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Development of a Turbocharged Direct Injection Downsizing Demonstrator Engine

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ABSTRACT

This paper describes the initial development of a 3 cylinder 1.2l technology demonstrator engine from MAHLE. The purpose of this highly turbocharged direct injection engine is to demonstrate production-ready technologies that enable low CO₂ emissions via downsizing by 50%.

Downsizing is one of the most proven paths to CO₂ emission reduction. By using careful design, a 2.4 l engine can be replaced by a 1.2l engine that has superior torque at all speeds and on-road fuel consumption benefits of 25 - 30%.

A two-stage turbocharging system has been developed for the engine to enable good transient response and the high torque levels at all engine speeds demanded by a downsizing approach. Several options were tested and the final system exceeds the 30bar peak BMEP target with stoichiometric fuelling. Indeed, $\lambda = 1.0$ fuelling is maintained over the majority of the full-load line and the 144kW peak power requirement is fulfilled at only 6000 rpm.

Test data are presented for both steady state and transient performance as well as vehicle fuel economy simulation results. Discussions on combustion system development and emissions performance status are included.