

Operators wanting to run older trucks and buses in London's upcoming ULEZ look set to benefit from CPT's revolutionary work with Eminox. Brian Weatherley reports



ELECTRIC ENGINEERING

It's not every day I visit a company only to be told "You've probably come six to 12 months too early". But then it's not every day we get a story about a joint venture aimed at converting Euro 4 truck and bus engines to Euro 6 emissions standards – and while also improving fuel economy.

So what's this about? British-based Controlled Power Technologies (CPT), which majors on drivetrain electrification, has joined forces with emissions-busting specialist Eminox to develop just such a system. It's based on CPT's electric supercharger and Eminox's SCRT (continuously regenerating trap and selective catalytic reduction) technology.

What's more, this is just one of several projects harnessing CPT's 48V electrification platform. Others include its Cobra (controlled boosting for rapid response applications) electric supercharger, Tigers (turbine integrated exhaust gas energy recovery system), and SpeedStart and SpeedTorq motor-generator torque-assist and kinetic energy recovery systems.

First things first. Why should anyone electrify mechanical engine ancillaries? CPT's CEO Nick Pascoe states that to

gain efficiencies and cut emissions, "the truck industry can't ignore what's happening in automotive". But while electrification of CVs may well mean going bigger, it doesn't automatically mean full electric drives. "That's the last thing you'd go for," he insists.

Which is not to say CPT isn't involved with electric drives. The firm is lead contractor on Project Fever and is developing a 48V ultra-lightweight electrified rear axle for a hybrid city car with Ricardo, Tata Motors European Technical Centre and Provector.

PARASITIC LOSSES

For CVs, however, its priorities are to cut (or eliminate) parasitic losses from ancillaries, harvest wasted energy and provide supplementary power for heavy-duty engines – especially downsized.

CPT sees 48V as the future here. Why? Because you can run ancillaries more efficiently at 48V, than 12 or 24, not least due to the lower current draw. Why not go higher than 48V? "Because at 60V you hit a safety limit," explains Pascoe. "That's when the big orange cables appear and the costs start soaring."

So, which ancillaries are ripe for

electrification? Pascoe picks out fuel and steering pumps, each of which typically requires 5–10kW. Electrification could also supplement air compressors on downsized diesels. However, you need to do more than simply swap a mechanical pump for an electric alternative, he says. You need to make it switchable on and off, and ideally also regenerative.

Mark that last word. For Pascoe, electrification is in large part about recycling energy. On trucks and buses that means regenerative braking and



Andy Dickinson (centre) and Rick Quinn (right) head up development of CPT Cobra and Tigers technology



"We're reducing demand on the combustion chamber when NOx is at its worst and the chamber hottest"

Nick Pascoe

CPT's Tigers thermal energy recovery system has been applied to a government-supported programme led by Wrightbus



waste heat recovery - using CPT's Tigers. "Then you're not only getting your electrical energy free, but you've also got ways of returning energy back to the wheels," he enthuses.

Consider CPT's SpeedStart motor generator (engine side of the clutch) and SpeedTorq (driveline side) for electrically-driven transmissions and axles. As well as replacing alternators and starter motors, these can boost torque in launch and hill climbing. It's about helping the engine through "maximum flame growth", says Pascoe. "We're reducing demand on the combustion chamber when NOx is at its worst and the chamber hottest." The choice of drive - direct to the starter ring-gear or belt-driven - then depends on engine size and cranking cycles.

However, with motor generators and regenerative braking (typically recovering 10-12.5kW) offering free energy, what is the best storage method? Not batteries, replies Pascoe. A more attractive solution is supercapacitors which can capture and release large-scale electrical energy very fast. "That's why I say come back in six to 12 months," he laughs.

But there's more. On the boosting front, Pascoe reiterates there's nothing

to be gained simply from swapping turbochargers for electric compressors. "Turbochargers are good at providing pressurised air into the engine. Their problem is they can't do it quickly." That's where CPT's electric supercharger comes in. It can deliver more air, faster and at low engine revs, so ensuring better combustion, performance and emissions, particularly on downsized engines.

ELECTRIC SUPERCHARGER

So how will a CPT/Eminox Euro 4 to Euro 6 conversion perform? CPT engineering manager Andy Dickinson explains that Cobra will "fill-in some of the operational holes" of existing engine turbos. It will reduce engine load, especially during launch, so allowing the fuel sweet-spot to be enlarged, particularly into the lower rev range. That, in turn, delivers the driveline efficiencies and fuel savings.

"It's what we call part-load assistance. We're providing air all the time, which means the engine doesn't have to pump so hard," he says. And he adds that, since accelerating Cobra to 50,000 rpm takes just 0.5 seconds, air is delivered super-fast on demand. Meanwhile, better combustion means lower emissions,

especially particulates - which are then tackled downstream by Eminox's SCRT emission control system.

Encouragingly, Dickinson states that in prototype installations there have been no engine bay packaging problems. The Cobra supercharger simply mounts upstream of the turbocharger, using existing water cooling. Furthermore, the conversion doesn't involve major ECU re-programming. Cobra reads engine speed, etc, from the vehicle Canbus, and calculates when to supply supplementary boost, he says.

For even greater efficiency gains, Dickinson concedes that more integration would be required, along with changes to fuelling. However, for the moment CPT's focus for its electric supercharger is all about low rev (700-1,000 rpm) boost enhancement on large displacement engines.

By teaming up with Eminox, CPT gains a partner already well versed in reducing older engine emissions. Eminox's service network could also undertake conversions, as might dealers and operator workshops. As for timescales, Pascoe says: "In retrofit terms it could come next year. We also see this as an opportunity for the OEMs over the next three years and beyond."

There's certainly plenty to play for. The current consultation by London mayor Sadiq Khan on bringing forward the Euro 6-based ULEZ to 2019 and extending its scope in 2020 will focus minds, especially those of bus companies, running non-Euro 6 vehicles. And there are plenty of those: according to a recent study, while some 3,500 Euro 6 buses are now operating in the UK, more than 17,000 are Euro 5 or more polluting.

What about the payback? While there's still some months to go before the CPT/Eminox conversion is available, Dickinson suggests that potential buyers should expect a two-year return on investment. [IE](#)