KOOIMAN MARINE B.V.

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DE GROEP DE KOOIMAN

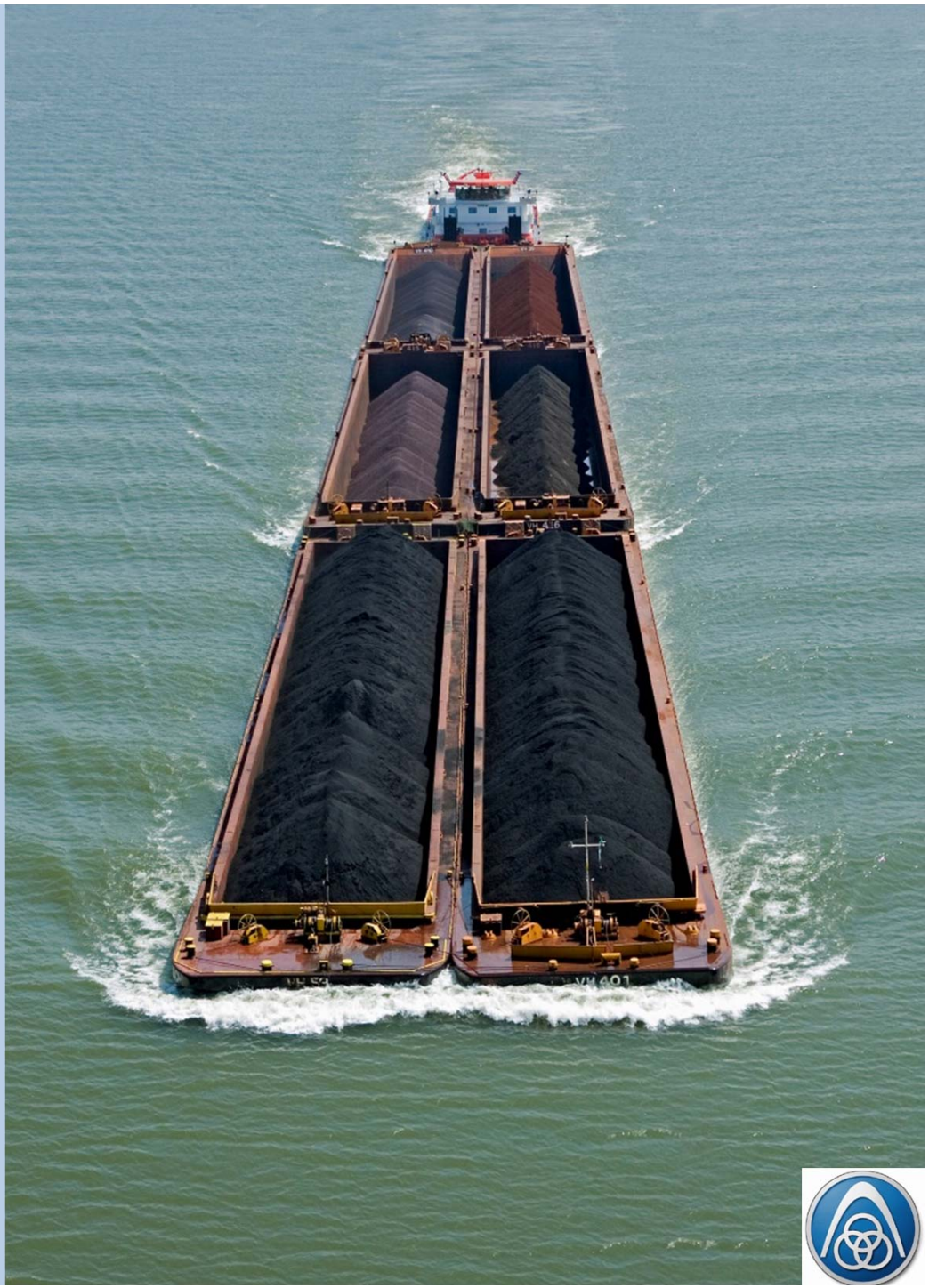
scheepswerf GEBR. KOOIMAN

PETER VROLIJK PROJECT MANAGER

4240 kW (5766 HP) LNG ‘DUAL’ FUELED IWW PUSH BOAT

VEERHAVEN X
“ORKA”

Sailing upstream with
6 loaded barges approx
16.800 Tonnes
(coal and ore)



GROEP DE KOOIMAN

Service routes ThyssenKrupp Veerhaven BV

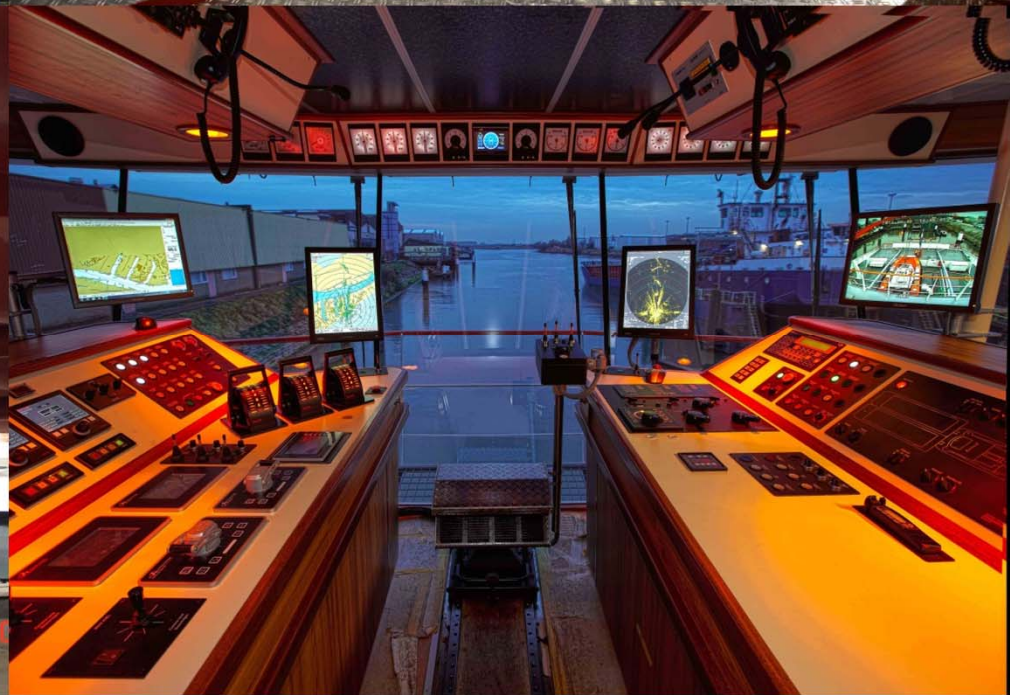
FUTURE PUSHER
DESIGN CHALLENGE

- Performance and functionality: Not to be less than existing vessels of the fleet.
- Overall fuel consumption: Less than existing vessels of the fleet.
- Range: 4 round trips (=one week 24/7 sailing).
- Bunker operations: Within 2 hours once a week.
- Environmental: Able to fulfill (at that time expected) requirements of CCR4.
- Redundancy: Independent of alternative fuel supply.
- Draught: Less than existing vessels of the fleet.

  Target draught: 1,60 m

DE GROEP DE KOOIMAN

Why ADN ?



Time line

- 2011-2012 Future Pusher project
- May 2012 Start Concept Design LNG fueled push boat
- December 2012 Official presentation vertical tank concept to Lloyds R
- January 2013 Introduction LNG project to Ministry I&E in The Hague
- February 2013 Submission call for Ten T in LNG Master plan Rhine-Main-Danube
- March 2013 Hazid study Lloyds (TNO present at all meetings with Class)
- April-May 2013 Working at recommendations Hazid study
- June 2013 Presentation at CCR meeting in Brussels
- August 2013 Presentation at AND meeting in Genève

- July-Dec. 2013 Detailed design and submission plans and calculations to Lloyds Plan Approval
- January 2014 Start hull construction and Keel laying
- June 2015 Tests, trials and maiden voyage.

