MEYER WERFT
PAPENBURG 1795

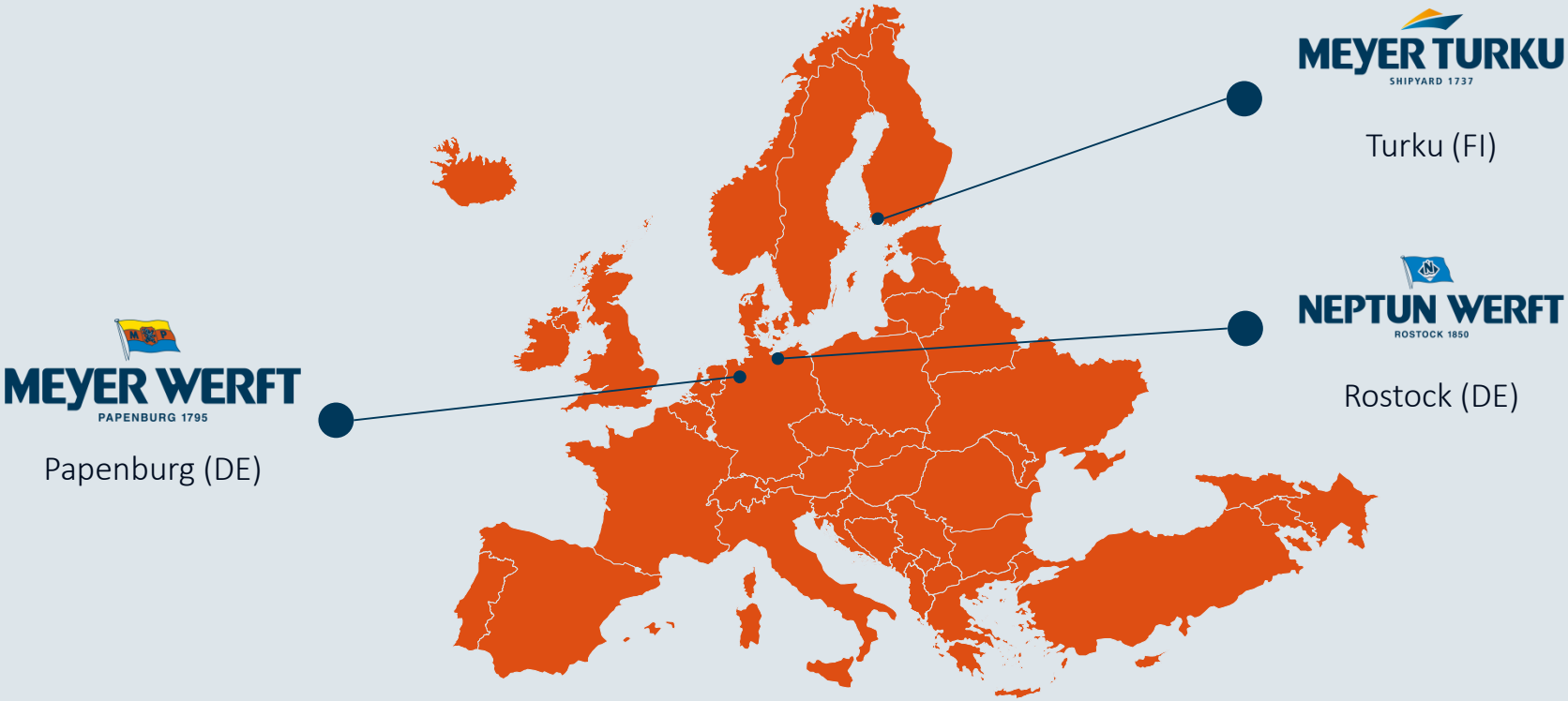
Key aspects for new ship fuels

FASTWATER / LUND UNIVERSITY METHANOL DAY

RD / Daniel Sahnen

05.11.2020

THREE SHIPYARDS



AGENDA

- **STATUS & BASIC ASPECTS**
- **SIMPLICITY IS KEY**
- **FUEL COSTS – THE BIGGER FRAME**
- **CONCLUSION**

MEYER GROUP SHIPS

