

## eSupercharged Heavily Downsized Gasoline Demonstrator

Dr. Mike Bassett, Jonathan Hall, Benjamin Hibberd, Dr. Stephen Borman and Simon Reader  
MAHLE Powertrain Limited, Northampton, UK

### Abstract

Gasoline engine downsizing is already established as a proven technology to reduce automotive fleet CO<sub>2</sub> emissions by as much as 25 %. Further benefits are possible through more aggressive downsizing, however, the trade-off between the CO<sub>2</sub> reduction achieved and vehicle drive-ability limits the level of engine downsizing currently adopted. This paper will present results showing the benefits of adding an eSupercharger to a very heavily downsized engine. Measurements will be presented from a 1.2 litre, 3-cylinder, engine fitted with an eSupercharger in addition to a conventional turbocharger.

The original cutting-edge MAHLE downsizing engine still has higher BMEP levels than any gasoline engine currently in series production. This engine has now been re-configured to enable a specific power output in excess of 160 kW/litre. Of key importance is a cost effective, efficient and flexible boosting system. The Aeristech eSupercharger, operating at 48 V, enables the transient response and low speed torque to be more than recovered, enabling both very high specific output and specific torque characteristic with excellent transient response and drive-ability characteristics, clearly demonstrating eSupercharging as a key technology for enabling further engine downsizing.

The resulting heavily downsized engine is to be installed into a demonstrator vehicle. The vehicle will feature an advanced 48 V lead-carbon battery pack and a 48 V belt-integrated starter generator (BISG). The battery and BISG have been selected to enable the continuous high-output (>6 kW) operation of the eSupercharger to support prolonged operation of the engine at low-speed and high-torque output. The resulting demonstrator vehicle will be described and drive-cycle CO<sub>2</sub> performance will be presented.