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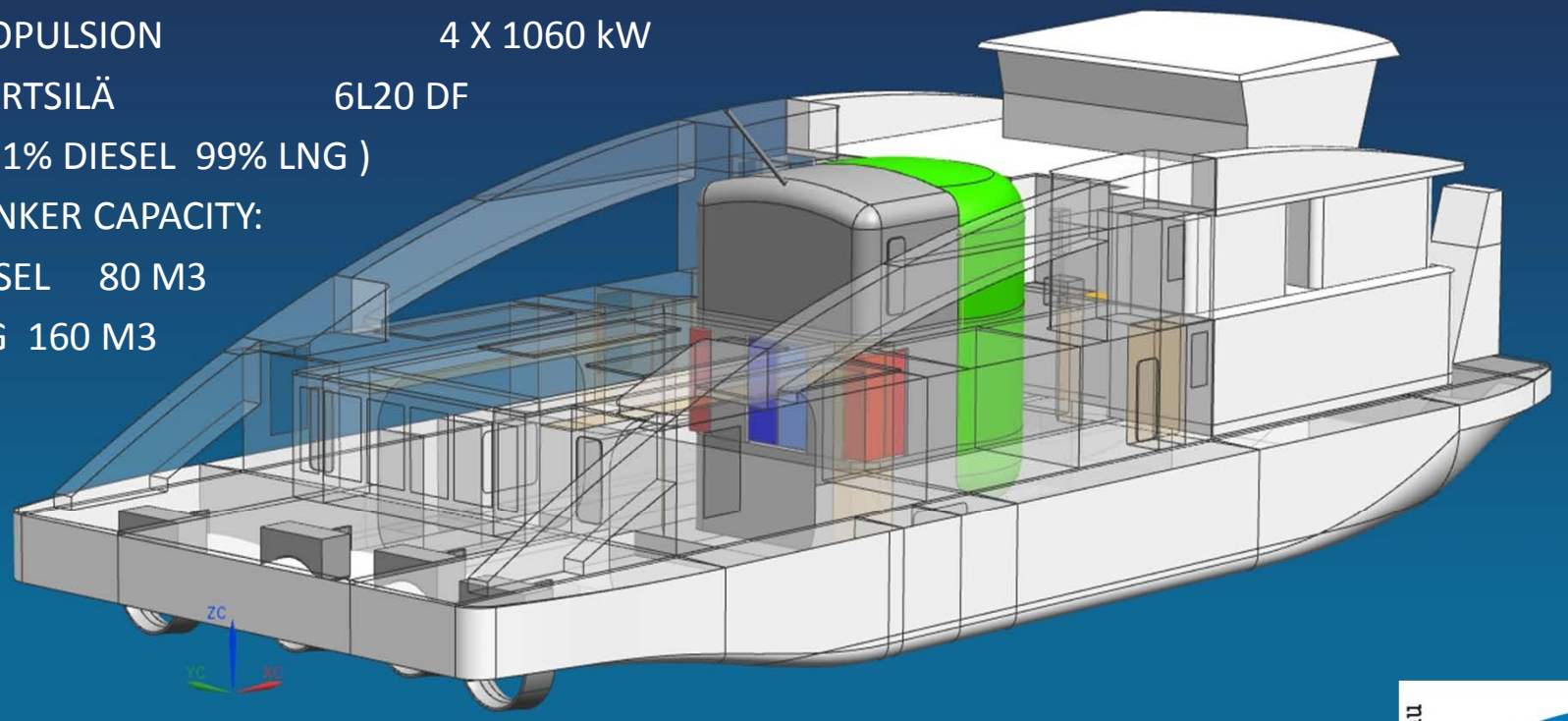
MAIN PARTICULARS LNG PUSH BOAT:

- LENGTH: 40 M
- BEAM 18 M
- DRAUGHT (WITH 30% CONSUMABLES) 1,60 M
- PROPULSION 4 X 1060 kW
- WÄRTSILÄ 6L20 DF
- (1% DIESEL 99% LNG)
- BUNKER CAPACITY:

DIESEL 80 M3

LNG 160 M3



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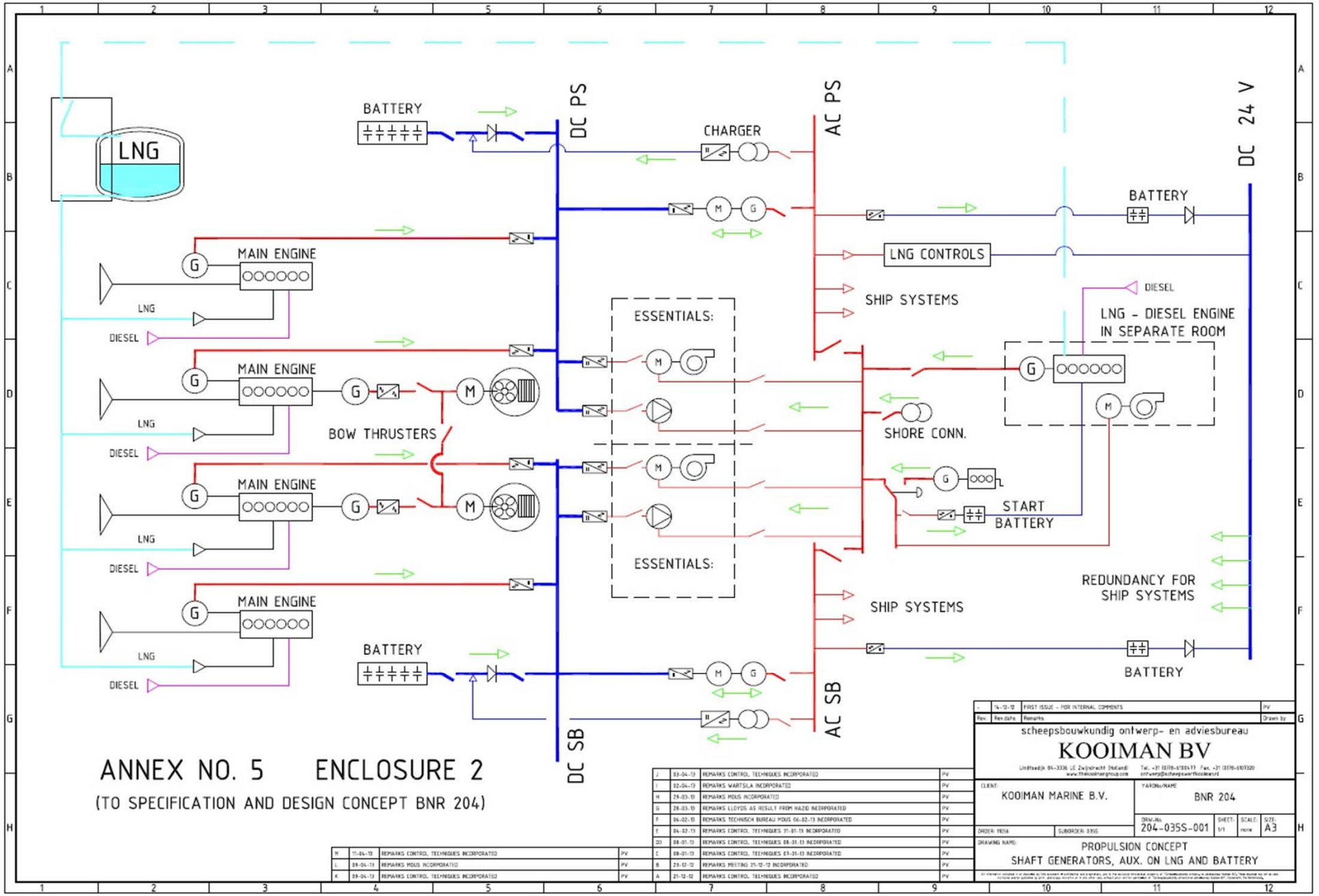
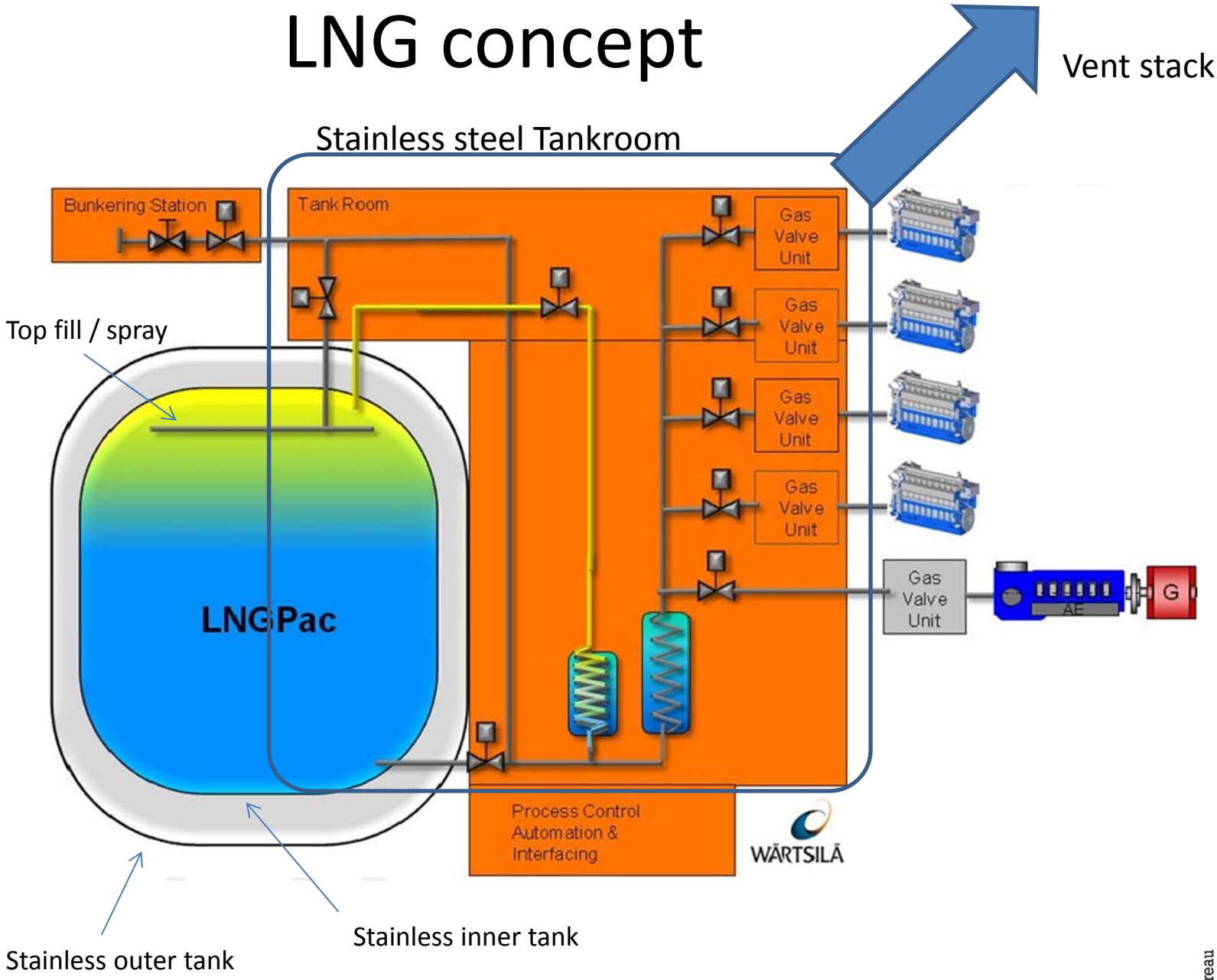
Propulsion concept



