D2.6 – Characteristics and specifications of EAS for stoichiometric gas combustion concept with biomethane (TWC)

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Written By	He Zhou, Klaus Hadl, Georg Kaufmann (all AVL)	2022-01-13
Checked by	IFPEN Gaetano de Paola	2022-01-14
Reviewed by	Louise Olsson (CHALM)	2022-01-14
Reviewed by	Stefano Golini (FPT)	2022-01-14
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Publishable summary

This report describes the development and layout of an exhaust aftertreatment system for a stoichiometric gas engine developed in WP4 of LONGRUN. The report includes measurements from on a synthetic gas test bench, modelling of reaction kinetics and the layout of the exhaust aftertreatment system.

At start of the work the LONGRUN emission targets for gas engines were discussed. The contractually agreed target for NOx (30% reduction based on EURO VI = 0,32 g/kWh) was considerably lowered to 0,1 g/kWh (referring to a combined WHTC cold/ warm).

Two aftertreatment system configurations were investigated in detail:

1st EAS concept: a main three-way catalyst (TWC) and coated CNG particulate filter (CPF)

With the chosen engine-out emission traces of a WHTC, the tailpipe brake-specific NOx and the tailpipe average NH3 targets were not met. Both an improved cold start and lambda control had to be applied to meet the targets.

2nd EAS concept: close-coupled three-way catalyst (ccTWC), a main three-way catalyst (TWC), and a coated CNG particulate filter (CPF)

This concept uses a small close coupled TWC and a main TWC. The volumes of both these TWCs are equal to the TWC volume of the 1st concept. The purpose of this TWC split is to gain advantage in their overall light-off performance due to the higher exhaust temperature at the close-coupled TWC position. With this system, CO and CH4 emissions can be significantly reduced compared to the 1st EAS concept. NOx emissions in the cold WHTC are approximately 30% lower when using the 2nd EAS concept, while hot emissions remain on a similar level. This leads to overall reduced NOx emissions for the 2nd EAS concept. N2O emissions increase in the 2nd EAS concept as a side effect of increased NOx conversion. NH3 emissions are slightly lower when using the 2nd EAS concept. Still, to meet the LONGRUN project targets also for the 2nd EAS concept an improved cold start and lambda control had to be applied to meet the targets.

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Project partners:

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