LeanShips
Low Energy And
Near to zero emissions Ships

LeanShips

A 'Mobility for Growth' European Innovation project call "Towards the energy-efficient and very low emission vessel"

Prof. Sebastian Verhelst, Ghent University, WP05 leader

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LeanShips ...

... aims to demonstrate the effectiveness and reliability of energy saving and emission reduction technologies at real scale.

Target markets ...

... are the small to midsized ships for intra-European waterborne transport, vessels for offshore operations and the leisure and cruise market.

Eight demonstrators will be carried out ...

... combining technologies for improved efficiency and pollution reduction, in line with end-users' needs and requirements.

Main objectives ...

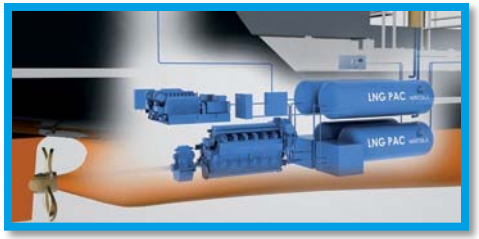
- ✓ CO_2 reduction of at least 25%
- ✓ Estimated fuel saving of up to 25%
- ✓ Expected decrease of SO_X/NO_X/PM air pollutants by up to 100%

Coordinated by DAMEN

Examples of Demonstrator Cases

Develop a large diameter propeller to improve the performance of the vessel propulsion system, reducing fuel consumption and emissions

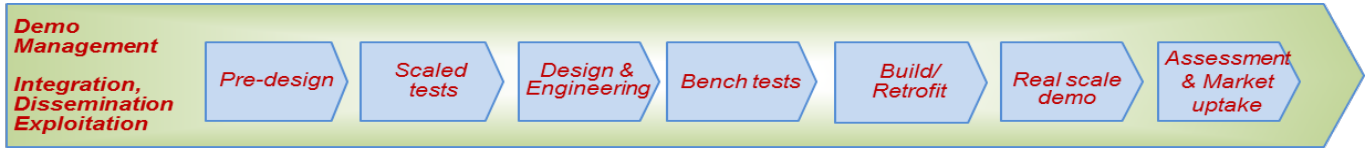
Design and build a new generation ship handling tug with two LNG-fuelled engines



Develop a refit strategy for a fleet of general cargo vessels

Demonstrate a high-speed diesel engine converted to dual fuel operation (diesel/methanol)

Parallel development of demonstrators and their contribution to the project objectives, following the same harmonised innovation process.



LeanShips covers the entire energy chain

Demonstrator platforms	Technology cluster 1: Engines, fuels, drive trains						Technology cluster 2: Hull, propulsors		Technology cluster 3: Energy systems and emissions abatement technologies				
	Internal combustion engines	Fuels	Generator	Electrical energy transformation	Storage device	Electrical motor	Improved geometry	Propulsors	Waste heat recovery	Incinerator	Photo voltaics, Wind energy, fuel cells	Scrubbers	Energy management systems
WP04: Tug	XX	XX			XX		XX	XX					
WP05: SWATH/dredge	XX	XX			XX								
WP06: LNG carrier	XX	XX	XX		XX		XX	XX					x
WP07: General cargo ship	XX	XX	XX		XX							XX	
WP08: Inland ship	x	x	x	x	x		XX	XX					
WP09: Ice going cargo ship	x	x			x	XX	XX	XX					
WP10: Cruise/Leisure					x		XX	XX					XX
WP11: Cruise/Leisure									XX	XX	XX	XX	

Lean**Ships'** mission:

