

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 mid-sized 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 ...

- ✓ CO₂ 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%

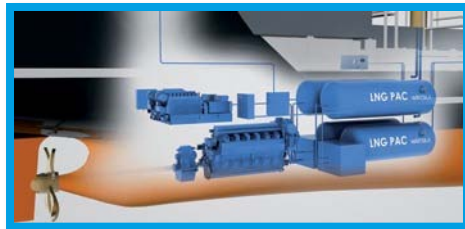
Examples of Demonstrator Cases



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.

Demo Management
Integration, Dissemination
Exploitation

Pre-design

Scaled tests

Design & Engineering

Bench tests

Build/ Retrofit

Real scale demo

Assessment & Market uptake

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				
													
<i>WP04: Tug</i>	XX	XX			XX		XX	XX					
<i>WP05: SWATH/dredge</i>	XX	XX			XX								
<i>WP06: LNG carrier</i>	XX	XX	XX		XX		XX	XX					x
<i>WP07: General cargo ship</i>	XX	XX	XX		XX							XX	
<i>WP08: Inland ship</i>	x	x	x	x	x		XX	XX					
<i>WP09: Ice going cargo ship</i>	x	x			x	XX	XX	XX					
<i>WP10: Cruise/Leisure</i>					x		XX	XX					XX
<i>WP11: Cruise/Leisure</i>									XX	XX	XX	XX	

LeanShips' 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:



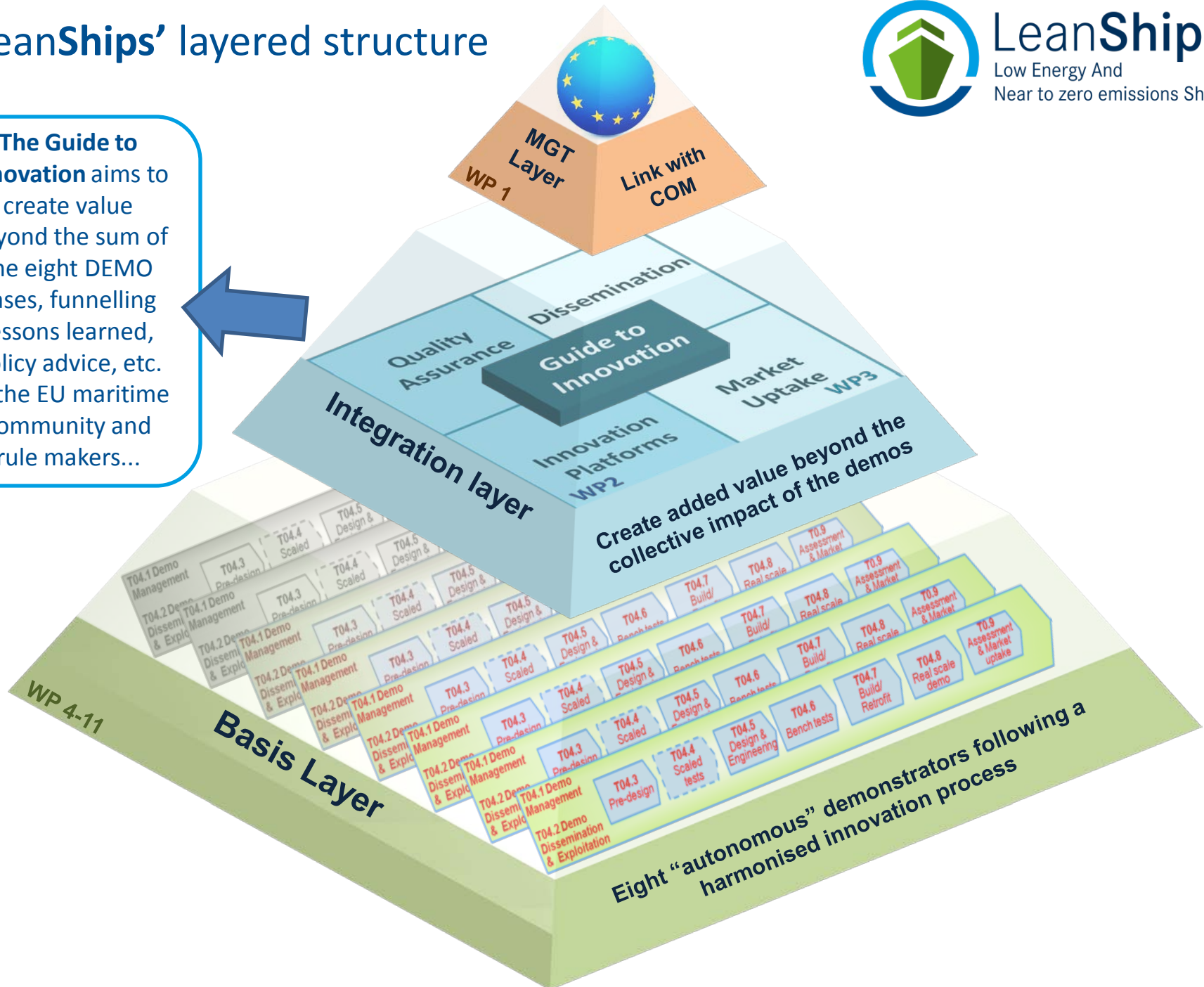
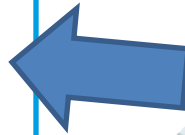
LeanShips' layered structure



