

Objectives

- Integration of SCR (Selective Catalytic Reduction) with the existing strong Miller cycle 4-stroke diesel engine and combining it with particulate emission (PM) abatement technology would enable to achieve more than 80% NO_x emission reduction and 25% reduction in PM. Also a combination of integrated SCR and EGR (Exhaust Gas Recirculation) is to be developed. Feasible solutions of combining the above mentioned technologies having as a target the near zero emission engine are also studied.
- Integrating methane and ethane abatement technology into lean burn 4-stroke gas engines will enable compact solutions to reduce methane and ethane slip. The objective is a catalytic system working with the engine and optimization of the engine performance. Also the knowledge on deactivation & regeneration strategies for integrated catalyst solutions and methane formation and location in the engine exhaust system should increase. Target is a greenhouse gas emission decrease up to 15% and fuel savings up to 5%.

WP Leader: Jukka Leinonen



Partners:  WÄRTSILÄ  VTT  Vaasan yliopisto
UNIVERSITY OF VAASA  PSI

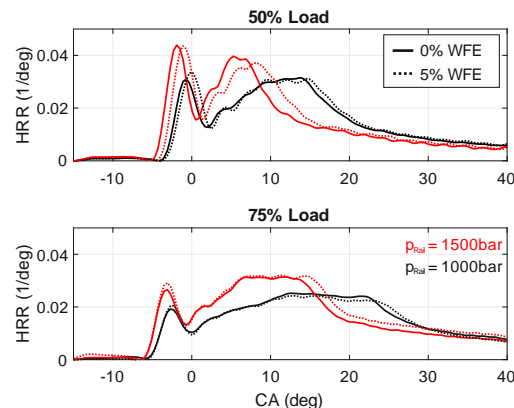
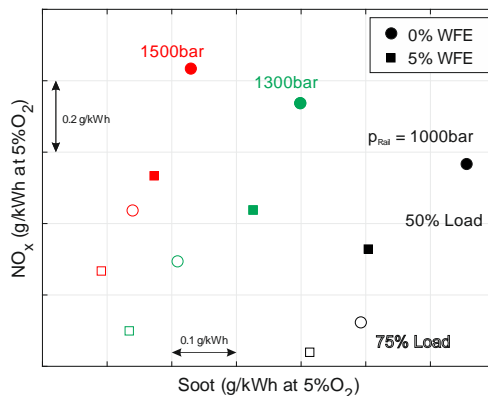
Subprojects

- 7.1 Combined on-engine aftertreatment solutions for 4-stroke diesel engines
- 7.2 SCR reduction agent injection solutions
- 7.3 Integration of methane and ethane abatement technology with gas engines
- 7.4 Emission measurement systems for integrated after treatment technologies

Progress update

- PSI, Feasibility and demonstration of NO_x and particulate reduction with pre-tests on test engine was completed and analysis & evaluation of available data has been evaluated and Analyzed. Work will be finalized due to plan.
- WFI, Activities are ongoing within schedule. PM measurement reporting is completed. Deliverable 7.3 is almost ready for submittal and Deliverable 7.7 will be submitted due to plan.
- WSP, Feasibility and demonstration of integrated methane and ethane abatement with gas engine testing continues as planned.
- UV, Feasibility and demonstration of methane catalyst element has been continued with regeneration method study and experimental study has started and will be closed during spring 2018.
- VTT, NH₃ sensors test results are still under analysis. PM emission testing has been completed and results are under analyzes. Project schedule were update and delivery date of D7.2 was moved 6 months

50/75% Load, 22% EGR, SOI 10/11°CA bTDC



ESP + Cyclone container and inlet pipe during installation

Deliverables and Plan for future work

- Literature review regarding SCR engine integration and particulate abatement.
- Emission measurement systems for SO₃, NH₃ and PM emissions to support integrated after-treatment technologies
- Experimental assessment of integration of methane and ethane abatement technology into gas engine structure
- Experimental assessment of SCR reduction agent injection systems with sensors for feedback control



Vaasan yliopisto
UNIVERSITY OF VAASA



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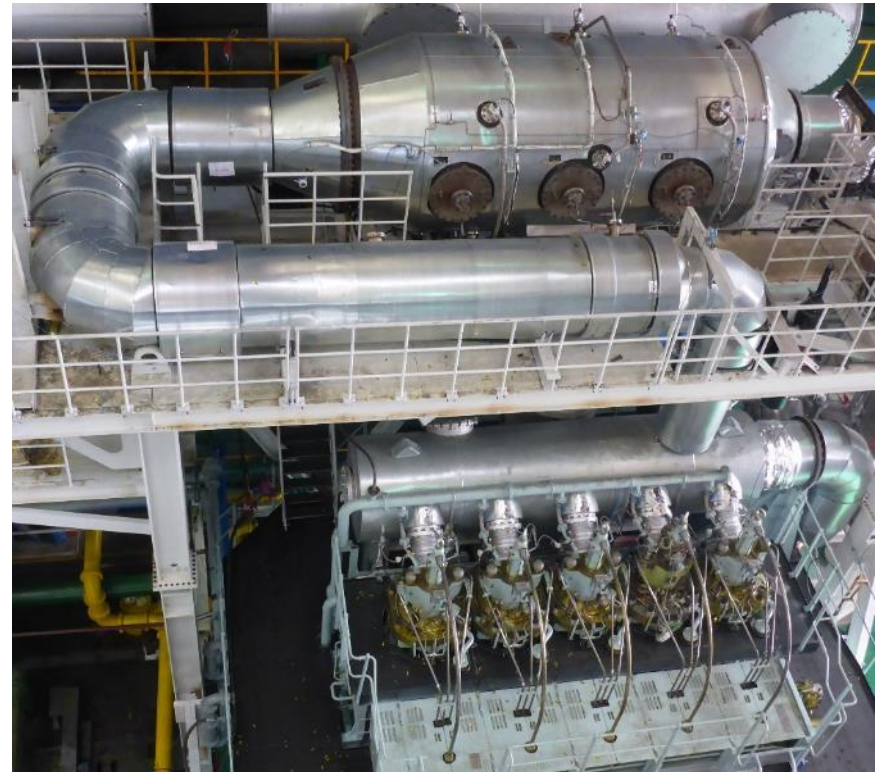
Objectives of Work Package