New ships easily reach 2050, solutions needed today

EMISSIONS

Pollutants

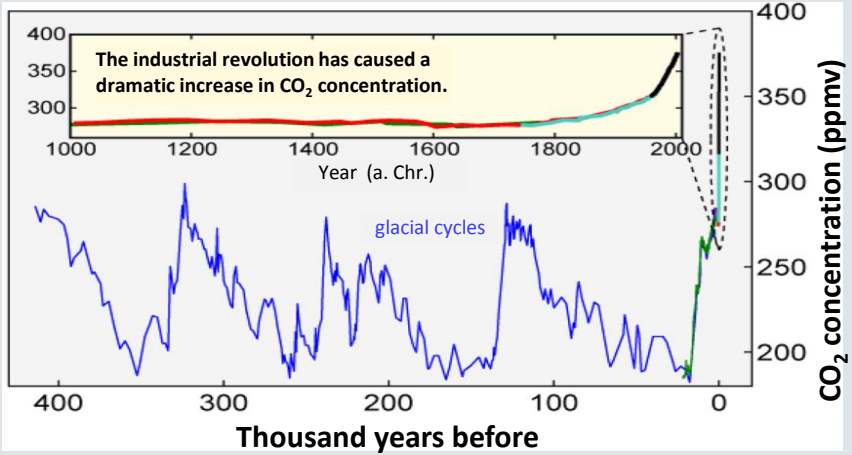
Harmful for health, “dirty air”

- Soot, particulate matter (PM)
- Nitogen oxides (NOx)
- Sulphur oxides (SOx)

Greenhouse gases

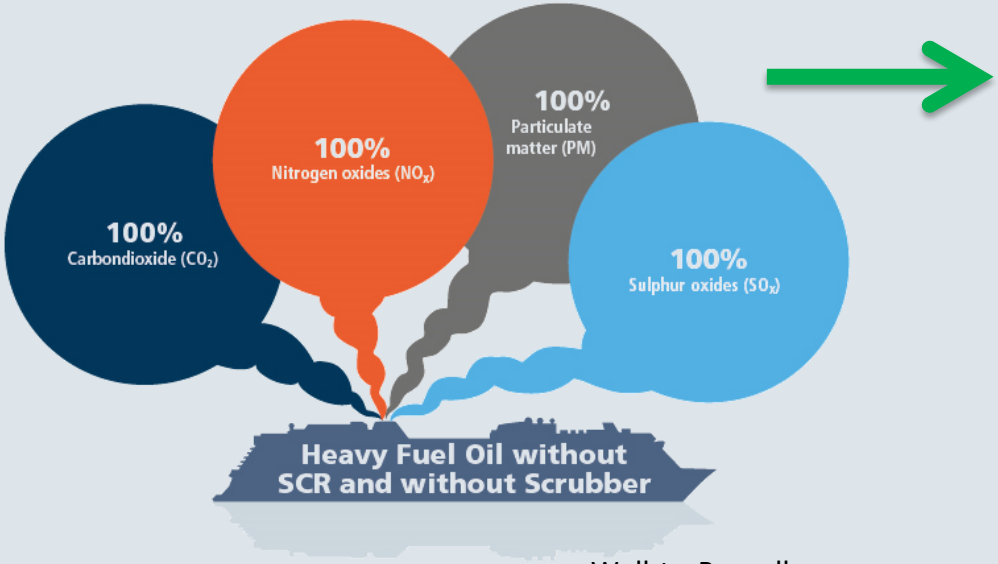
Global warming, “Climate crisis”