LNG concept



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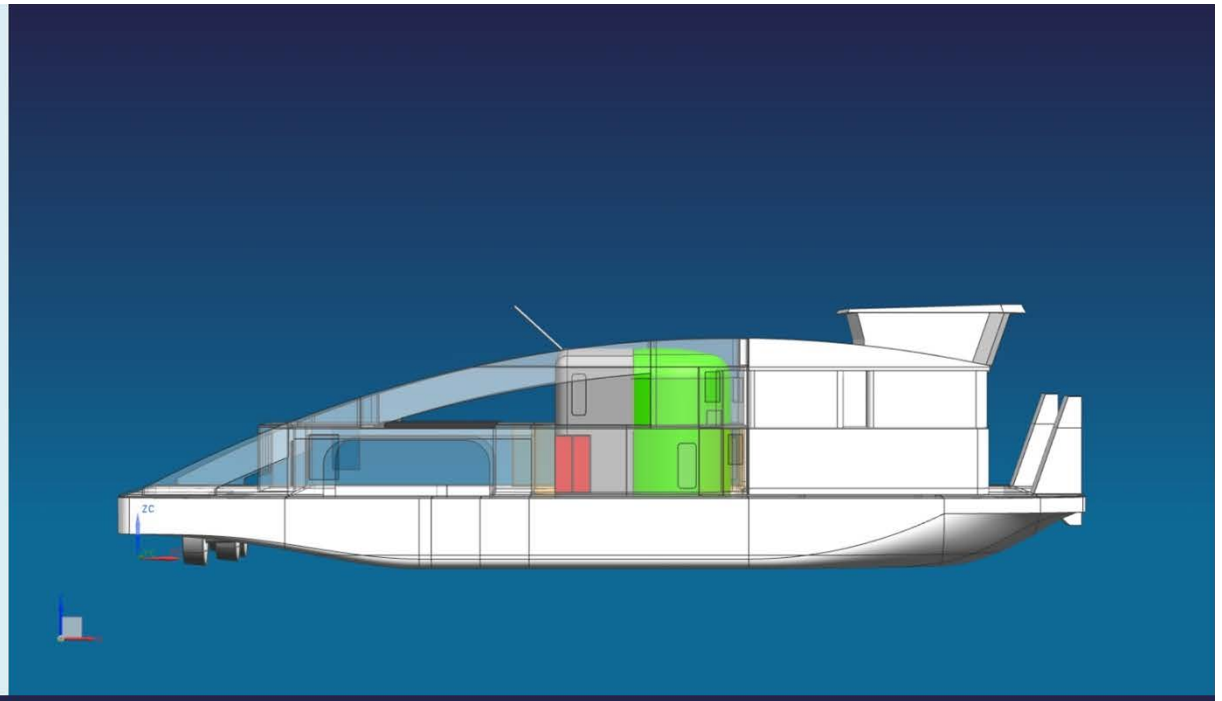
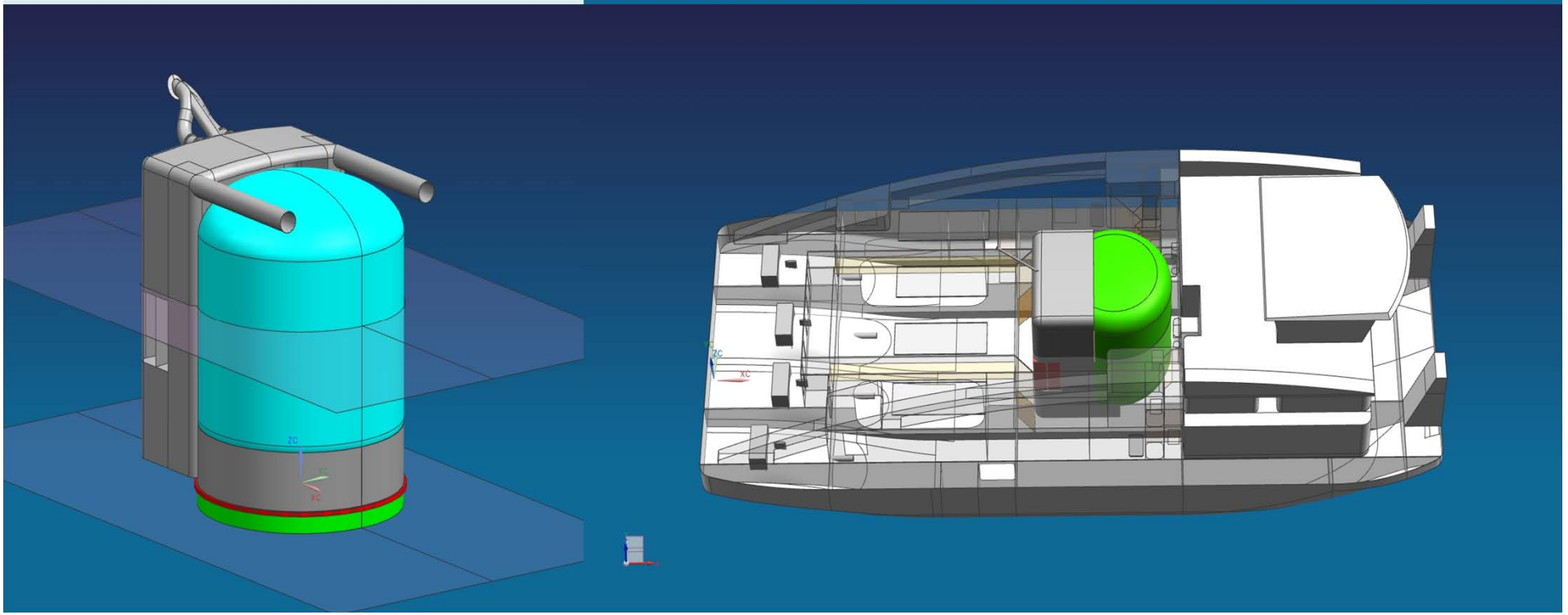
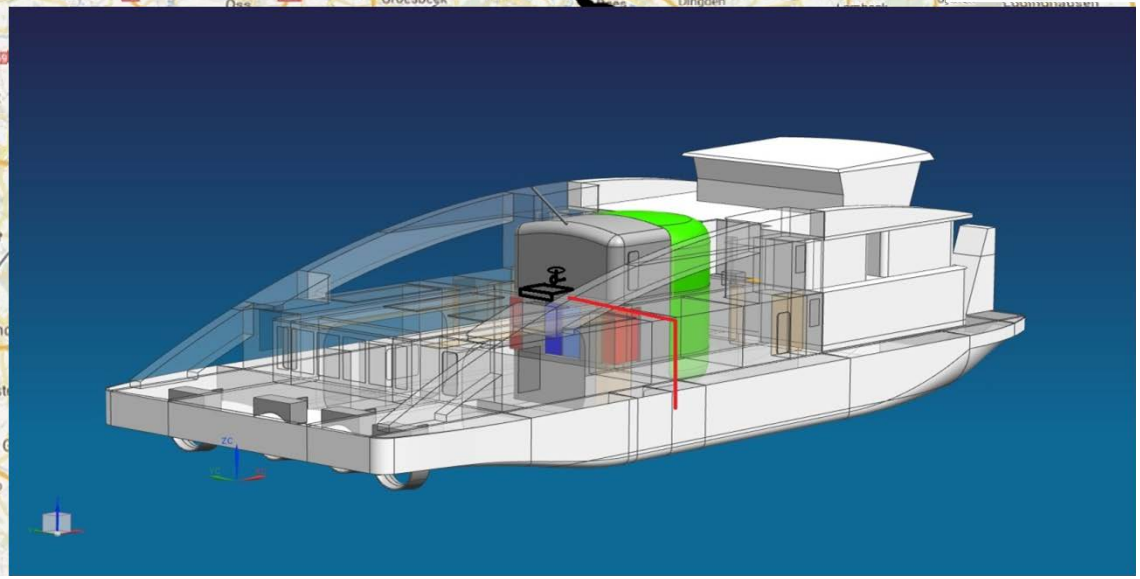
Tank position