- Development of key technology for integration of the currently separated SCR aftertreatment into existing 2-stroke engine structure, which enables widespread installation of SCR systems on all ship types and additionally increase overall NO_x removal efficiency above 80%, reduce overall hydrocarbon emissions (HCs) by 50% or more, reduce PM emissions and lead to potential fuel savings of up to 5%.

Subproject

7.5 Robust catalysts for pre-turbo SCR

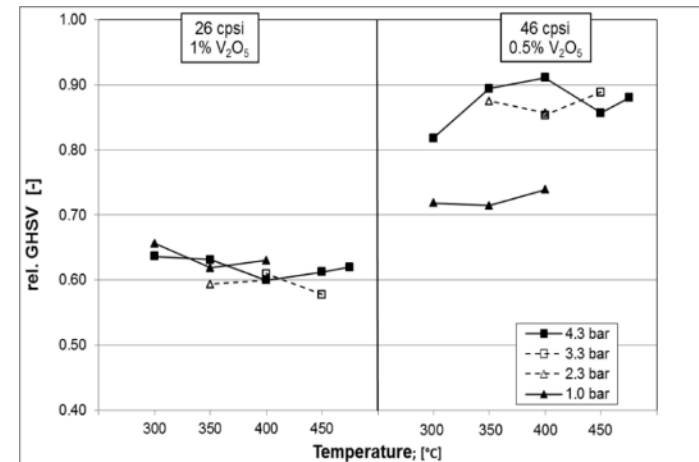
WP deputy: Flavio Soppelsa



WinGD pre-turbocharger SCR system

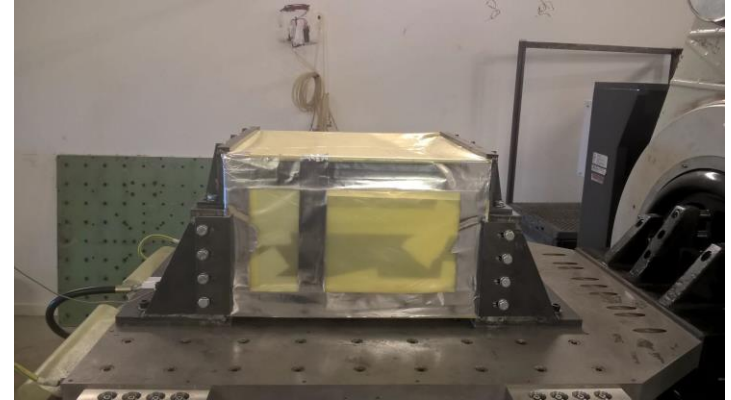
Results of past period month 25-30 for WinGD/PSI

- Field test on vessel started with vibration resistant catalyst designs
- Investigation of SCR reaction kinetics under elevated pressure



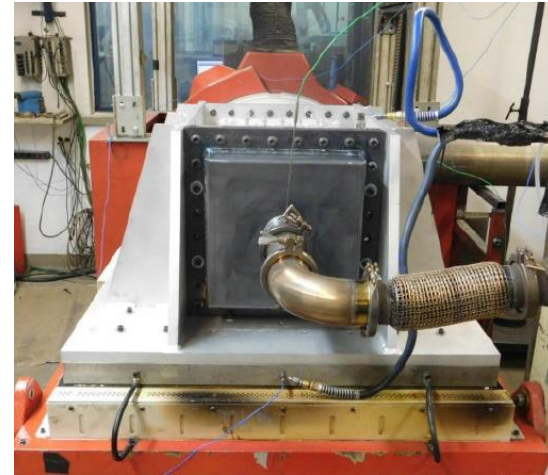
Results of past period month 25-30 for Dinex Ecocat

- Re-designed catalyst support designs were tested on vibration test bench (cold shaker test)
- Re-designed catalyst support prototypes withstand vibration requirements with reservation
- Washcoat adhesion might still in focus



Results of past period month 25-30 for Johnson Matthey

- Hot gas vibration test bench testing finished, vibration resistant catalyst designs identified
- Samples delivered for field test on vessel



Deliverables and Future work

- Hot shake test of newly produced prototypes, supply of samples for field testing.
- Support the follow up of field test
- Document and publish SCR reaction kinetics
- Vibration testing of prototype vibration resistant catalyst on engines operating in the field