- Carbon dioxide CO_2
- Methane CH_4
- Laughing gas N_2O



CHALLENGE

Reference: Heavy Fuel Oil



Well-to-Propeller

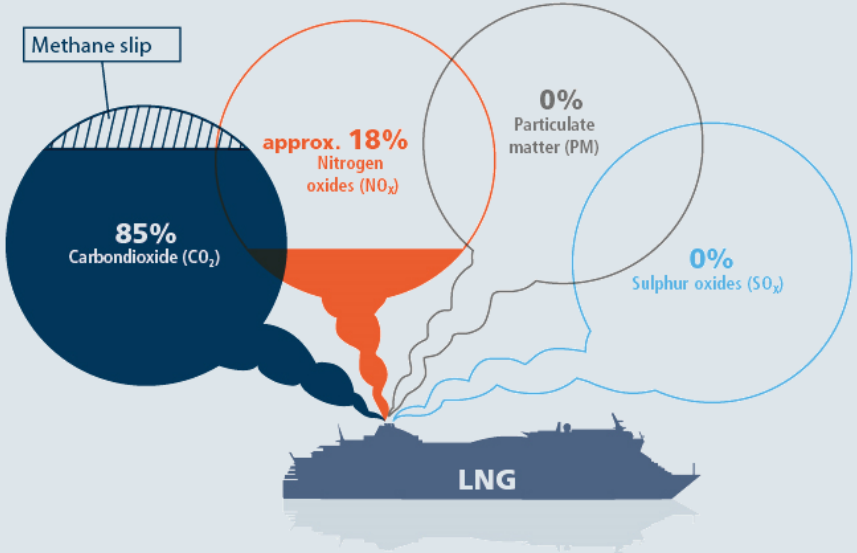
Target

- no pollutants
- renewable
- climate neutral
- sustainable

1. step: Turn away from HFO

SUCCESSFUL POLLUTANT REDUCTION

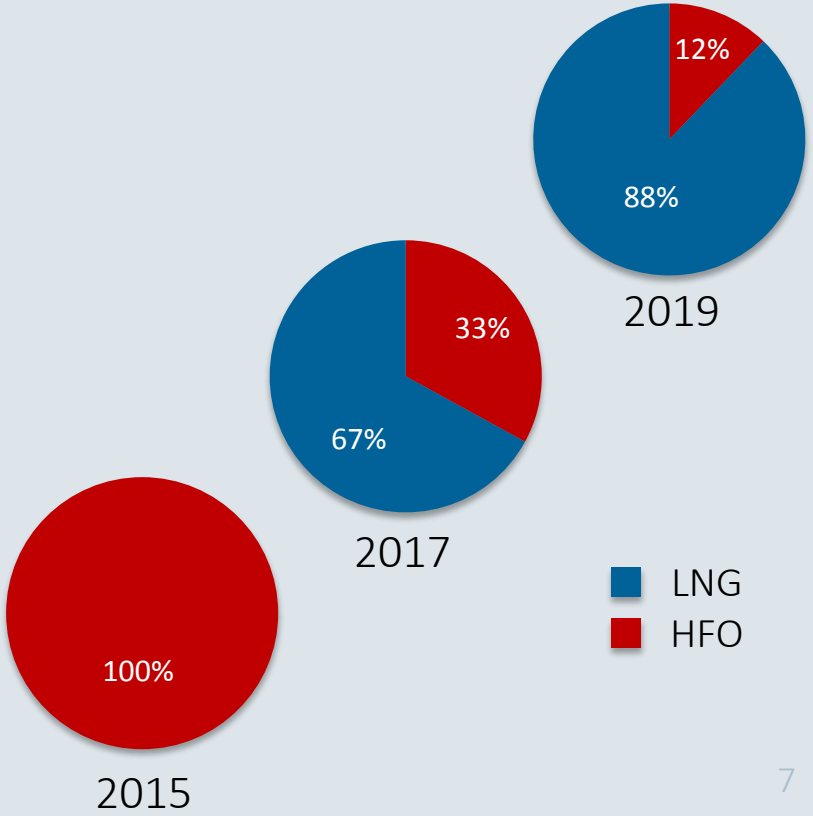
State of the art: LNG



Well-to-Propeller

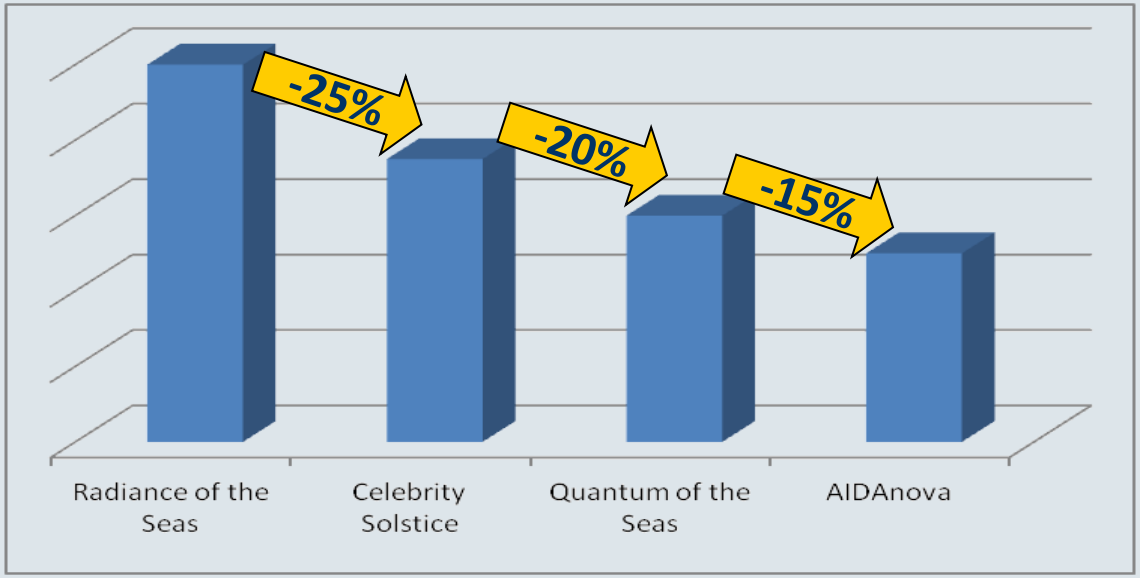
- cleanest fossil fuel
- technically sophisticated