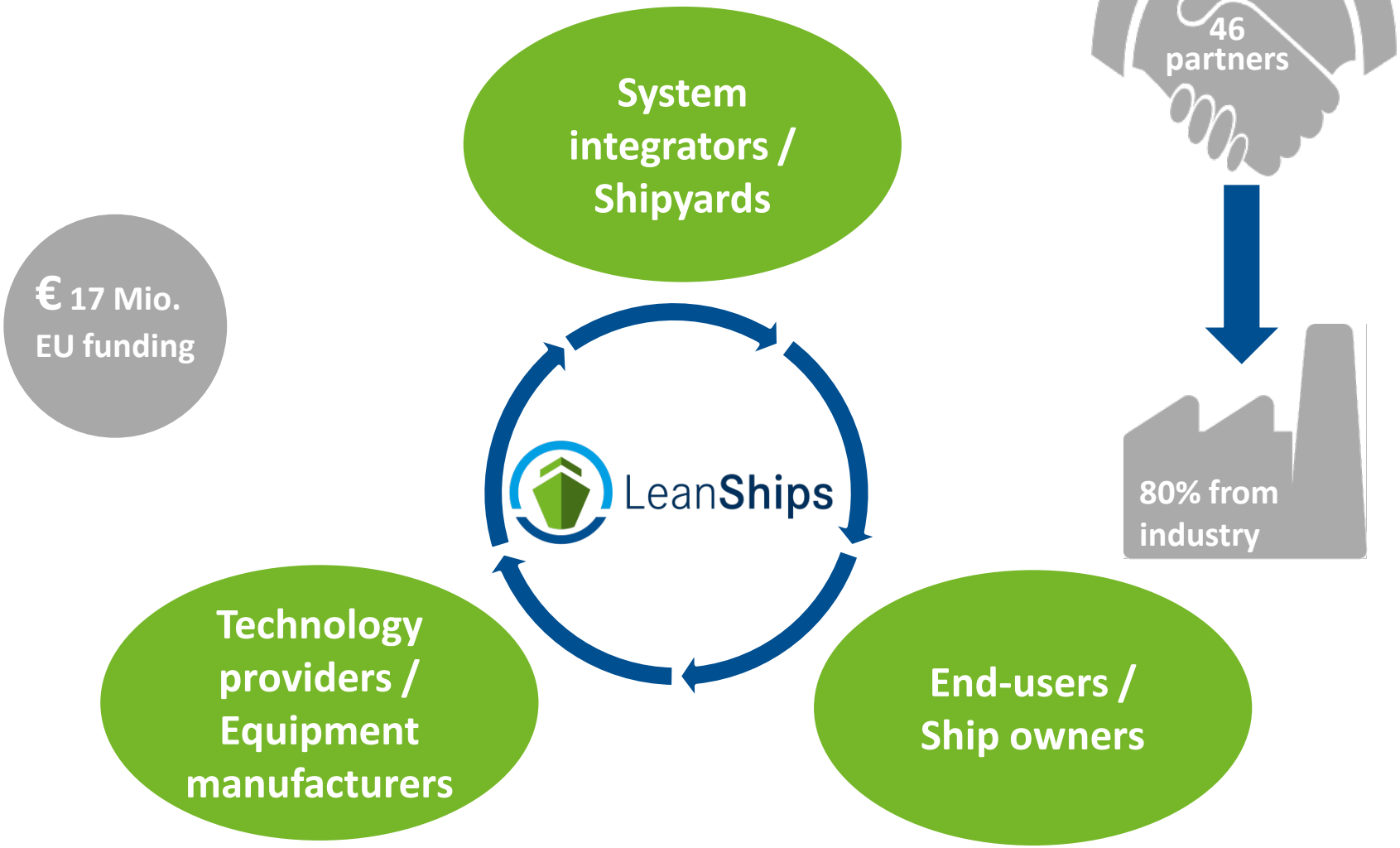
Prove that:

a) **green** technology can be installed **onboard** (new and old - *retrofit*);
b) **green** technology works in maritime and is **reliable**
c) **green** technology can be **economically viable**

And can **significantly contribute** to the EU energy and emission policies by collaborating with:

a) ship equipment manufacturers;
b) ship builders;
c) ship operators;
d) classification societies;
e) research centres and universities

LeanShips' stakeholders:



