

## Challenges for high specific output engines to achieve Real Driving Emissions

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### Abstract

Gasoline engine downsizing is already established as a proven technology to reduce automotive CO<sub>2</sub> emissions by as much as 25 % over the NEDC emissions cycle. However with changes to emissions legislation to adopt the WLTP cycle for fuel consumption and emissions reporting and the addition of Real Driving Emissions (RDE) testing the region of engine operation will change dramatically during emissions testing to regions of higher engine loading. During the emissions tests a greater proportion of the engine operation is expected to be spent within the less efficient knock-limited and component protection regions of the engine operating map.

An in-depth investigation of the RDE regulations has been undertaken as part of MAHLE Powertrain's RDE compliant engine development process. Analysis of the RDE emissions cycle has been performed against real world data collected from varied driver demographics and vehicle types to assess how representative RDE testing is of real world driving. The effect of these new regulations on high specific output engines has also been considered.

The key change introduced with RDE legislation is the requirement for vehicles to meet an emissions target within a wide range of boundary conditions. During emissions testing, vehicles will be operated at higher loads and speeds, with wide temperatures and altitude requirements. Analysis of the emissions performance across all boundary conditions will be presented.

This paper will present the results from emissions testing performed at MAHLE Powertrain's Emissions Development Centre and RDE testing over a range of C-segment vehicles with varying levels of downsizing. Measurements will be presented highlighting the effect of varying levels of downsizing on emissions and fuel consumption for future legislation requirements. Technology options will be discussed to achieve RDE compliance for high specific output engines.