MEYER GROUP Orderbook (GT)



ENERGY EFFICIENCY

Less energy demand -> less effort

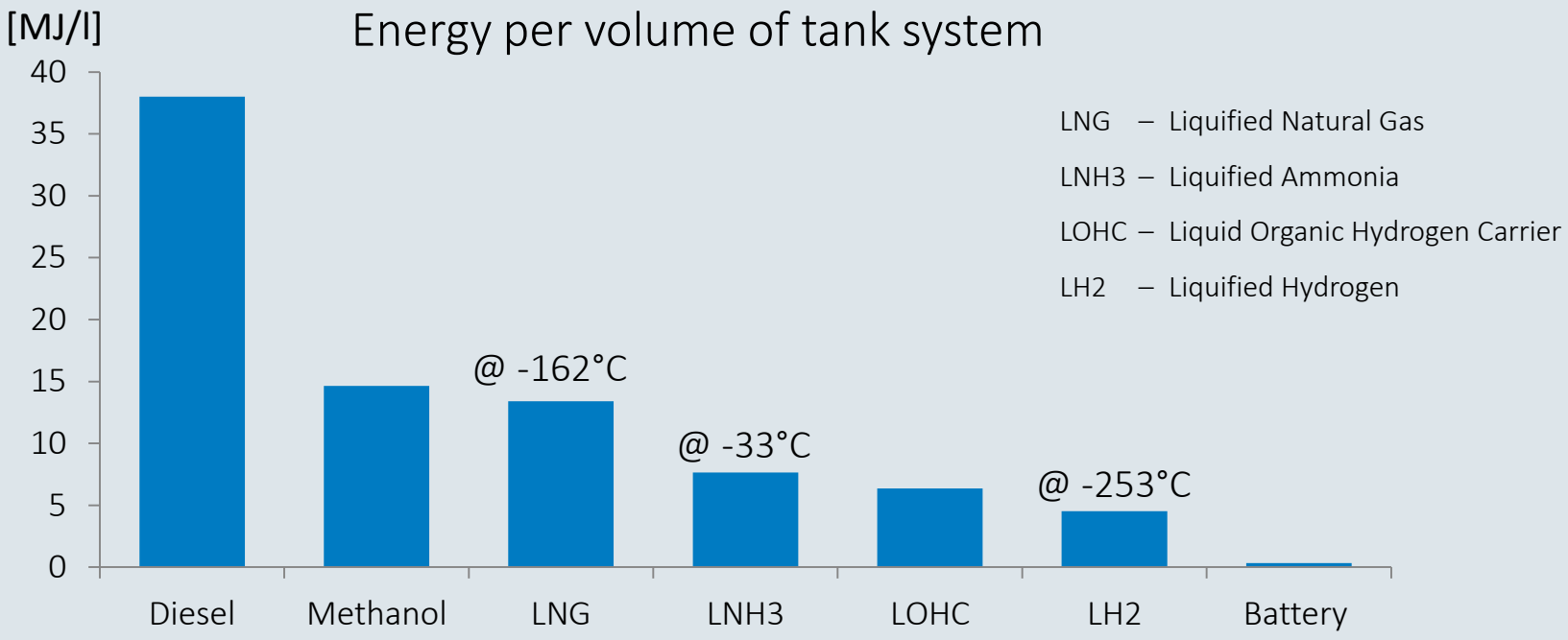


2001	2008	2014	2018
90.090 GT	122.000 GT	167.400 GT	183.900 GT
1.056 cabins	1.426 cabins	2.074 cabins	2.626 cabins
40.0 MW	41.0 MW	41.0 MW	37.0 MW