LeanShips' layered structure

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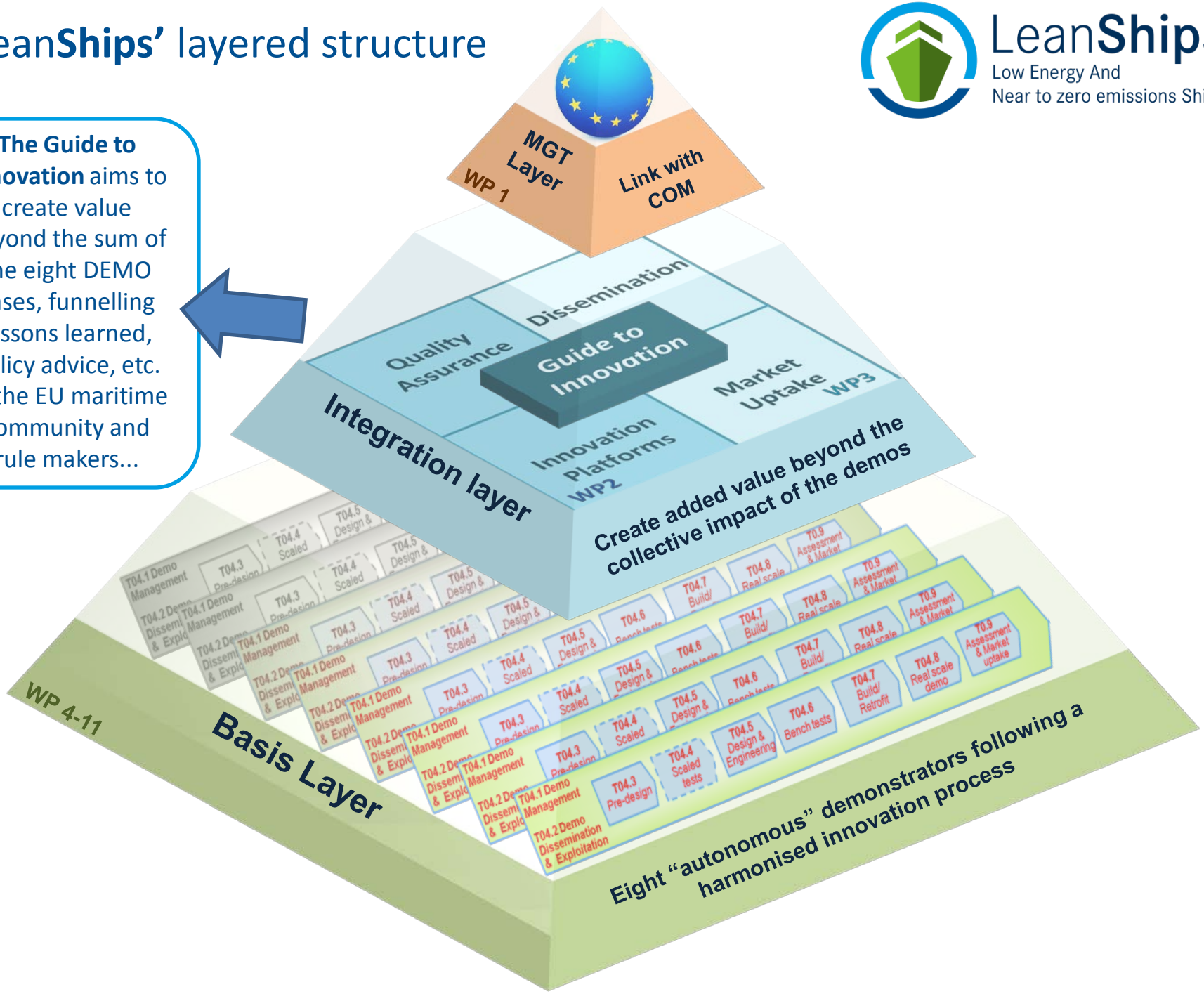
The Guide to Innovation aims to create value beyond the sum of the eight DEMO cases, funnelling lessons learned, policy advice, etc. to the EU maritime community and rule makers...



