

WP 1

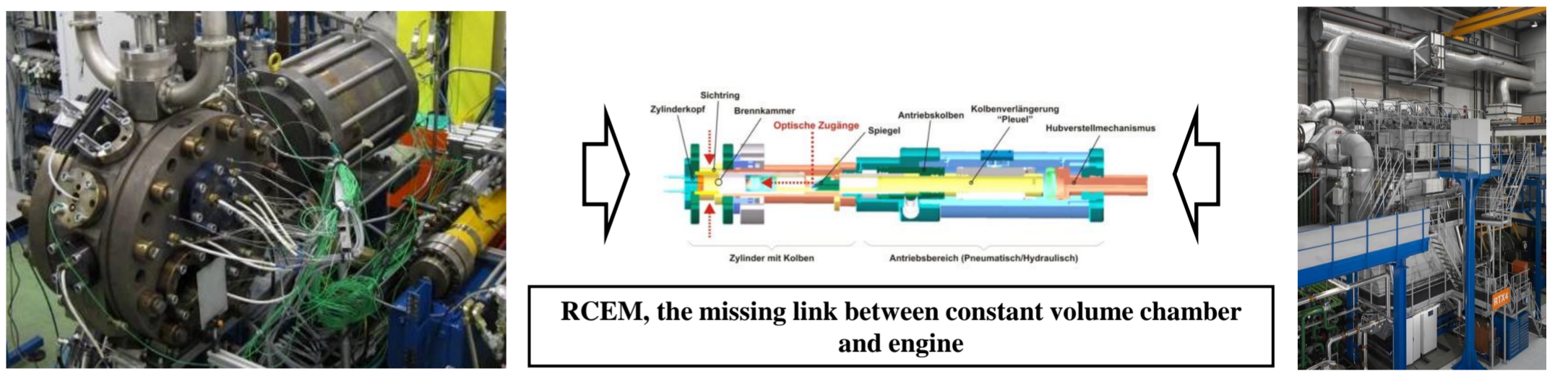
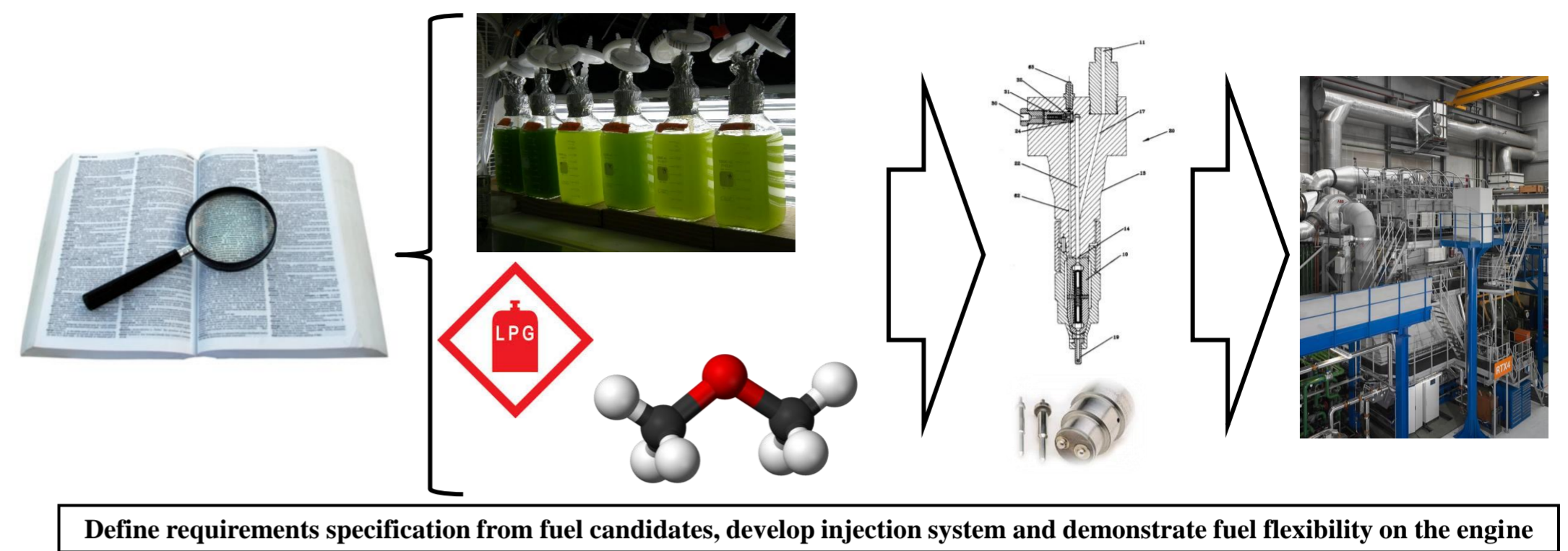
Fuel Flexible Engine



WP OBJECTIVES

To develop engines able to switch between fuels, whilst operating in the most cost effective way and complying with the regulations in all sailing regions.

