



Particle Reduced, Efficient Gasoline Engines

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Written By	Andrew Lane (RIC) Andrew Murphy (RIC) Gareth Jones (RIC) Yuanping Li (RIC) Sam Davies(RIC)	2019-12-11
Checked by	Niall Turner (JLR)	2019-12-17
Approved by	Andrew Lane (RIC) Niall Turner (JLR) Normann Freisinger (DAI) Simon Edwards (RIC) - Coordinator	2019-12-17 2019-12-19 2019-12-19 2019-12-20
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Publishable Summary

The Particle Reduced Efficient Gasoline Engine (PaREGEEn) project is a European Horizon 2020 project that has been created with a view to demonstrating a new generation of Gasoline Direct Injection (GDI) engines, achieving a reduction in CO₂ emissions of 15% compared to the baseline product available in 2016, and control of particle size down to 10 nm in size through the adoption of new technologies. Jaguar Land Rover (JLR), in conjunction with Bosch (BOSCH), Johnson Matthey (JM), Ricardo (RIC), Garrett (GAR) and the University of Brighton (UOB) are to deliver a Jaguar XE vehicle in 2019 that will adopt dilute combustion (excess air, external Exhaust Gas Recirculation (EGR), internal exhaust residuals or a combination of all three) in order to achieve the targeted 15% CO₂ improvement, as well as meeting EU6d levels of tailpipe emissions, including particulates measured down to 10 nm.

This report, Deliverable 4.6 sets out the technical advances made in the tasks to develop a demonstrator vehicle. In this task, the engine and aftertreatment systems, as detailed in the previous reports, have been implemented. This work includes the integration and development of vehicle control system changes plus the calibration of the engine and aftertreatment systems, to maximize the fuel saving and emissions reduction. In this report the final development work from the Multi-Cylinder Engine (MCE) testbed, at the University of Brighton, is reported as well as the work carried out for demonstrator vehicle build and demonstrator vehicle testing results. This is the final task and deliverable from WP4.

Testing on the MCE testbed covered the introduction of the E-Compressor and the swap from Engine #1 to Engine #2 (containing higher compression ratio pistons). The E-Compressor has enabled the low engine speed torque targets to be met under stoichiometric operation and allowed an extension of the lean operating window. Following this work, the swap from Engine #1 to Engine #2 was carried out. The initial stoichiometric and lean remapping tasks returned a fuel consumption improvement and a reduction of engine out NO_x emissions.

The demonstrator vehicle has been built and developed from the Jaguar XE donor vehicle at Ricardo. The hardware includes the same 48V system, including E-Compressor and Electrically Heated Catalyst, and the same exhaust aftertreatment as fitted to the MCE testbed. The base calibration developed on the MCE testbed was transferred to the vehicle and additional, vehicle specific, calibration and control strategy development tasks were carried out. The demonstrator vehicle was tested on the chassis dynamometer and the results from the WLTC Low cycle are presented in the report. The results show successful integration of the key technologies into the demonstrator vehicle.

To summarise, all the major hardware has been tested and their relative benefits quantified using the MCE testbed. The components, except for the high compression ratio pistons, have been successfully integrated into the demonstrator vehicle. This demonstrator has conducted multiple emissions tests and shown the potential benefits of the dry dilution concept versus the baseline vehicle. The emissions tests have been impacted by limitation of the prototype ECU, but this impact has been quantified and a walk to the programme targets has been provided.

Appendix A – Acknowledgement

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Project partners:

#	Partner	Partner Full Name
1	RIC	RICARDO UK LIMITED
2	DAI	DAIMLER AG
3	JLR	JAGUAR LAND ROVER LIMITED
4	BOSCH	ROBERT BOSCH GMBH
5	FEV	FEV EUROPE GMBH
6	JM	JOHNSON MATTHEY PLC
7	HON	HONEYWELL, SPOL. S.R.O
8	JRC	JOINT RESEARCH CENTRE – EUROPEAN COMMISSION
9	UNR	UNIRESEARCH BV
10	IDIADA	IDIADA AUTOMOTIVE TECHNOLOGY SA
11	SIEMENS	SIEMENS INDUSTRY SOFTWARE SAS
12	LOGE	LUND COMBUSTION ENGINEERING LOGE AB
13	ETH	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH
14	UDE	UNIVERSITAET DUISBURG-ESSEN
15	RWTH	RWTH AACHEN UNIVERSITY
16	UFI	UFI FILTERS SPA
17	UOB	UNIVERSITY OF BRIGHTON
18	GARR	GARRET MOTION CZECH REPUBLIC SRO



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