Particle Reduced, Efficient Gasoline Engines

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Summary

The aim of Work Package (WP) 5 is the validation and assessment of the systems developed in the PaREGEn project (especially WP3 and WP4) through physical testing, with the final objective being to ensure the correct operation of the developed subsystems and their optimal integration into the demonstrator vehicles. A a Mercedes E180 and Jaguar XE were chosen as baseline vehicles by Daimler and Jaguar Land Rover, respectively, for their demonstrators.

Throughout the project, tracking and monitoring activities of these developments were performed in order to align the project results. At the end of the project, an evaluation of the complete system developed in each of the two demonstrators (in terms of fuel consumption improvement and pollutant emissions reduction) was performed. This evaluation consisted of the independent validation of the ≥ 15% CO_2 reduction potential of the two demonstrator vehicles and compliance with Euro 6(d) RDE limits (including the ability to effectively reduce the particle emissions down to 10 nm) to give an indication of the potential to reach possible future EU Super Low Emission Vehicle standards.

Deliverable D5.3 shows the results of the different testing campaigns performed for each of the demonstrator vehicles, the Mercedes E180 for WP3 and the Jaguar XE for WP4. These vehicles were tested while equipped with the new technology developed within the PaREGEn project, both in terms of combustion system, engine optimization and with a new aftertreatment system capable of reducing the pollutants and PN emissions, especially sub-23 nm, at the tailpipe.

Various cycles were performed on IDIADA's chassis dynamometer (CD) during the testing campaign of each demonstrator vehicle. Basically, the NEDC, WLTC and an RDE Cycle (simulated on the CD) exhaust emission tests were done.

The results obtained for the WP3 demonstrator vehicle are presented in this document for each of the cycles performed. The main parameters of the testing campaign to be analysed were the CO_2 and PN emissions, including sub 23 nm particles. Concerning these emissions, the targets defined for the WLTC, both for the TML (Test Mass Low) and TMH (Test Mass High) (the cycles were performed with two different load conditions in order to assess the best and the worst cases), were successfully achieved in terms of CO_2 saving and PN emissions. In addition, the results of the other pollutants were below the legislation limit. It should be noted that, as originally proposed, the targets for the vehicle were not the full 15% CO_2 saving, however opportunities to achieve the full 15% were evaluated.

Regarding the WP4 demonstrator vehicle, the testing campaign was performed with a very stable and consistent performance of the vehicle. Furthermore, the targets defined at the beginning of the project were achieved in terms of PN emissions, including for particle size down to 10 nm. In terms of CO_2 saving, the targets defined for the WLTC TML and TMH were not achieved with the Jaguar demonstrator vehicle due to the immaturity of the vehicle's calibration and the need for further control system development. The other main pollutants, the nitrogen oxides (NO_x) and the hydrocarbons (HC), were slightly above the Euro 6(d) limits, for the same reasons as for the CO_2 results. However, according to the WP4 team analysis, the project targets should be achievable with the chosen technology and enough time to develop it.

Finally, an extended particle emissions analysis, especially sub-23 nm particles, was undertaken during the demonstrator testing by using different, newly developed equipment from the PEMS4Nano project, capable of measuring particles down to 10 nm. These PN measurement systems were combined with another sub-23 nm measurement device and a size distributor to enable a more detailed analysis of the particle emissions.

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
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15	RWTH	RWTH AACHEN UNIVERSITY
16	UFI	UFI FILTERS SPA
17	UOB	UNIVERSITY OF BRIGHTON
18	GARR	GARRET MOTION CZECH REPUBLIC S.R.O.

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