- Study ignition capability of selected fuel candidates
- Develop a fuel injection system for multi fuel purposes
- Demonstrate fuel flexible engine operation
- Perform feasibility study on Rapid Compression Expansion Machine (RCEM)



EXPECTED OUTCOME

Sub project 1.1:
The demonstration of a novel injection system, allowing the closed loop controlled application of alternative fuels in marine engines.

Sub project 1.2:
Feasibility study on rapid compression/expansion machine to base decisions on for further steps

PROGRESS AND PLANS

- Literature review accomplished (database)
- Fuel candidates identified
- Corresponding properties collected
- First design ideas evaluated

- Definition of possible candidates
- Definition of requirement specification
- Development of the injection components

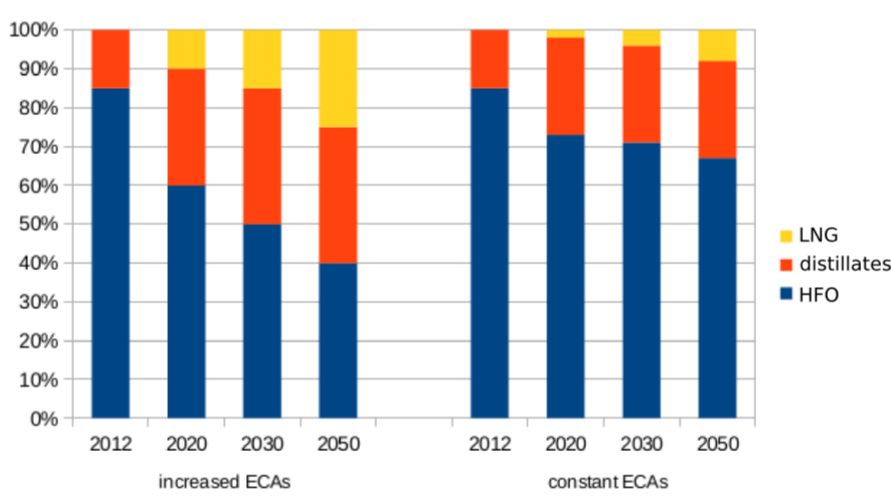


Fig. 1.1.1: Possible future fuel mix

	IFO	LSFO	MGO/GTL/BTL	HVO/SVO/FAME	MeOH	DME/LPG	LNG/LBG
Engine and fuel system cost	Drop-in	Drop-in	Drop-in	Drop-in	Dual fuel	Gas tank	Dual fuel Cryo tanks
Projected fuel cost		Refining	Refining	Land use		Infra-structure	Infra-structure
Emission abatement cost	SOx, NOx, PM, CO ₂		NOx, PM, CO ₂				
Safety related cost					Flash point	Ventilation	Press./temp
Indirect cost				Ethics	Cargo space	Cargo space	Cargo space

Fig. 1.1.2: Future fuel candidates

- Literature review accomplished (database)
- Characterization and classification completed
- Requirement specifications basically defined
- Assessment applicability features (ongoing)

- Elaboration of two concepts:
 - crank mechanism driven
 - alternative (e.g. hydraulic) driven

included systems	combustion	+ charge movement	+ compression stroke	+ expansion stroke	+ intake stroke	+ gas exchange
categories	Constant Volume Combustion Chamber		Rapid Compression and Expansion Machine		Single Cylinder Engine	
operating mode	single combustion	single combustion	single stroke		single combustion	continuous combustion
example						
optical accessibility	excellent	good			poor	
engine-like piston motion		ballistic			crankshaft drive	
bore	up to Ø500 mm	up to Ø100 mm			from Ø 200 mm to Ø 600 mm depending on the optical accessibility	

Fig. 1.2.1 : Schematic overview categories of optical accessible test rigs for combustion process investigations

WP PARTICIPANTS

WP1 - 4 stroke

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WP1 - 2 stroke

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