LeanShips

Low Energy And
Near to zero emissions Ships

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**



DAMEN



ABE KING & RASMUSSEN



**Dredging
International**



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



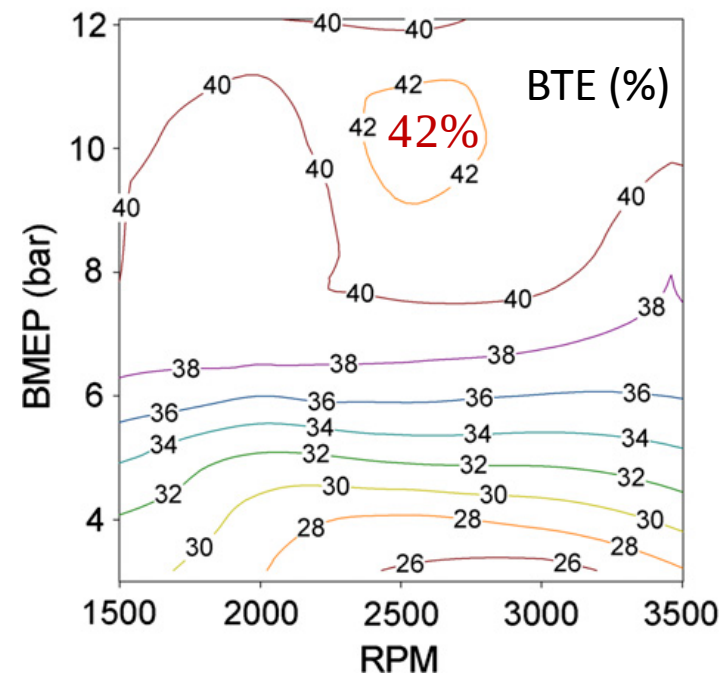
The case for methanol

- 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 liquid at atmospheric conditions
 - Much easier to handle, distribute, store onboard, ...
- Great engine fuel!

Ghent University background

- 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

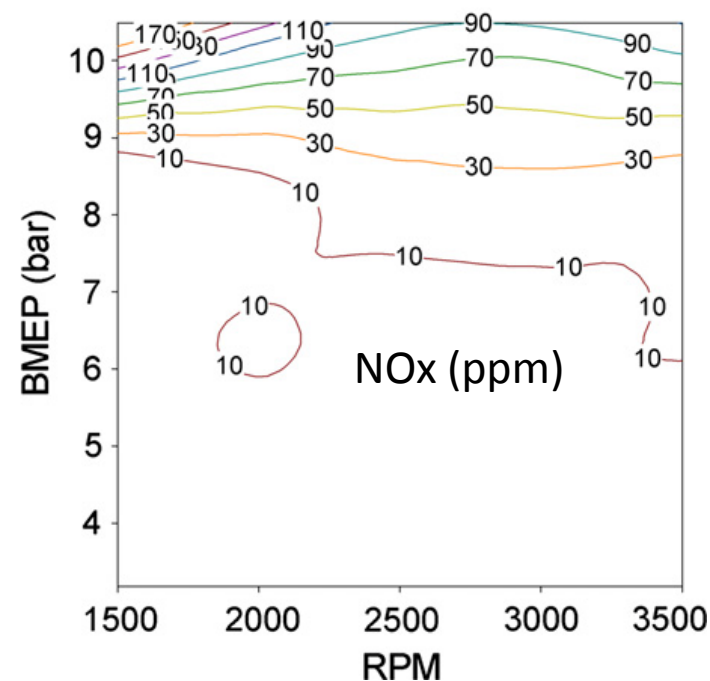
Illustration



*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***

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





interest: smaller vessels, LNG alternative



ABEKING & RASMUSSEN

interest: SWATH vessels, storage challenge



Dredging
International

interest: dredgers, storage challenge



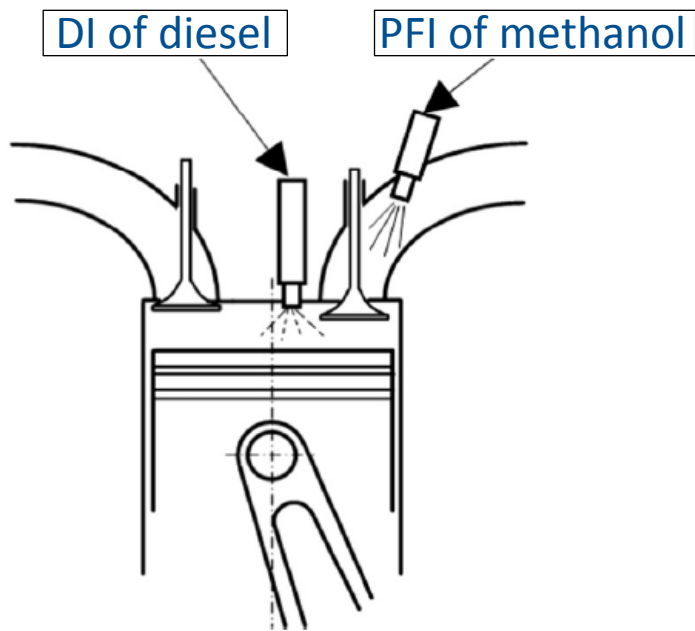
POWERED BY
VOLVO
PENTA

interest: marine engine supplier



interest: methanol producer and supplier

DUAL FUEL CONCEPT



Adapted from Tutak et al.