… but efficiency alone is not enough

Renewable fuels are urgently needed

FUEL STORAGE SEAGOING VESSELS



Battery, H2, LOHC and LNH3 not suitable for long distances

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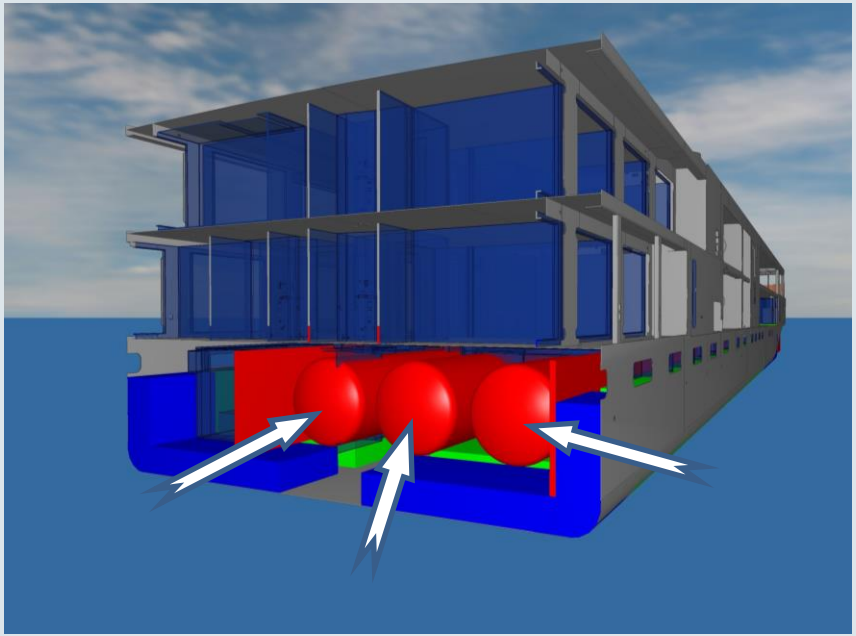
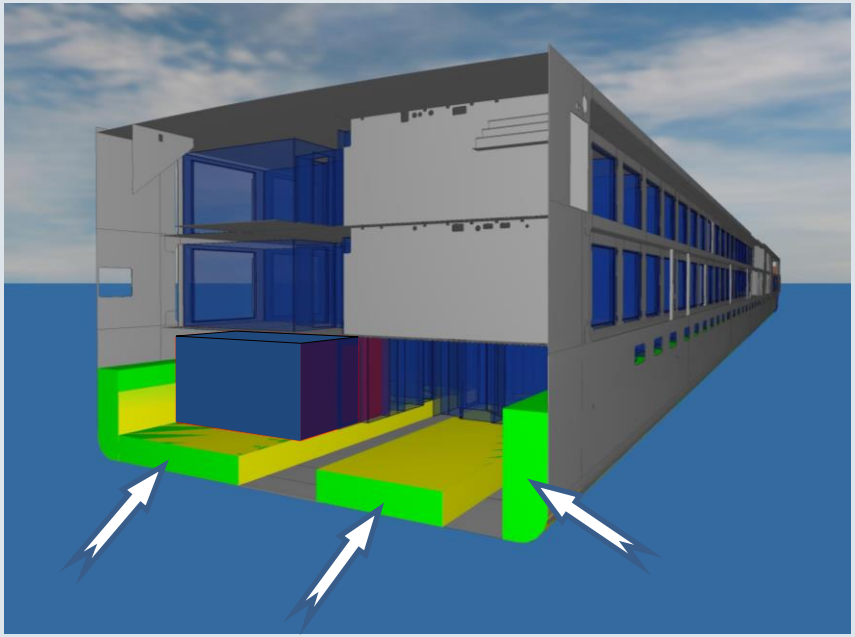
ENERGY STORAGE ON BOARD

Methane (@-162°C)



Methanol



Methanol allows nearly random tank arrangement

ENVIRONMENTAL PROPERTY

Methanol[1]
15,400 (mg/l)

LC50 for fish, LC – Lethal Concentration:

Concentration in water, at which half the population died within a specified test duration.

Methane[5]
49.9 (mg/l)

Heavy Fuel Oil[3]
79 (mg/l)

Diesel[4]
65 (mg/l)

Gasoline[2]
8.2 (mg/l)

[1] ECHA, European Chemicals Agency, registration dossier Methanol; [2] Petrobras/Statoil ASA, Safety Data Sheet, ECHA registration dossier Gasoline; [3] GKG/ A/S Dansk Shell, Safety Data Sheet; [4] ECHA, European Chemicals Agency, registration dossier Diesel; [5] ECHA, European Chemicals Agency, registration dossier Methane

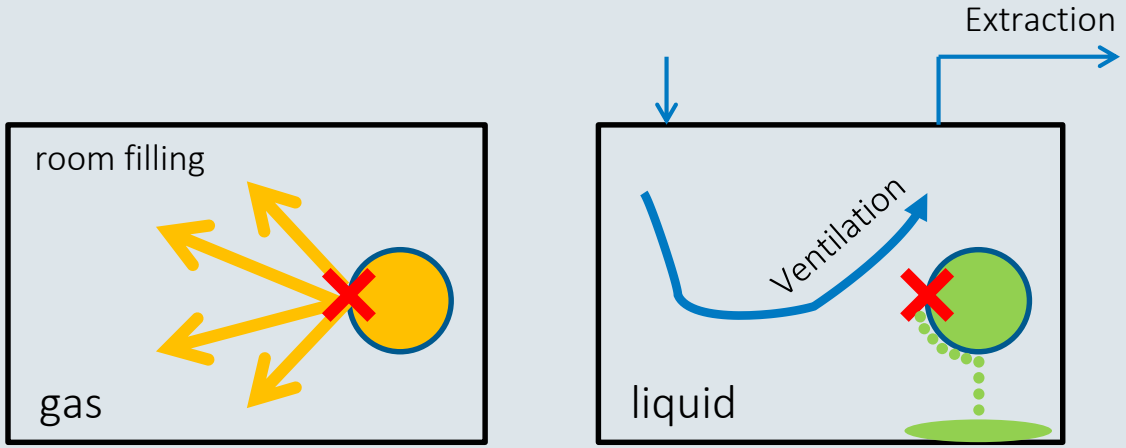
Methanol better than
- Diesel by factor 240
- Gasoline by factor 1900