WP 05

Demonstrating the potential of methanol as an alternative fuel

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DAMEN

ABEKING & RASMUSSEN

methanex
the power of agility

Dredging International

MARINE & INDUSTRIE
KANT
ANTWERPEN NV

POWERED BY
VOLVO PENTA

Background

IMO Tier III → major reduction in NO_x

- HFO: scrubber + SCR system
- LNG

Both add cost and are hard to implement/ retrofit on smaller vessels

The case for methanol

- Available now
  - One of the most widely shipped chemicals in the world
  - Already present in most terminals
- Can be made from renewables (long-term)
  - Fits within long-term view of UGent on energy supply and transportation → keywords sustainable – scalable – energy-dense
- Currently produced from natural gas, but <u>liquid at atmospheric conditions</u>
  - Much easier to handle, distribute, store onboard, …
- Great engine fuel!

Ghent University background

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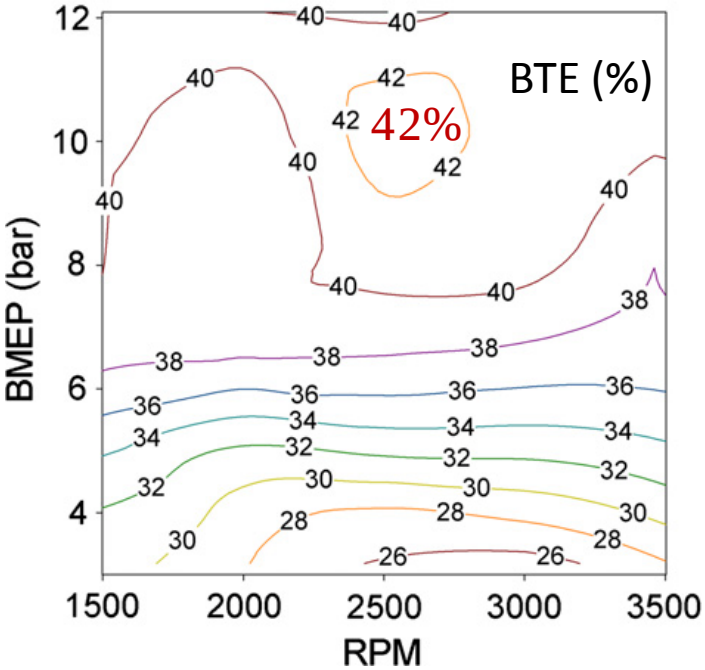
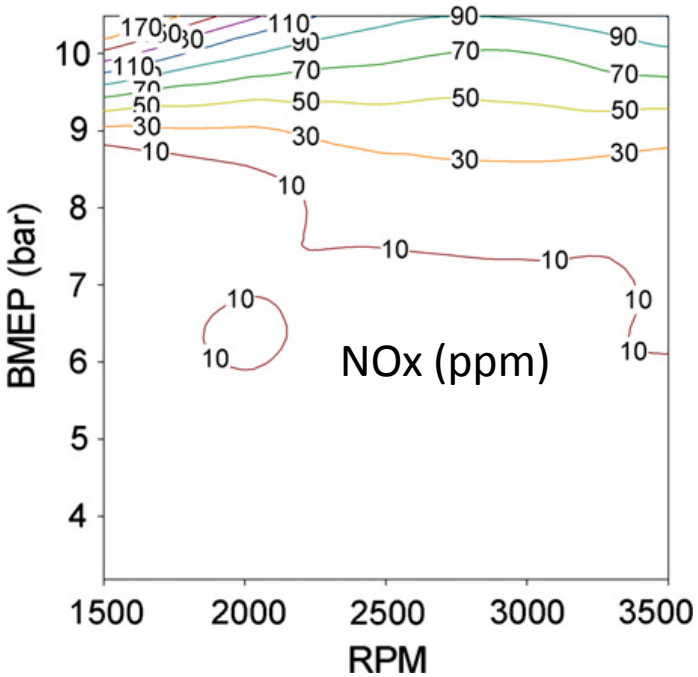
- Focus on sustainable, scalable (& liquid) fuels