Bunkering locations

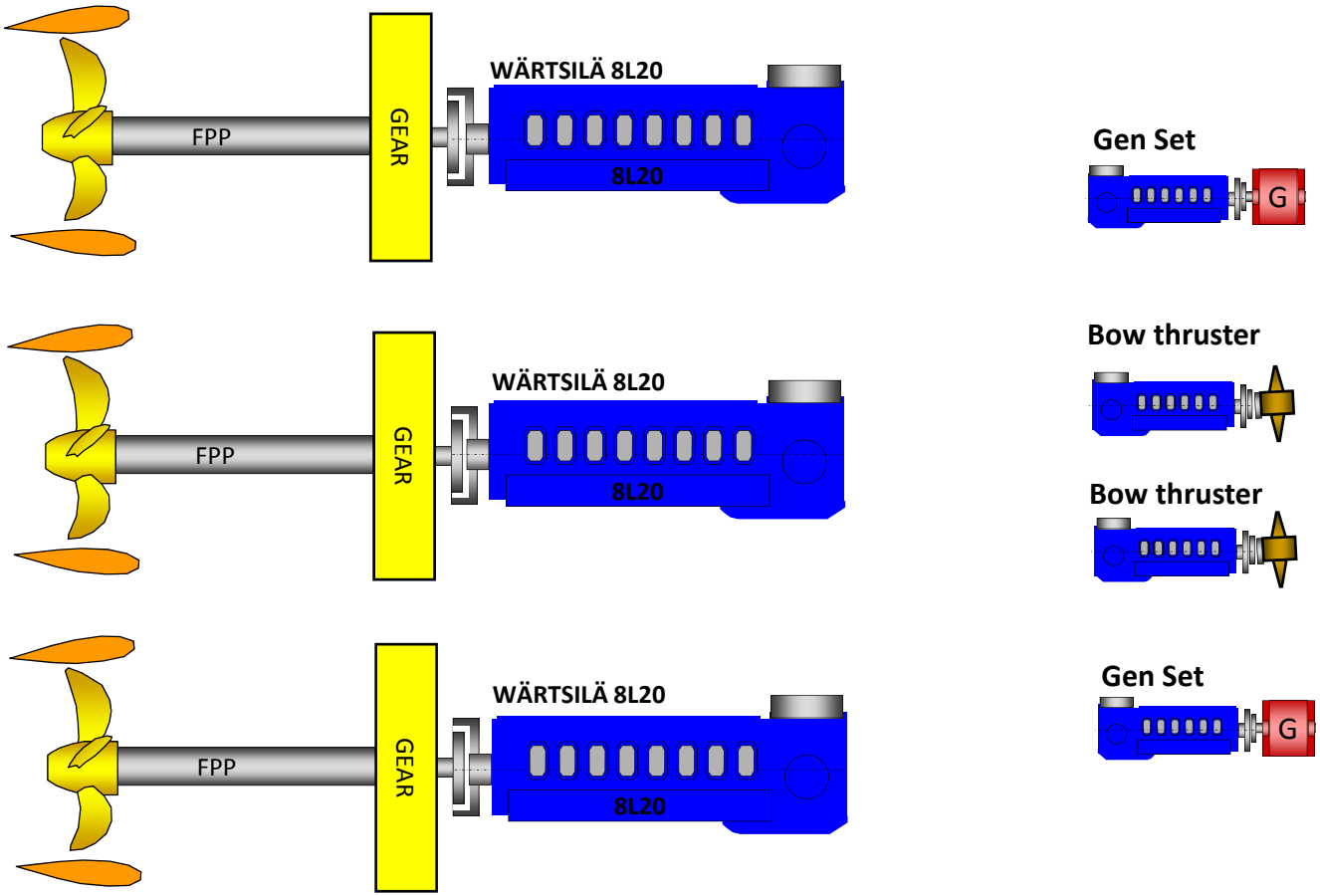


Can we sail this LNG push boat under AND flag in 2015?

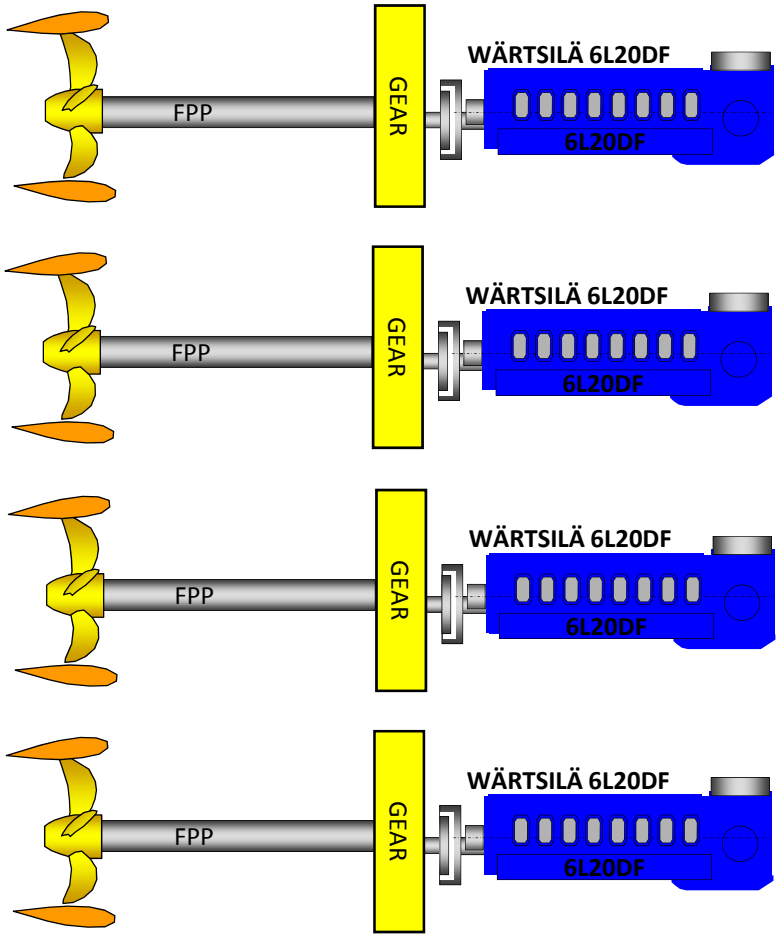
Thank you all for your interest in this presentation of our LNG push boat design

