MAHLE Powertrain has integrated a 48 V eSupercharger into their latest downsized engine, along with a conventional exhaust driven turbocharger for high speed, full load performance.

A maximum power output level of 193 kW has been achieved during dynamometer testing, resulting in an increase in specific power output from 100 to 161 kW/litre whilst also achieving high torque (in excess of 33 bar BMEP) at low engine speeds. This enables a greater degree of engine downsizing to be achieved, thus yielding significant fuel economy improvements. This represents a new development in engine boosting technology by hybridisation of the air intake system, making the electrical charging device a fundamental part of the enabling technology. The eSupercharger is, in this application, no longer simply a transient device, but also a key contributor to the low speed steady state engine performance.

This eSupercharged engine has been installed in a demonstrator vehicle developed by MAHLE Powertrain. The 48 V platform used in this application comprises a 3-cell advanced lead acid battery pack, a DC/DC converter to maintain the state of charge of the 12 V battery (which supports the existing 12 V systems), the eSupercharger and a 10 kW BISG (belt integrated starter generator). The latter provides continuous electrical power to the eSupercharger, even when the 48 V battery is depleted. The combination of a heavily downsized gasoline engine, together with the 48 V hybridisation applied to this demonstrator vehicle, is expected to yield a combined CO₂ reduction of 25 % over the NEDC.
MAHLE eSupercharged Downsizing Demonstrator Vehicle

- 48V hybridisation with electric supercharging
- Energy recuperation via a belt-integrated starter generator
- Extremely high specific power and torque
- Excellent transient response and driveability
- Increased levels of downsizing possible
- Greater CO₂ reduction potential

**Technical specifications eSupercharged Downsizing Engine**

- Displacement: 1.2 Litres
- Bore x stroke: 83.0 mm x 73.9 mm
- Specific power: 161 kW/L (~260 bhp)
- Peak torque: 315 Nm @ 1,500 rev/min (33 bar BMEP)
- Boosting System: 48 V eSupercharger & Turbo Charger

**Vehicle Targets**

- CO₂ output NEDC: 25% reduction compared to baseline
- Emissions target: EU6C
- 0-100 km/h: 6.4 s
- Maximum Speed: 155 mph / 250 km/h
- Kerb Weight: 1,545 kg