

TUNING IN

Peter Shakespeare looks at the questionable practice of aftermarket truck engine re-mapping

A quick Google search for 'truck engine remapping' will yield aftermarket tuning specialists claiming torque and horsepower increases in excess of 20%, and fuel economy increases ranging between eight and 15%. The tuners claim engines ranging from Euro IV to Euro VI can benefit from a re-map.

In one corner is Andy Booth of Doncaster-based commercial vehicle engine remapping specialists, ECU-Flash. He says that what motivates the majority of its customers to have their vehicles re-mapped is fuel savings. Normally its cost is around £450+VAT per vehicle to go to the customers' premises and carry out the work. Typically the customer will see a return on their investment within 4-6 weeks. ECU-Flash claims to cover the majority of engines from the big seven European OEMs from Euro IV-VI. So what's not to like?

Answering that question requires some background. Electronic engine control units (ECU) have been around since the late 1930s and first appeared on German-built aero engines. They didn't appear on a mass produced vehicle engine until the early 1970s, when Ford pioneered electronic engine control using a Toshiba microprocessor. Up to this point, throttle pedals were connected to diesel injection pumps and carburettors by a cable. By the early 1990s, ECUs were in widespread use across automotive engine manufacturing. Today, they can be found on all modern engines and play a critical

role in managing exhaust emissions, both inside the engine and by exhaust aftertreatment systems.

In basic terms, ECUs process inputs from various sensors on the engine, transmission and fuel system and interface with control systems to adjust fuel and air flow into the cylinders, injection timing, open and close EGR valves, operate variable valve timing and control gear shifting. In parallel to this, they also control systems such as exhaust aftertreatment, traction control, anti-lock braking and cruise control through CAN-Bus. At their heart is a microprocessor.

Its microcontroller chip is programmed with sets of instructions developed at the engine design and development stage which, in simple terms, dictate the inputs required to achieve desired outputs. In the case of engine power and torque output, throttle opening (air/fuel mix and injection timing) and resulting engine speed will dictate the engine's power and torque output. In modern engines, the inputs must be balanced by the OEM's engine designers to manage combustion efficiency and resulting exhaust emissions, while delivering the desired engine performance across its duty cycles to meet strict type approvals.

The OEMs achieve this during powertrain development over long



periods of time, using engine test beds and dynamometers, sophisticated computer models, test tracks and large and highly-skilled engineering teams. It is massively expensive to achieve a fine balance between inputs, outputs, duty cycles and emissions.

THE CASE FOR THE PROSECUTION

In the other corner is Andy Noble, commercial vehicle and off-highway market sector head at Ricardo (pictured, above). He is clear that the likelihood is that "any aftermarket ECU re-map will have a negative effect on exhaust emissions as well as compromising powertrain reliability and durability". He adds that in all probability, their use will also have a detrimental effect on some elements of the engine's exhaust aftertreatment system, such as diesel particulate filters. Added to this, because changing the engine map on the most modern vehicles to increase power and torque will increase the levels of NOx and PMs, vehicles fitted with on-board diagnostics (OBD) will need additional defeat devices fitted, which on these vehicles, moves the practice into the realms of illegality.



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“While it is possible to get up to 30% more power and torque from most heavy-duty factory-calibrated diesel engines, and reduce fuel consumption, it will have a significant impact on durability and emissions.”

On that point, Phil Moon, marketing manager at vehicle and engine OEM DAF states: “All new vehicles must comply with strict legislation which involves certification against Euro VI emission standards. Any interference with the engine calibration or the aftertreatment system could potentially compromise performance and lead to emissions of potentially harmful gases.”

Booth at ECU-Flash did not respond to further requests to explain what changes are made to the engine during tuning. In his absence, Noble explains how it is done: “The ECU hackers achieve increased power and torque by changing the engine map to overfuel the full-load portion of the power and torque curve. This much richer air/fuel mix will increase PM production. A 10% increase in fuel in the mix will increase smoke by maybe 100%. A negative effect of increased PM emissions is quicker DPF (diesel particulate filter) clogging, meaning more frequent

regeneration and a shorter life expectancy. As they are expensive to replace, removal by unscrupulous operators is not uncommon.

“While over-fuelling during full-load increases fuel consumption in this part of the duty cycle, the hackers change the injection timing to early injection and under-fuel in the part-load portion, where the engine spends most time during the duty cycle. This means over the course of a journey overall fuel consumption will be reduced.

MORE POLLUTANTS

“Introducing early injection during part-load in most heavy duty engines significantly increases NOx levels. Where OBD is fitted, it must be fooled, so it doesn't detect the increased NOx and PM levels. Such measures include the so-called ‘AdBlue eliminator’, ECU flashing to disable the SCR system and turning off the EGR by re-coding the ECU so the system does not function. Tampering with vehicle emissions control systems is illegal in the EU and operators or drivers who do so can now be fined. If the re-mapped vehicle is to pass its MOT, it will need to be returned to factory settings.

“The hackers and OEMs have been playing a game of cat and mouse for some time, as the OEMs want maximum reliability and durability to avoid warranty claims. Euro VI vehicles have been engineered to be far more tamper-proof, but Euro IV and V vehicles are far more vulnerable.”

Anything that interferes with the OEM's factory ECU calibration will invalidate the vehicle warranty for any engine and powertrain related failures. Most OEMs will contribute towards the cost of component or system failures, even if the vehicle is out of the initial warranty period, if a design flaw or common in-service failure is shown to be the cause. But if any interference can be proved, they will wash their hands of any responsibility, which can lead to hefty bills for the vehicle's owner.

While researching this feature, the author witnessed AdBlue removal and EGR removal ‘solutions’ advertised on re-mappers' websites, alongside HGV tuning and ECU re-mapping. In 2017 DVSA, following 4,000 roadside checks, reported that one in 13 HGVs tested were found to be using emissions cheating devices.

Andy Noble says that the introduction of fines for operators found to be cheating and increasing numbers of tamper-proof vehicles on the road may reduce this problem, but the ability to prosecute the suppliers of the avoidance methods has been hampered by lack of legislation.

So what conclusions can be drawn? Engineering expertise upholds the re-mappers' claims of better fuel efficiency, which in emissions terms, means lower greenhouse gas emissions. And lower fuel bills mean better profitability for those operators who follow the re-map path.

But this comes at the expense of complying with current laws limiting the emissions of harmful gases, including NOx and particulates. **TE**