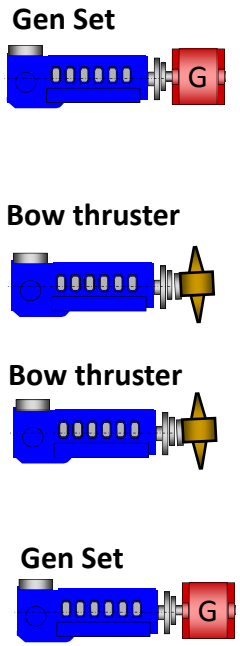
Hierna hulpsheets voor evt uitleg

3 * 8L20 - Reference configuration

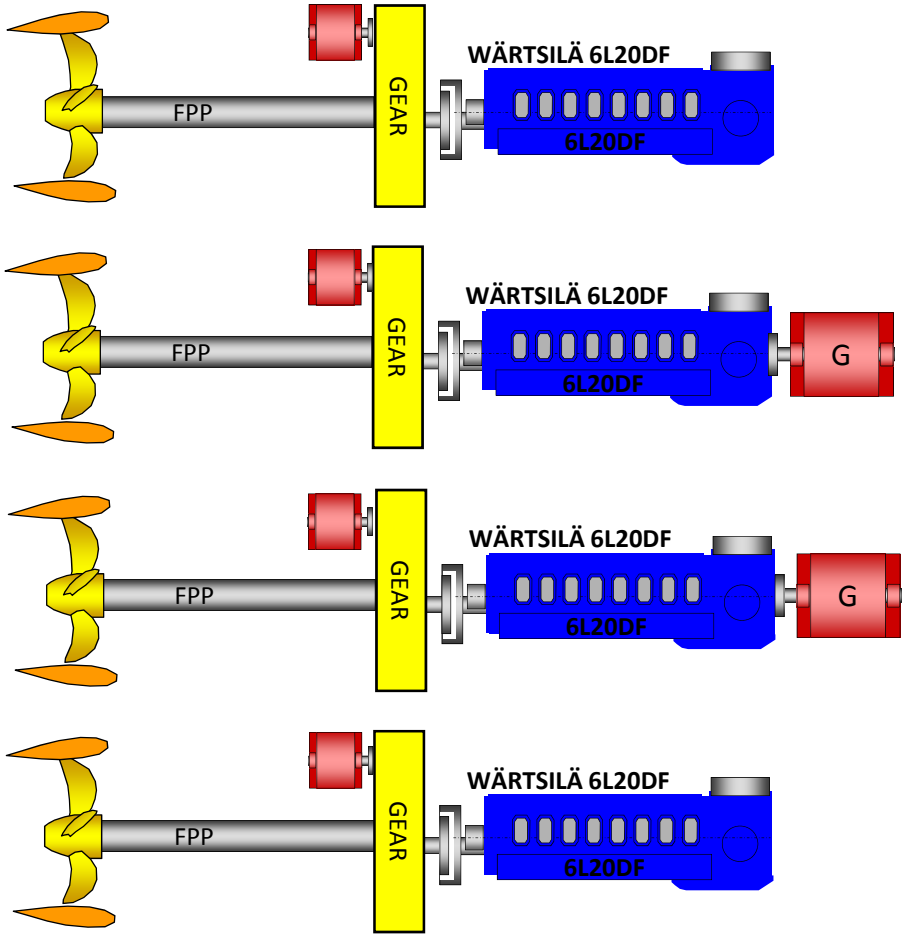


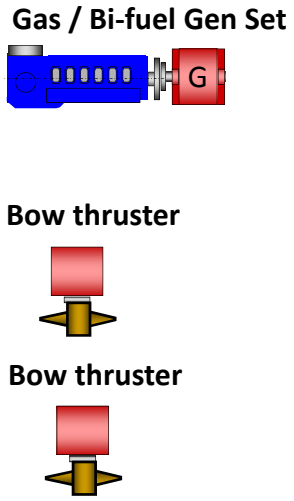
4 * 6L20DF – conventional configuration





4 * 6L20DF – hybrid configuration



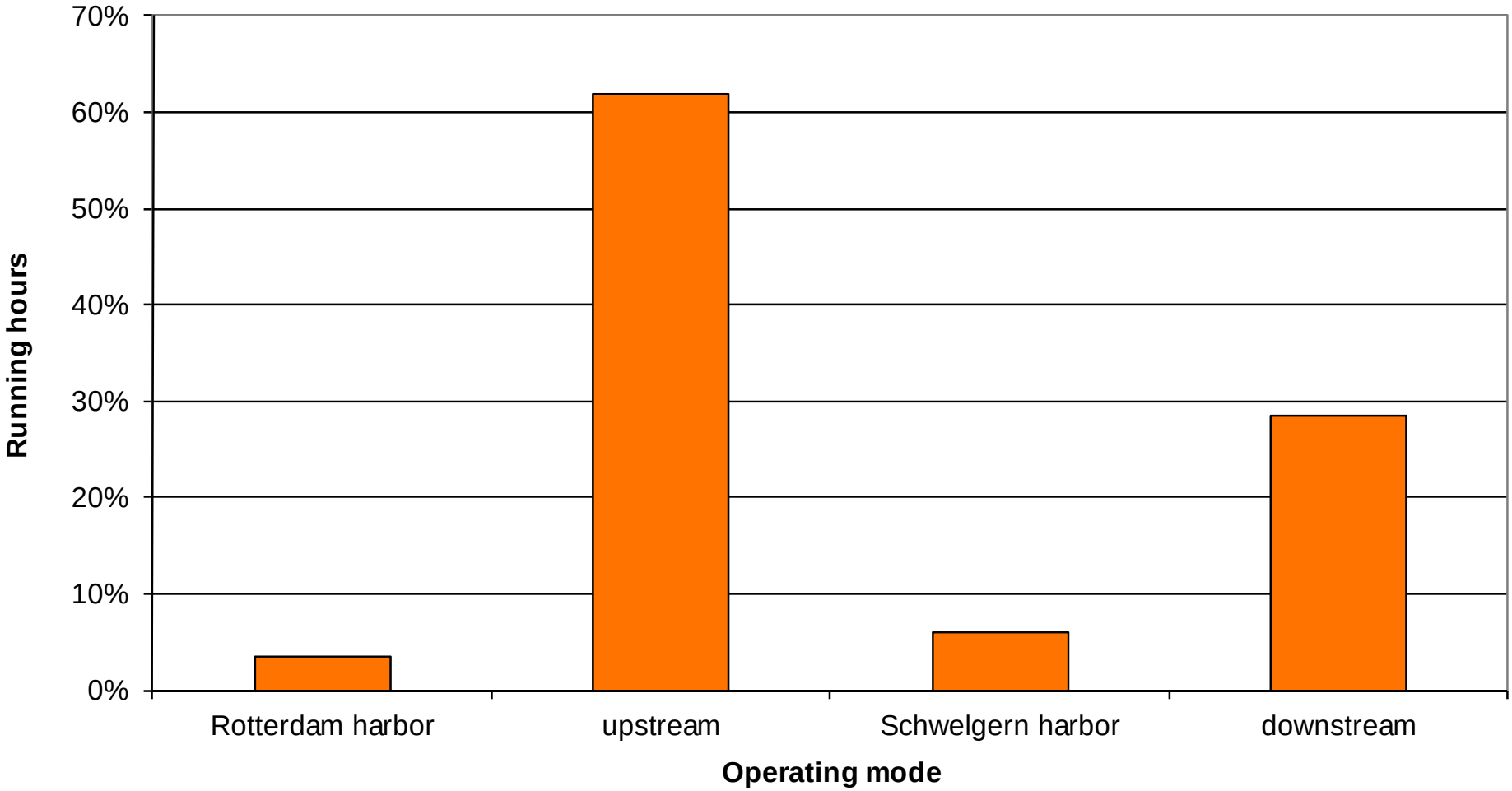


Operating Profile

Operating profile: Rotterdam <-> Duisburg (Schwelgern)

	Time	Power
Return trip	42 hours	
Rotterdam harbor	1.5 hours	2 * 400 kW main propulsion 400 kW bowthruster ¼ of time
Rotterdam to Duisburg (loaded)	26 hours	3726 kW
Duisberg harbor	2.5 hours	2 * 400 kW main propulsion 400 kW bowthruster ¼ of time
Duisberg to Rotterdam (empty)	12 hours	1326 kW
Domestic consumption (all conditions)		120 kWe

Operating profile graph



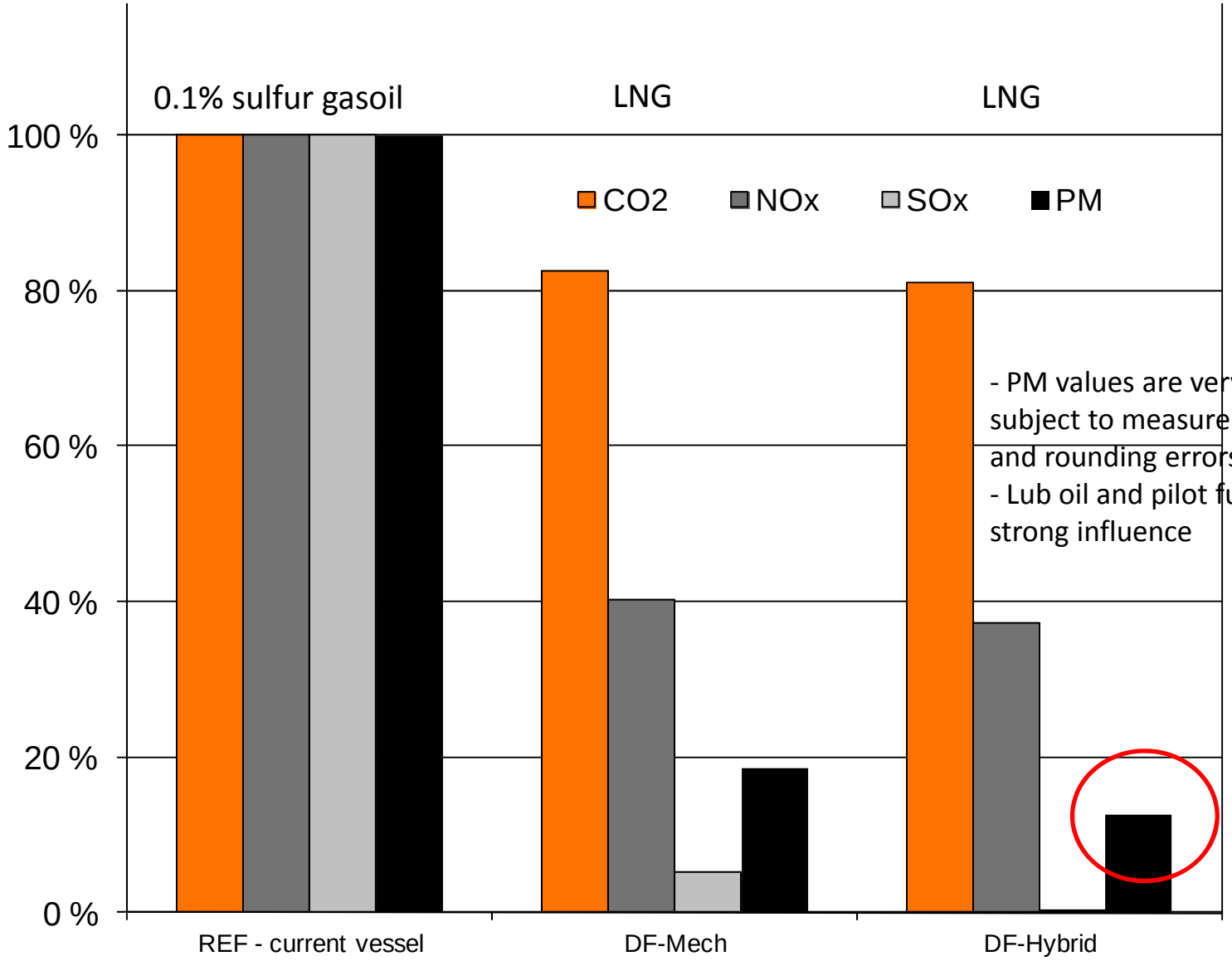
Operating notes

- 7500 running hours per year on the main engines

- The minimum number of engines allowed are operating
  - Upstream all main engines are running
  - Downstream minimum 2
  - Harbor minimum 2

