



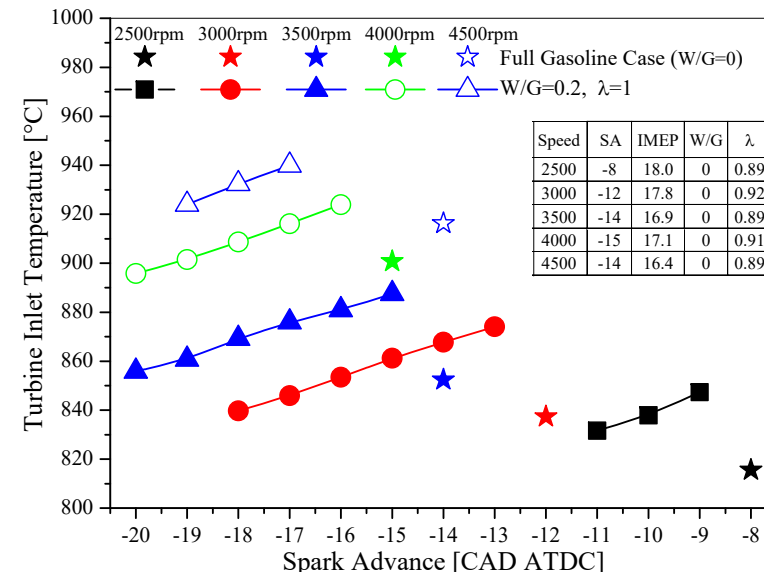
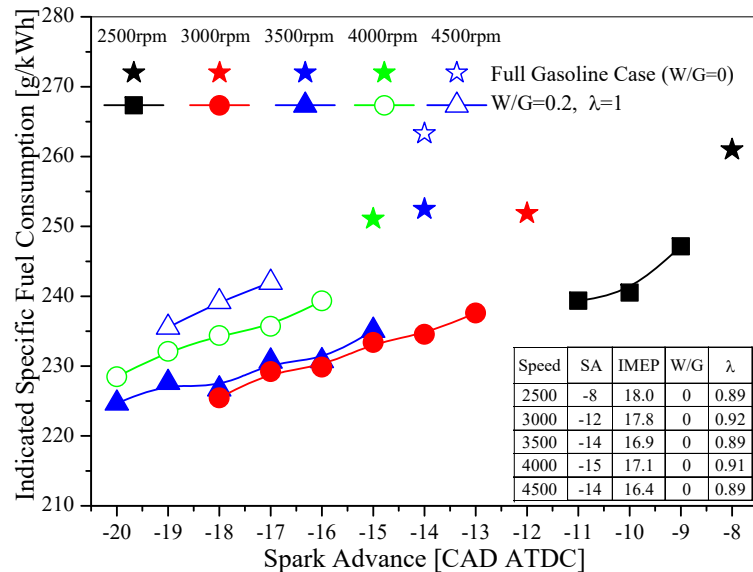
Gasoline engine powertrain development for 2025 and beyond is focused on finding the best solutions for optimal combustion engine efficiency and strategies to reach the requirements for the highest specific power levels. Besides the cooled exhaust gas recirculation (EGR) and the variable compression ratio, the injection of water, under investigation, is gaining interest as a way to increase thermal efficiency and decrease pollutant emissions and CO₂ by reducing fuel enrichment demand.

Investigations are performed on a turbocharged VVA twin cylinder engine (875cm³) with the water injected via separate low pressure solenoid injectors upstream the intake valves.

A reduction up to 15% on the indicated specific fuel consumption (ISFC) was reached with a combination of water injection and advanced spark timings that allowed to reach improvements in a wide area of the engine map.



Engine	PFI, 2 cylinders, 8 valves, VVA Turbocharged and Intercooled
Displacement	875 cm ³
Compression Ratio	9.9



Effect of Water Injection (W/G=0.2) on the Indicated Specific Fuel Consumption (left plot) & Turbine Inlet Temperature (right plot) against the spark advance, in the interval of engine speed from 2500 to 4500rpm.

The influence of the increased heat capacity provided by the water evaporation allowed to run the engine with leaner mixtures ($\lambda=1$) and advanced spark timings producing benefits both on the ISFC and turbine inlet temperature with respect to the full gasoline cases.

FUTURE INVESTIGATIONS

Further improvement of the water injection concept will be assessed investigating the trade-off with the cooled exhaust gas recirculation (EGR). Moreover, future investigations with advanced injection systems will show the additional benefits that can be achieved from this link of technologies.

ISTITUTO MOTORI

Advanced Systems for Thermal Engines Optimization Division

Contact Information



dr. Gerardo Valentino

Research Director

Istituto Motori, National Research Council (CNR)

Viale G. Marconi, 4

80125 Naples – Italy

Email: g.valentino@im.cnr.it

Phone +39 081 7177129

My ORCID <http://orcid.org/0000-0001-8353-9922>

Recent References:

Water Injection: A Technology to Improve Performance and Emissions of Down-Sized Turbocharged Spark Ignited Engines, C. Tornatore, D. Siano, L. Marchitto, A. Iacobacci, G. Valentino, F. Bozza. SAE Int Journal of Engines - V126-3E, Paper # 2017-24-0062, 2017

Water Injection to Enhance Performance and Emissions of a Turbocharged Gasoline Engine under High Load Condition, A. Iacobacci, L. Marchitto, G. Valentino. SAE International Journal of Engines 10 (2017-01-0660), 2017

A modeling study of cyclic dispersion impact on fuel economy for a small size turbocharged SI engine, V. De Bellis, F. Bozza, D. Siano, G. Valentino. SAE International Journal of Engines 9(4):2066-2078, 2016.

A Non-Linear Regression Technique to Estimate from Vibrational Engine Data the Instantaneous In-Cylinder Pressure Peak and Related Angular Position, D. Siano, G. Valentino, F. Bozza, A. Iacobacci, L. Marchitto. SAE Technical Paper 2016-01-2178, 2016