GAS VS. LIQUID

The physical behaviour of gas and liquid fuel is crucially different.

Liquids allow:

- immediate pressure release
- less medium released
- locally bound
- easy detection & mitigation



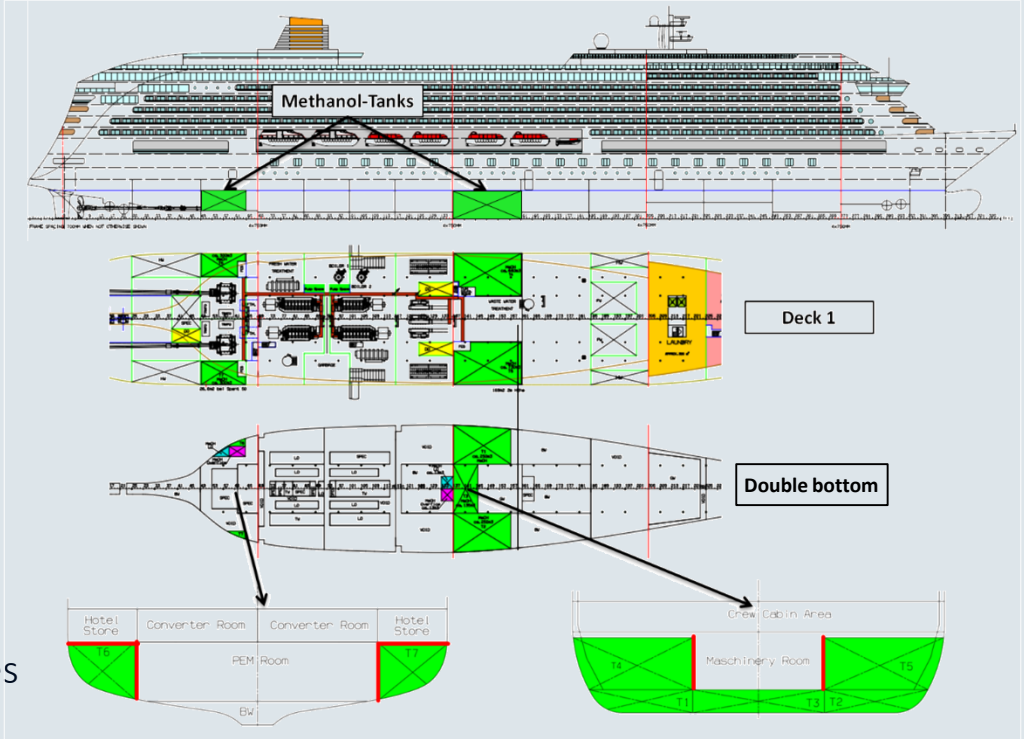
Liquid fuel systems less demanding than gas fuel systems

CLOSE-UPS

Methanol

- Storage at ambient pressure & temperature, no pressure build-up
- Room saving, structural tanks with storage in hull & double bottom
- Common mild steel
- Liquid fuel system
- Compelling environmental properties

→ Energy density acceptable, major advantages for marine application



CLOSE-UPS

Ammonia (NH3)

- Gas system + inferior energy density
- Extreme demands for material and equipment
- Difficult to burn
  - Low flame speed, small ignition window
  - Extra fuel system needed
- Show stopper N_2O ? (GHG-factor 265)

→ No “hot candidate”, keep under surveillance

LOHC (Liquid Organic Hydrogen Carrier)

- Inferior energy content (DBT: 1,9; Diesel: 10 kWh/l)
- Energy consuming treatment onboard
- H_2 gas system
- Additional tanks for unloaded LOHC
- Bi-directional transfer at bunkering (loaded-unloaded LOHC)

→ Interesting for land-based energy storage, marine rather not

unloaded loaded

READINESS IN MARINE CONTEXT

TECHNOLOGY READINESS LEVEL (TRL)

Source: www.cloudwatchhub.eu/exploitation/brief-refresher-technology-readiness-levels-trl