Relative emissions

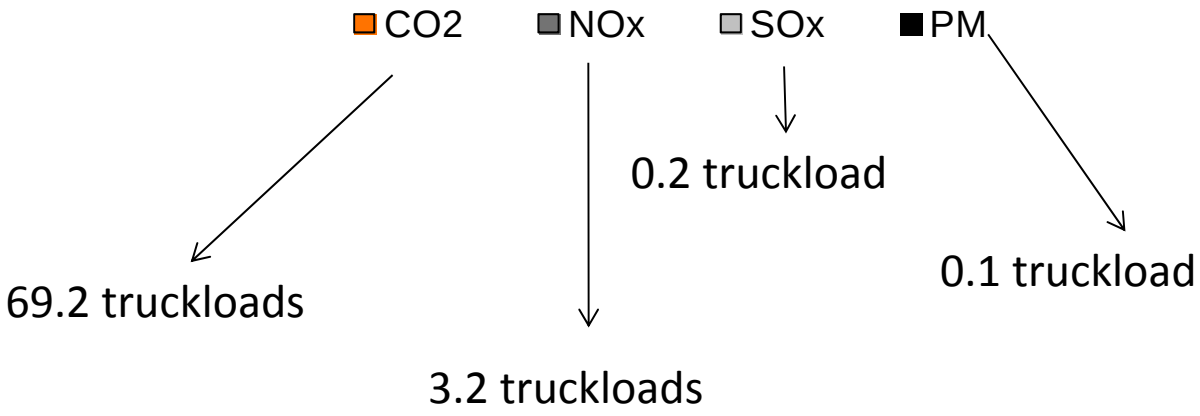
Emissions



- PM values are very small and thus subject to measurement inaccuracy and rounding errors.
- Lub oil and pilot fuel quality of strong influence

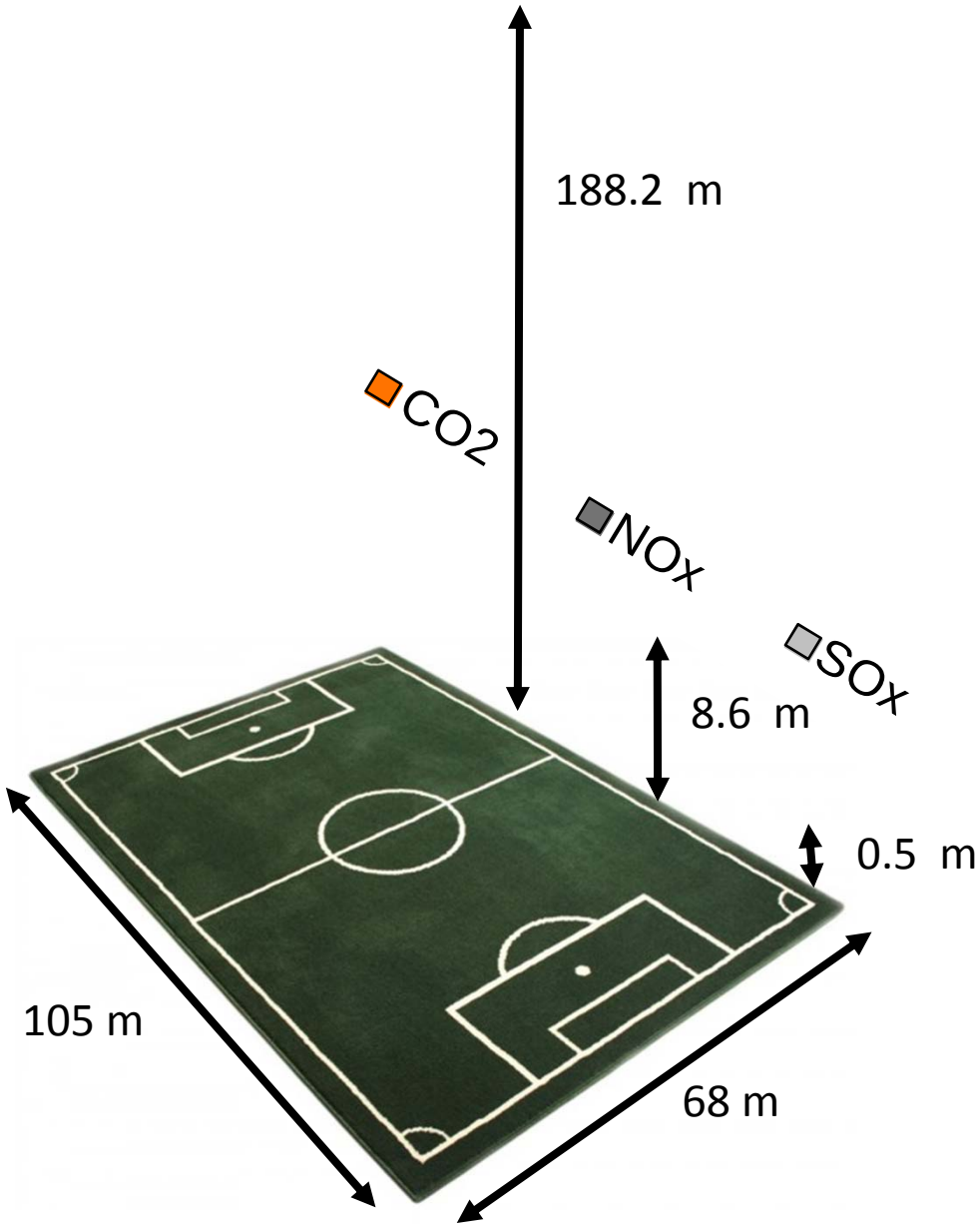
What do we save??

CO2:	2657 tonnes
NOx:	123 tonnes
SOx:	8 tonnes
PM:	4 tonnes



A sand truck can load 38.4 tons

What gas volume do we save annually??



A soccer field:
68 X 105 meters

What mass do we save??

A single barge can load 2840 tons at full draft

The annual CO2 savings nearly fill a barge

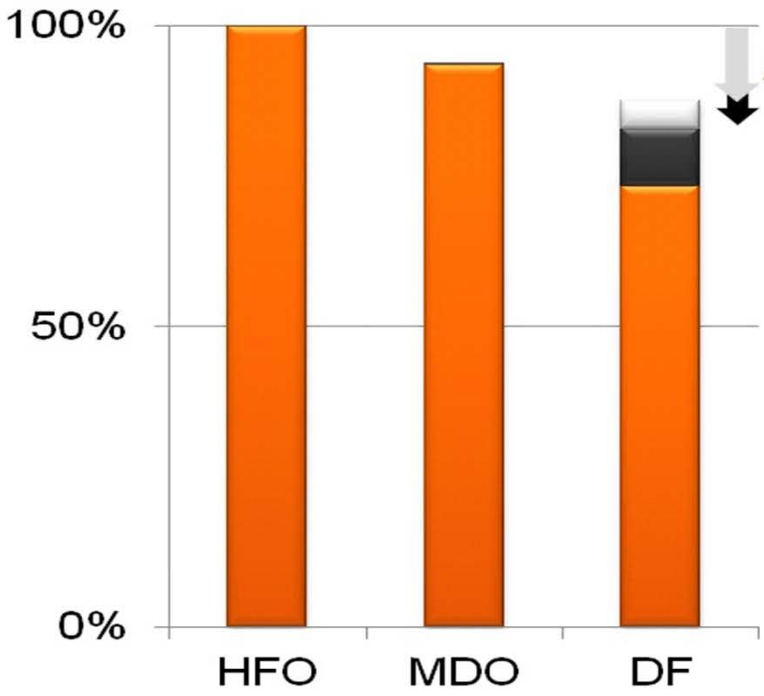
Annual PM emission savings

EU limits PM_{10} to 40 [microgram/m3] on average over the year

Savings are up to 4 tons of PM annually. If all of this is PM_{10}, this translates to 100 billion m3 of air at the 40 microgram/m3 limit. This is equivalent to a slice of nearly 2.5 meters over all of the Netherlands that is saved.

This is equivalent to a savings of 2.25 centimeters over all of the EU

Total Greenhouse Gases



Approx ~20% reduction*

CH_4 as CO_2 equivalent when CH_4 part of THC is max 90%

CH_4 as CO_2 equivalent when CH_4 part of THC is max 60%

CO_2

Based on the ISO defined operating profile
CH_4 in THC is 60-90% depending on gas composition

