PaREGEn

Particle Reduced, Efficient Gasoline Engines

EUROPEAN COMMISSION
Horizon 2020 | GV-2-2016 | Technologies for low emission light duty powertrains
GA # 723954

Deliverable No.	PaREGEn D4.5	
Deliverable Title	Engine Development Report	
Deliverable Date	2019-06-30	
Deliverable Type	REPORT	
Dissemination level	Confidential – member only (CO)	
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Status	FINAL	2019-07-29

Publishable Summary

The Particle Reduced Efficient Gasoline Engine (PaREGEn) 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 CO_2 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. In Work Package 4 (WP4) of the project, 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% CO_2 improvement, as well as meeting EU6d levels of tailpipe emissions, including particulates measured down to 10 nm.

Deliverable 4.5 sets out the work completed in the development and testing of the multi-cylinder engine and aftertreatment hardware in the facilities at Ricardo, Shoreham and the University of Brighton. This lead on from the single cylinder engine work as reported previously in Deliverable 4.4. Over the course of the testing, the major areas covered included the stoichiometric engine calibration, the lean engine calibration, and the aftertreatment characterisation.

Within the stoichiometric phase, the calibration process explored the trade-off between reducing pumping losses and maintaining combustion stability, whilst investigating the potential benefit of adding EGR to the stoichiometric combustion. During the lean calibration phase, the control of the actuators under lean conditions and how the combustion mode switching is approached, was devised. The results of the Design of Experiments calibration approach described the trade-off between fuel consumption, engine out NOx emissions and combustion stability.

The aftertreatment phase gave results of the stoichiometric and lean testing on the Three-Way Lean NOx Trap (TWLNT), the Three-Way Gasoline Particle Filter (TWGPF) and the Selective Catalytic Reduction (SCR) system. The stoichiometric components were shown to be capable of three-way conversion and the light-off profile, following a soaked ambient start, was as expected. Under lean conditions, a new formulation for the TWGPF is shown to greatly improve the SCR conversion efficiency of NOx.

The next development activity will include the use of the electrical compressor to increase the engine lean operating region and improve the full load performance. Additionally, the calibration and learning will be transferred to the WP4 demonstrator vehicle. It is with the demonstrator vehicle that an assessment will be made of the actual fuel economy improvements and emissions performance against the targets specified in Deliverable 5.1.

Acknowledgement

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

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	GARRETT–ADVANCING MOTION

This project has received funding from the European Union's Horizon2020 research and innovation programme under Grant Agreement no. 723954.