Technology	TRL	remark
Diesel	9	
LNG	8-9	
Methanol	7-8	big scale: 9
LOHC	3-4	
LH2	3-4	small scale: 5
NH3	2-3	
CCS on board	2-3	

Climate action, can not wait for basic R&D technology

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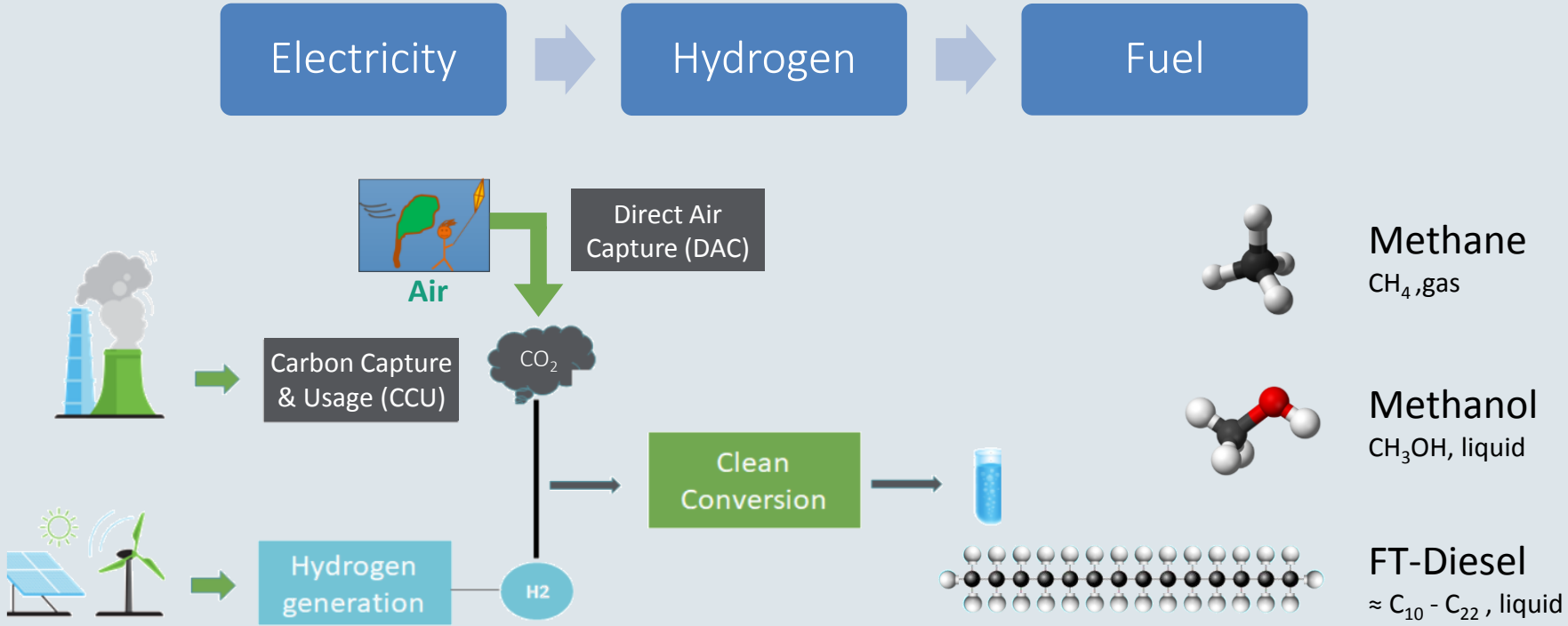
PRODUCTION OF E-FUELS