* Based on 32 / 34 bore comparison

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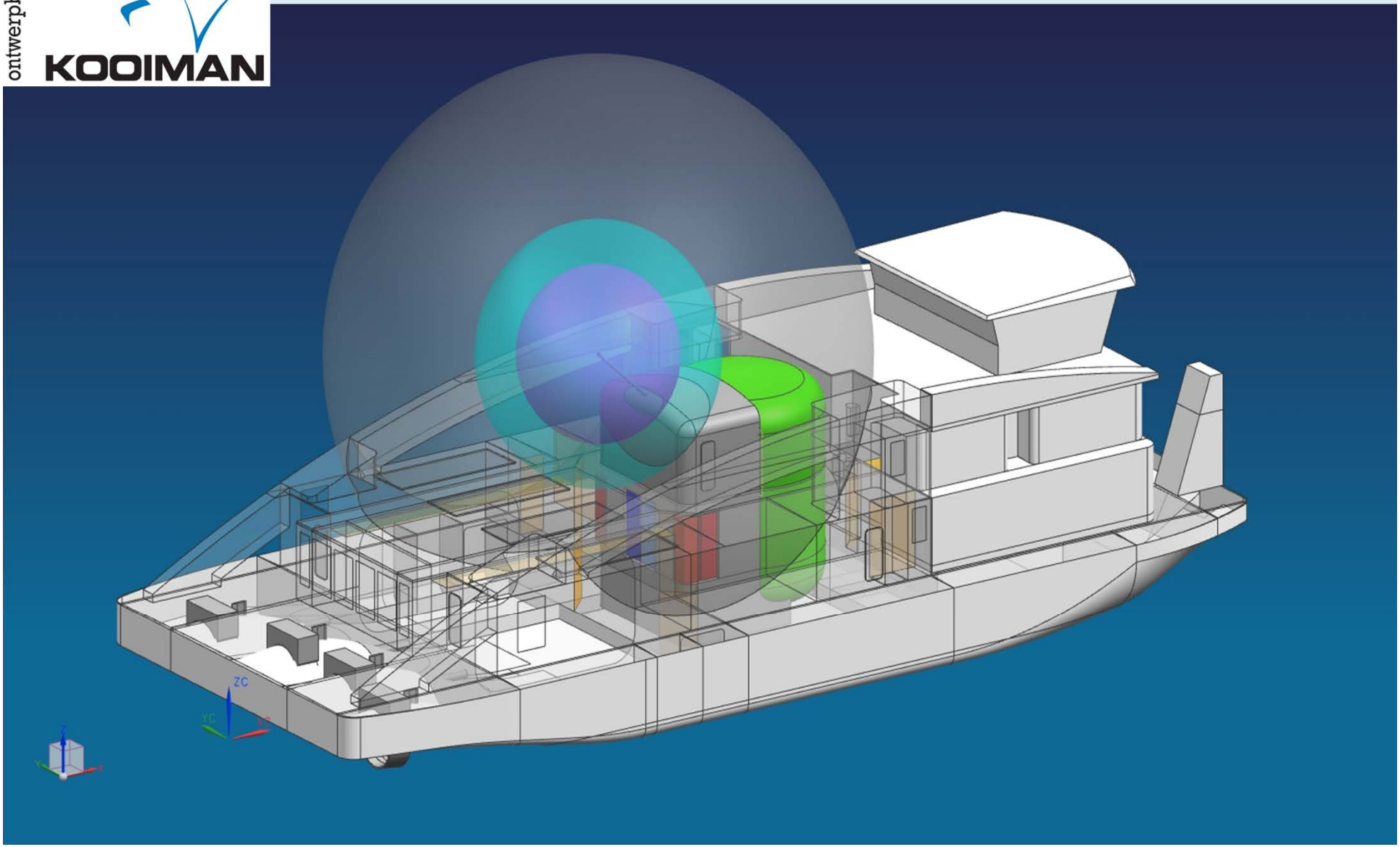

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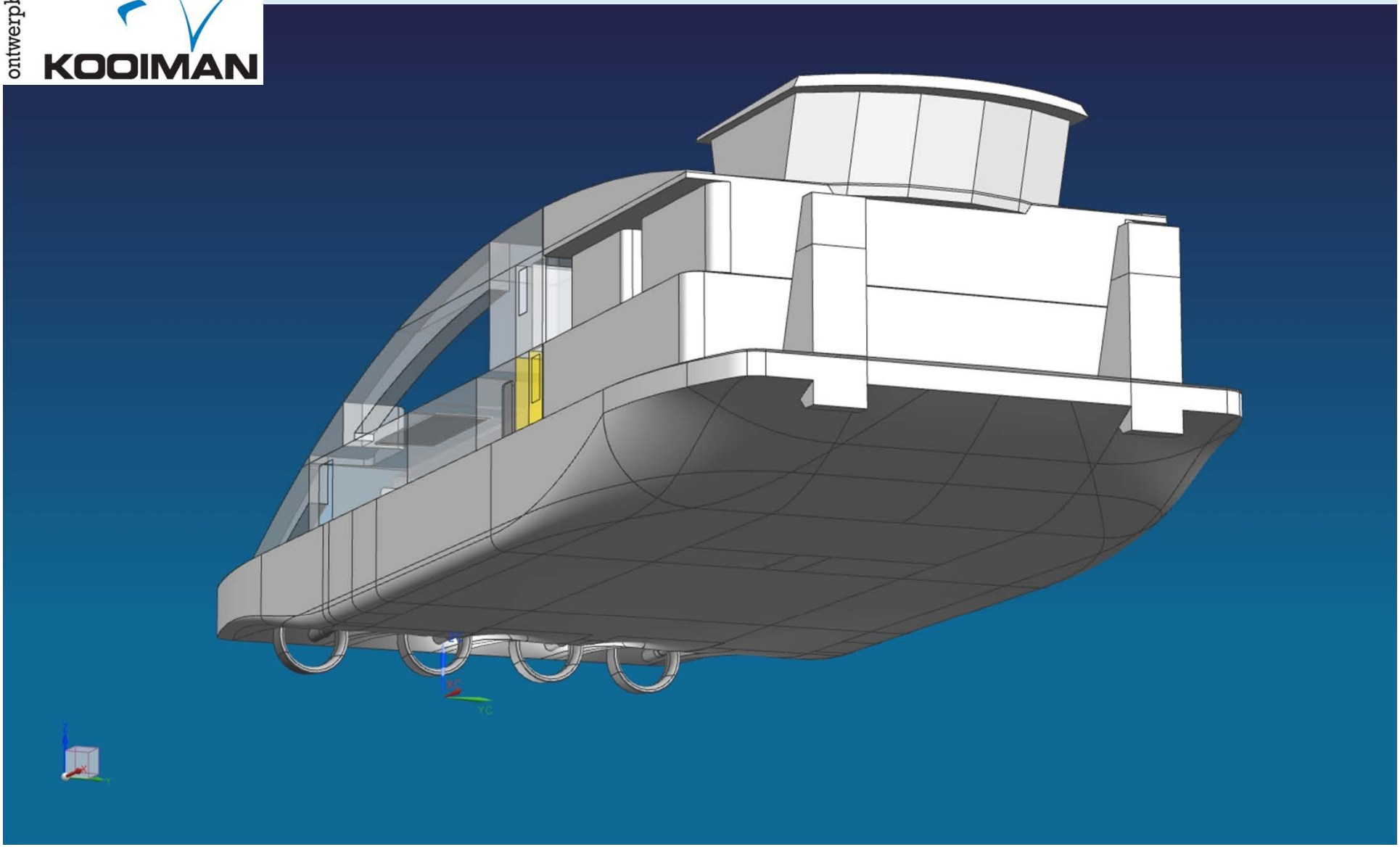

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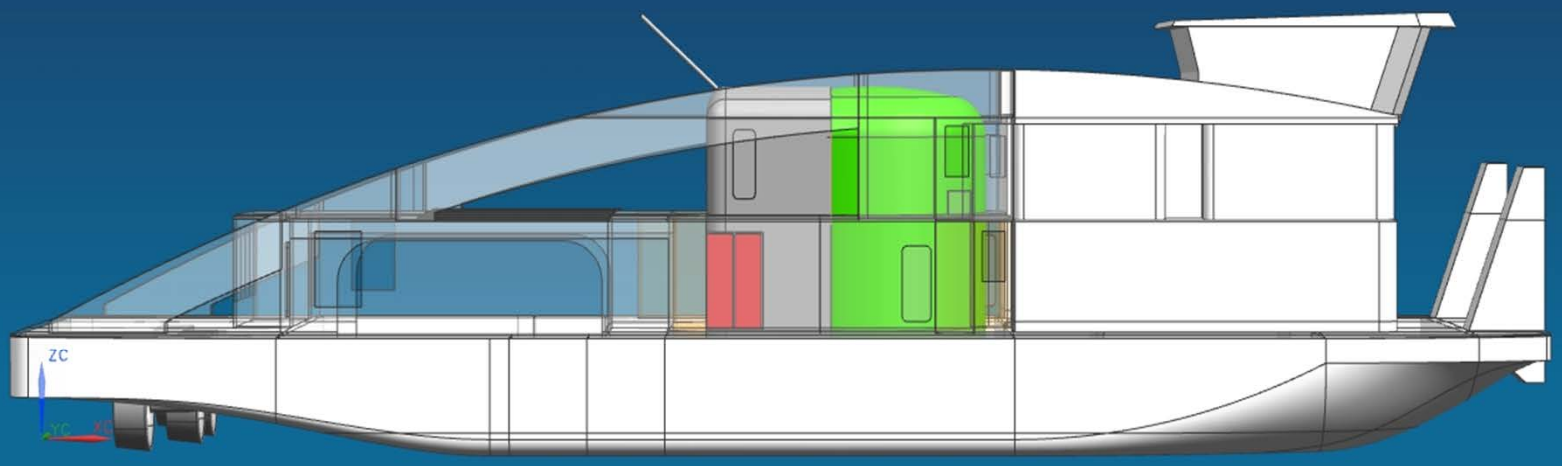
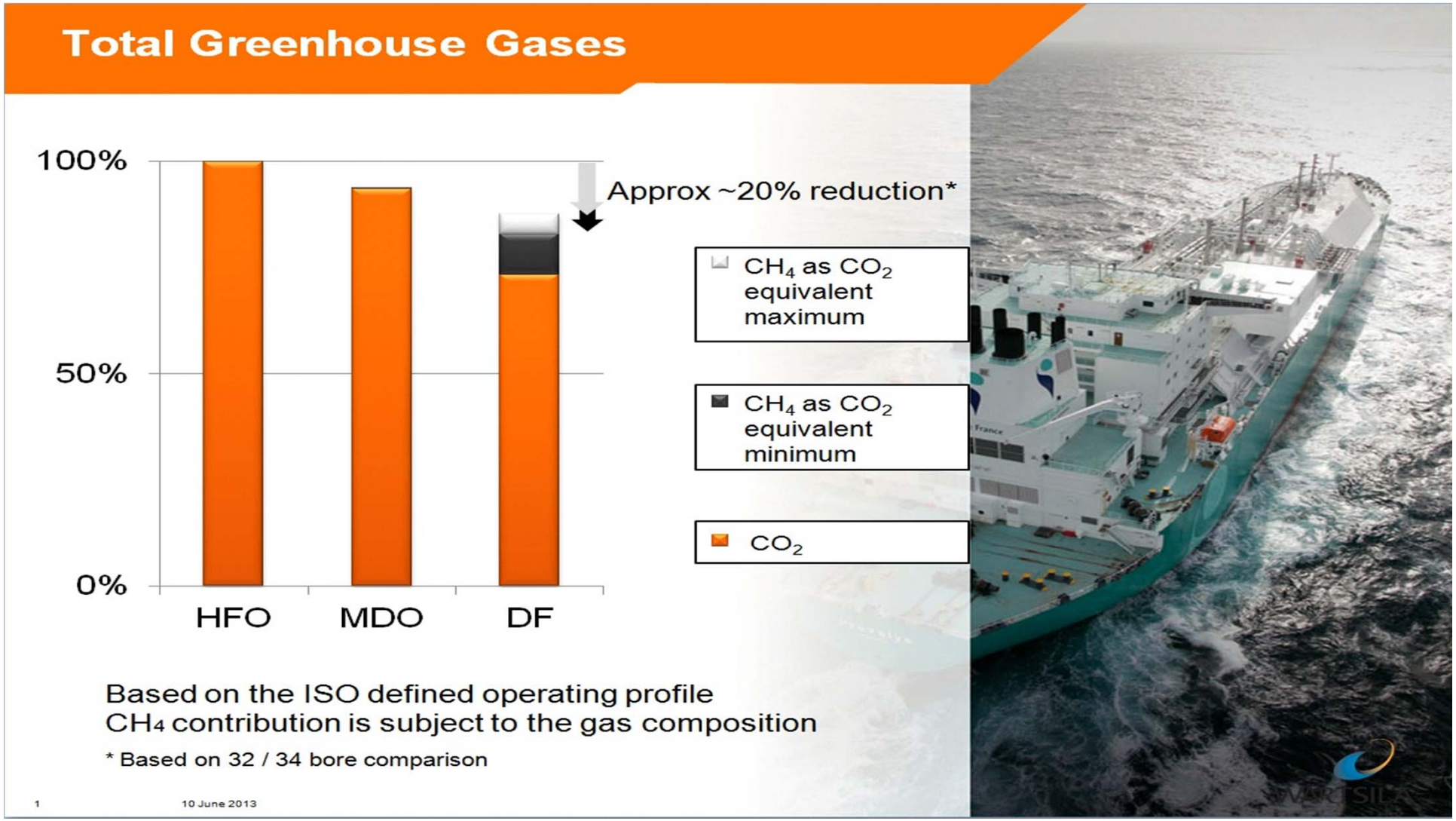


