accordingly. "Engine enhancements focus on bearings and injectors, with an upgraded starter motor provided capable of coping with up to 180,000 stop-start events," says Browne. "This enables the system to handle up to 30 stop-starts an hour, which is more than the average that we see."

Stop-start is available on Cummins' four-cylinder B4.5 and six-cylinder B6.7 engines (pictured below). It is also offered on the smaller F2.8 and F3.8 diesels, which Cummins suggests are suitable for mini-coaches.



A further reason why stop-start appeals to bus fleets is reduced noise, especially at bus stops. Boarding and alighting is a pleasanter experience without a diesel rumbling away.

LOW CV UPTAKE

While stop-start is accepted on vans and urban buses, truck manufacturers and their customers have shown next to zero enthusiasm for the idea. Recalls Browne: "They've not asked us for it," says Browne. "We piloted it on trucks when Euro VI was introduced, but there was no interest so it never went further."

Admittedly Cummins does not offer it on its bigger-capacity units, but it could make it available on smaller engines fitted to 7.5- and 18-tonners employed in urban distribution. "However, there's no real demand," he observes.

Truck manufacturers do of course offer idle shut-down systems designed to stop engines ticking over unnecessarily when trucks are parked. But those do not restart automatically.

Another approach to stop-start has been introduced by BAE Systems in conjunction with ADL in the latter's Enviro400ER series hybrid diesel-electric double-decker. Geofencing kills the diesel engine as the bus enters a city's

zero-emission zone, allowing it to switch to battery power. When the bus leaves the zone, the diesel cuts in again. The rule of thumb is that for every battery-driven mile travelled the bus must travel at least a mile with the engine on, charging the 32kWh battery to replace the energy expended. Regenerative braking also helps to top up the battery.

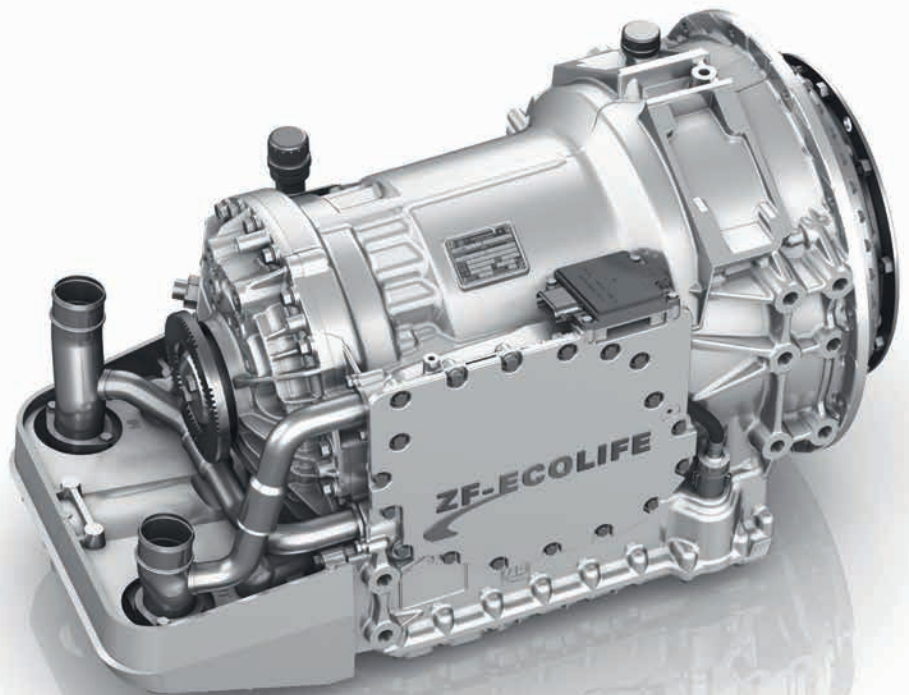
Stop-start on a conventional diesel-only bus can only function with compatible transmissions. Both Voith and ZF offer automatic gearboxes with this capability. "All our EcoLife 2 boxes are stop-start capable as are later EcoLife 1 boxes," says ZF technical manager, Simon Ackroyd. "We expect to see fuel savings of anywhere between 6% and 12%."

Shutting down and firing up a heavy-duty diesel several times an hour in slow-moving traffic can drain the starter battery and has implications for battery life. "Bus manufacturers fit sensors to monitor the state of charge," says Browne.

Stopping and starting the engine can also mean constantly cutting the power to any ancillary systems - air-conditioning, for example - that may be fitted. For that reason, operators who run buses in a humid climate with the air-conditioning always turned up to its maximum setting understandably do not always specify stop-start.

ANOTHER WAY

There is a way of addressing this drawback, however. Over the past 18 months, German operator Autokraft has acquired 246 MAN Lion's City buses equipped with Voith DIWA.6 automatic transmissions with stop-start (pictured, p31). Many of them also boast MAN's EfficientHybrid technology, which involves positioning an electric motor between the engine and gearbox which serves as a crankshaft starter alternator. Also fitted are a roof-mounted Ultra Cap energy accumulator and control system.



Every time the bus slows, the starter-alternator converts the energy recuperated into electrical energy which is stored in the UltraCap module. Whenever the start-stop function switches the engine off, the module releases energy which is then used to power the vehicle's electrical system.

"As a consequence of all this, we're substantially reducing our fuel consumption," says Autokraft deputy director, fleet operations and maintenance, Maik Knudsen. The Ultra-Cap accumulator can manage up to 2.6m stop-starts, claims MAN.

EfficientHybrid's benefits could sway truck operators that may be wary of stop-start because of the risk of interrupting the power supply to any ancillary equipment that has been fitted.

Voith transmissions that are stop-start compatible require no extra maintenance, says sales and marketing manager, John Domigan. "We fill them with fully-synthetic lubricant at the factory, but you can use a synthetic, semi-synthetic or mineral oil in them just so long as it meets our specifications," he says.

OIL MOVEMENTS

The longer a bus's engine is stopped, the more the lubricant drains out of the torque converter, points out Ackroyd. "So with EcoLife we've ensured that the converter remains full of oil, with an accumulator inside it that stores the pressure," he says.

"This means that buses fitted with our transmission with stop-start can remain stationary for a minute or more, and can respond quickly when the driver needs the engine to re-start so the vehicle can move away," he adds.

The degree to which oil drains down into the sump every time an engine stops can be an issue too, with all the implications this has for wear, says Scania pre-sales technical manager, Phil Rootham. And while stop-start can deliver attractive reductions in fuel usage, how attractive they are depends on how soon the engine is asked to fire up again, he contends.

Stop-start will burn a bit more diesel every time it starts, he points out; heavy-duty diesels have a lot more internal inertia to overcome than car or van diesels. This means that if the vehicle is only stationary for a few seconds, the extra fuel it consumes when it kicks into life again quickly cancels out any savings garnered during the brief time the engine was shut down.

"The problem is that if a vehicle has stopped at the lights, the driver has no idea whether they are going to go green in one second or 50," he says. "If an effective V2I (Vehicle to Infrastructure) system can be developed, however, then the traffic lights will be able to tell the stop-start system how long they will be at red."

The truck can then decide whether it is worthwhile switching the engine off; or if it makes better sense to allow it to keep ticking over. **TE**