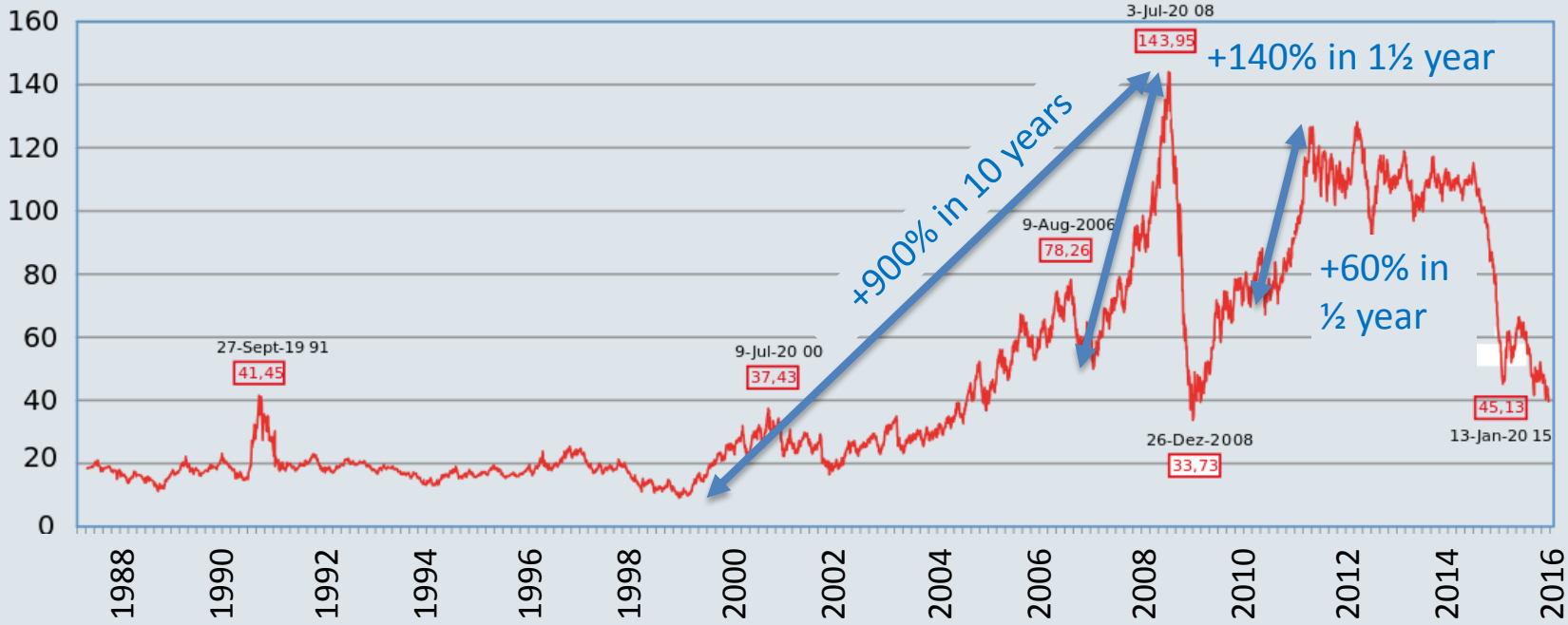


Source: CRI International

E-Fuels ≈ 3 MJ Renewable Energy per 1 MJ Fuel

FUEL PRICE DEVELOPMENT

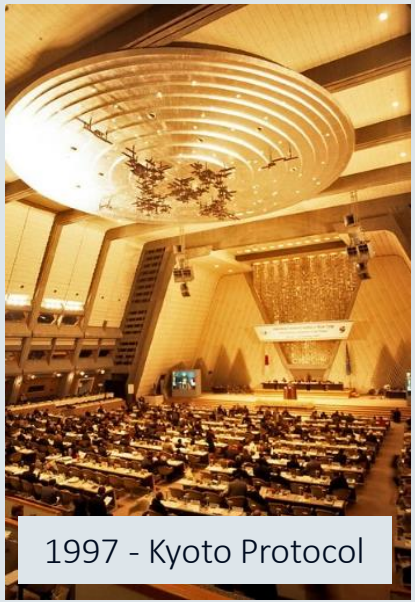
US $ / barrel (brent crude oil)



Factor 3 not harmful, but no chance when fossil fuel stays cheap

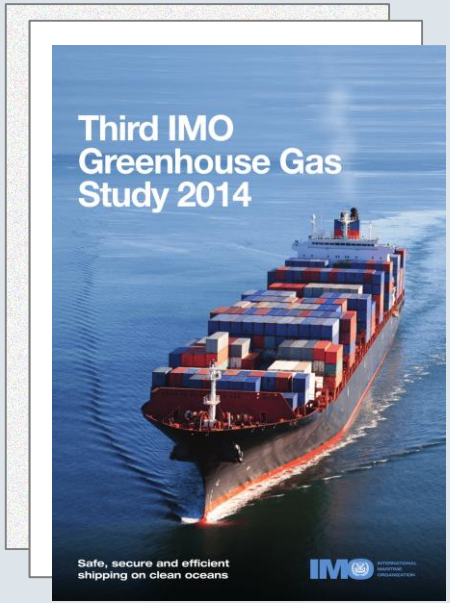
MARKET BASED MEASURES (MBM)

Call for IMO to reduce GHG



1997 - Kyoto Protocol

4 GHG studies



… today: still no MBM

The call to IMO is 23 years old …

Courtesy by Institute of Shipping Economics and Logistics (ISL), A. Hübscher

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CONCLUSION

- Pollutants solved, challenge: GHG emissions
- Significant GHG reduction only by renewable fuels
- Concentrate on almost mature, available technology
- The most simple and practical fuel “will make the race”
- For uptake of renewable fuels political measures are inevitable

  (e.g. fuel quota, emission trading system, carbon pricing, energy taxation)

THANK YOU …

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