Methane slip

By using Wärtsilä DF 20 diesels the methane slip is reduced to less than 6 g/kWh

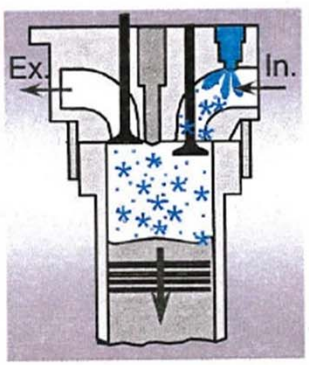
(Norwegian CO2 fee on petroleum products and measured as average in IMO / ISO test cycles)



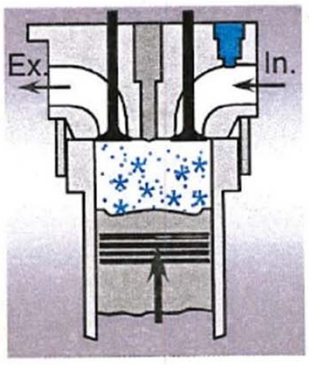
Dual-fuel motor - principe

Gas mode:

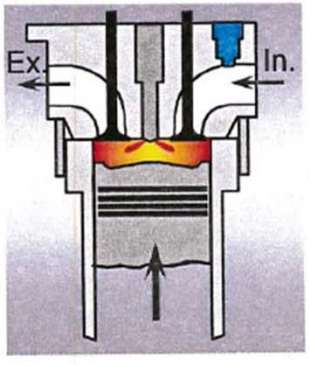
- Otto principe
- Lage druk gas toevoer
- 1% Pilot diesel inspuiting



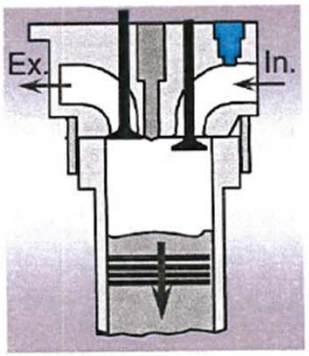
Intake of air and gas



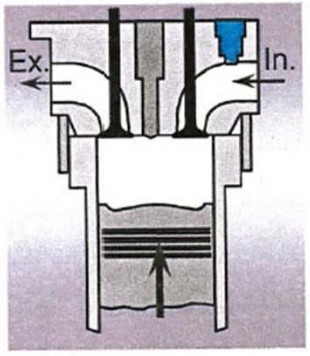
Compression of air and gas



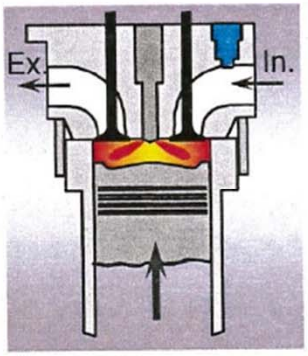
Ignition by pilot diesel fuel



Intake of air



Compression of air



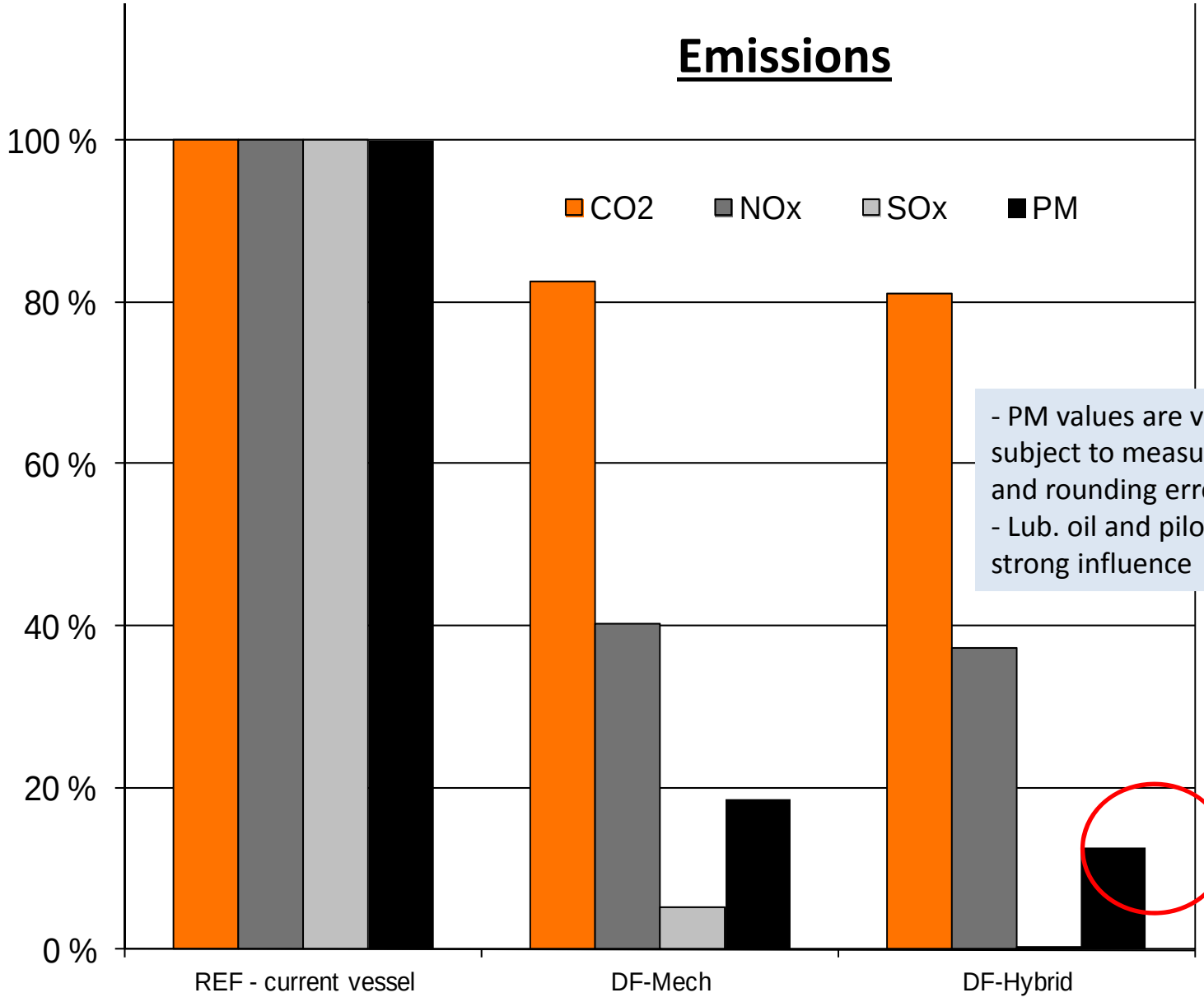
Injection of diesel fuel

Diesel mode:

- Diesel principe
- Diesel inspuiting

WÄRTSILÄ

Figures and Facts



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