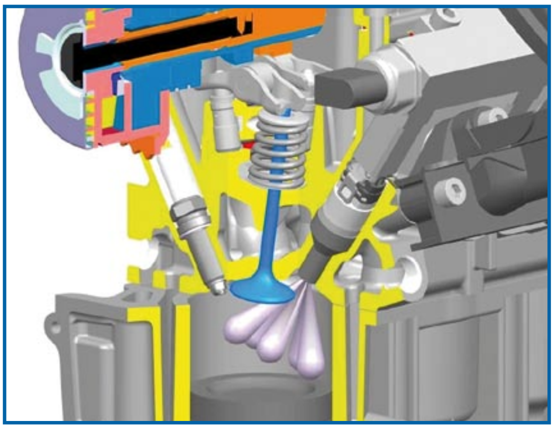
Turbocharged Three Cylinder-DI-SOHC Gasoline Engine - 95 g/km CO_2

Current and future legislation for CO_2 emission reduction also requires improved fuel economy for all vehicle classes. Engine downsizing combined with turbocharging and direct injection offers a promising path to achieve these future fuel economy standards.

In an effort to meet these targets, FEV adapted direct injection and variable valve timing technologies to a small turbocharged three-cylinder SOHC gasoline engine with two valves per cylinder. Due to the small cylinder bore diameter of this engine (66.5 mm) and a swept volume of 233 cm³ per cylinder, the injector layout and injector integration in the cylinder head were key factors during the concept phase in order to avoid increased oil dilution. A well-proven FEV tool chain, which considers injector spray characteristics, combustion chamber geometry, piston movement and in-cylinder charge motion effects was used to obtain a very low level of oil dilution. Compared to other engines in this class, the level of oil dilution can be found in the lower range of the scatterband, despite the very small bore diameter compared to most mass production direct injection gasoline engines.

The direct injection system was combined with a MAHLE CamInCam® system that enables independent variation of intake and exhaust cam timing for SOHC engines. Residual gas can, therefore, be reduced using scavenging during low engine speeds. Volumetric efficiency under full load operation was enhanced and the low end torque was significantly improved by up to 50%.



Combustion Chamber with integrated DI Injector

The variable valve timing helped to decrease the part load fuel consumption by up to 3% in the relevant engine map area for the NEDC. The greatest fuel economy advantages can be achieved during constant driving at several vehicle speeds. The overall fuel consumption advantage by using the small, boosted engine during the NEDC is 16% in comparison to a naturally aspirated 1.4L engine with comparable driving performance. Through the introduction of additional powertrain and vehicle-related CO_2 reduction measures, overall fuel consumption can be decreased by 29%. These measures, combined with a mild hybridization strategy, could result in a CO_2 level below 95 g/km over the NEDC for a vehicle within the inertia weight class of 1360 kg.

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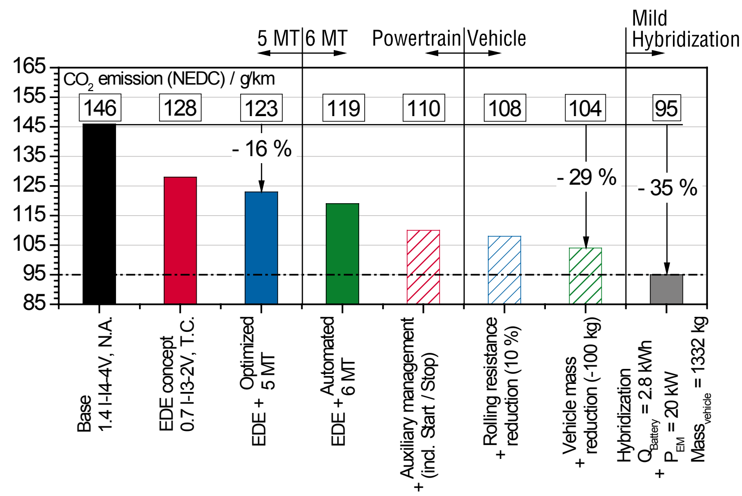
Inertia Weight Class: 1250 kg   Engine Performance = const. (65 kW)



CO_2-Reduction Potential