- Experience with methanol since 2009
  - Converted (automotive) engines (SI&CI base, to SI operation) & measured potential (power-efficiency-emissions)
  - Developed modeling tools (engine cycle simulation)
  - 2 PhD's, 9 MSc, 15 papers

Illustration





Diesel-like peak BTE
Part load efficiency gains up to 20%
(compared to throttled operation)

VW TDI → SI
CR 19.5:1
turbocharged + EGR

Vast engine-out NOx reductions (ppm)
Diesel-like efficiencies while using cheap aftertreatment systems

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Ghent University background

- "Resistance" in automotive, willingness in marine industry
  - & cooperation with Anglo Belgian Corporation nv

- Demonstrators with medium-speed engines on methanol, using proprietary equipment

→ WP05 main objective: **demonstrate universal methanol dual-fuel retrofit of high-speed diesel engine** while maintaining 100% diesel capability

DAMEN interest: smaller vessels, LNG alternative

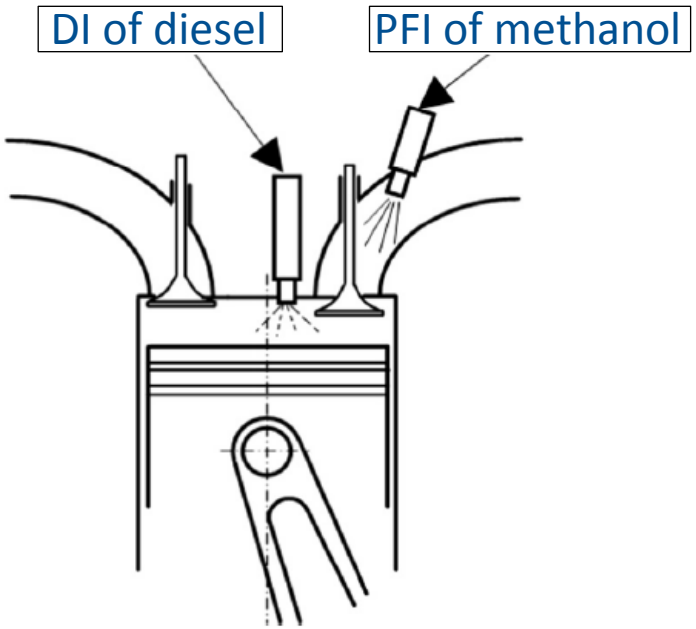
ABEKING & RASMUSSEN interest: SWATH vessels, storage challenge

Dredging International interest: dredgers, storage challenge

MARINE & INDUSTRIE KANT ANTWERPEN NV POWERED BY VOLVO PENTA interest: marine engine supplier

methanex the power of agility interest: methanol producer and supplier

DUAL FUEL CONCEPT



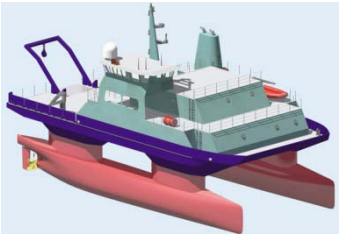
Adapted from Tutak et al.

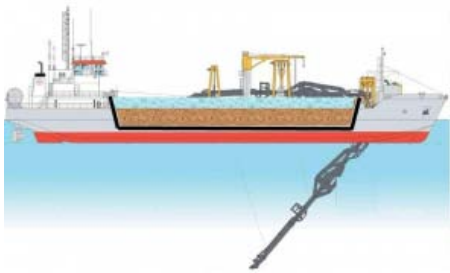
VOLVO PENTA D7C-B TA

- 6 in-line cylinders
- 7.15 L
- CR = 17.6:1
- 265 hp @ 2300 rpm
- 904 Nm @ 1500 rpm