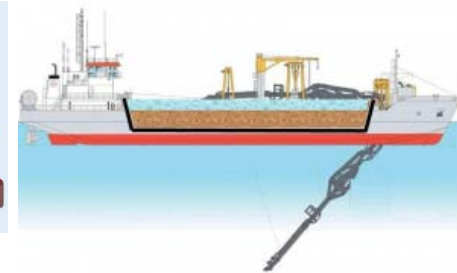
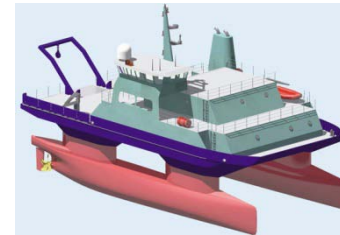
VOLVO PENTA D7C-B TA



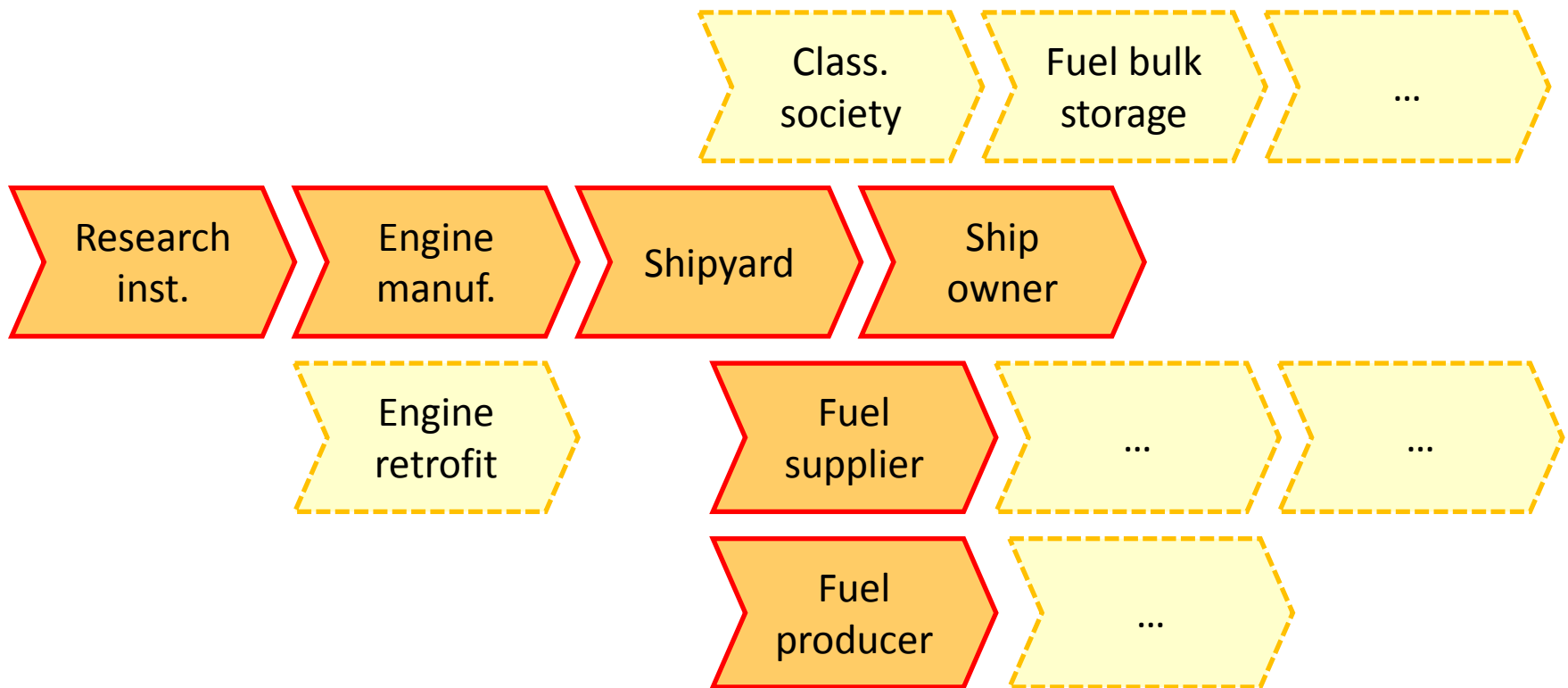
- 6 in-line cylinders
- 7.15 L
- CR = 17.6:1
- 265 hp @ 2300 rpm
- 904 Nm @ 1500 rpm

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



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/>