Additional objectives

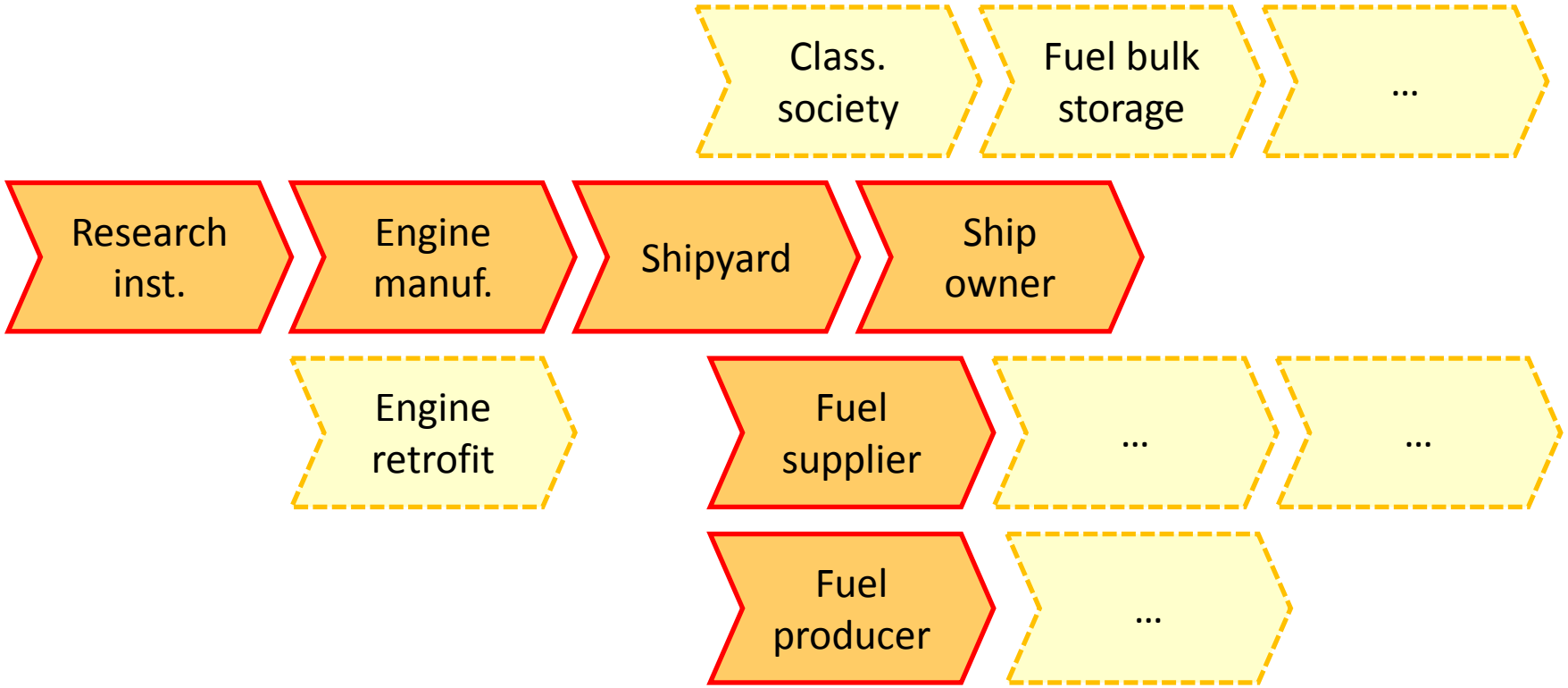
- Map the engine's potential on power, efficiency and emissions
  - & compare to original diesel operation
  - UGent testbench
- Use the data in an LCA calculation of using methanol as a fuel in shipping, for 2 cases:
  - SWATH (Small Waterplane Area Twin Hull)
  - TSHD (Trailing Suction Hopper Dredger)





- Provide concrete tools for the dissemination of methanol's potential and its exploitation
  - Goal: market uptake

WP05 value chain vs. partners



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Thank You
& Stay Tuned

Contact us at:
Mr. Pieter Huyskens,
LeanShips Project Manager,
E-mail: pieter.huyskens@damen.com
Website: www.leanships-project.eu

Contact us at:
Prof. Sebastian Verhelst,
LeanShips WP05 leader,
E-mail: sebastian.verhelst@UGent.be
Website: http://users.ugent.be/~sverhels/