



# Maersk Initial Methanol Experience

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Germany, 2022



Pakistan, 2022

Maersk has adopted a target of net zero greenhouse impact by 2040

This is in recognition of increasingly evident global warming impact

And with a belief that it is commercially sound



USA, 2022



Australia, 2022



# RENEWABLE FUELS - WHY METHANOL

**Can be produced "green" – either from electrolysis combined with carbon capture or from biomass**

Liquid at room temperatures – comparatively easy to store

Highly biodegradable – low risk of marine environment impact

Available engine technology

## CHALLENGES

Lower energy content than oil – 2.5 x volume

Different fire behaviour

Methanol is toxic to humans

Not smaller CO<sub>2</sub> release, so requires production using biogenic carbon

# Dual fuel engines

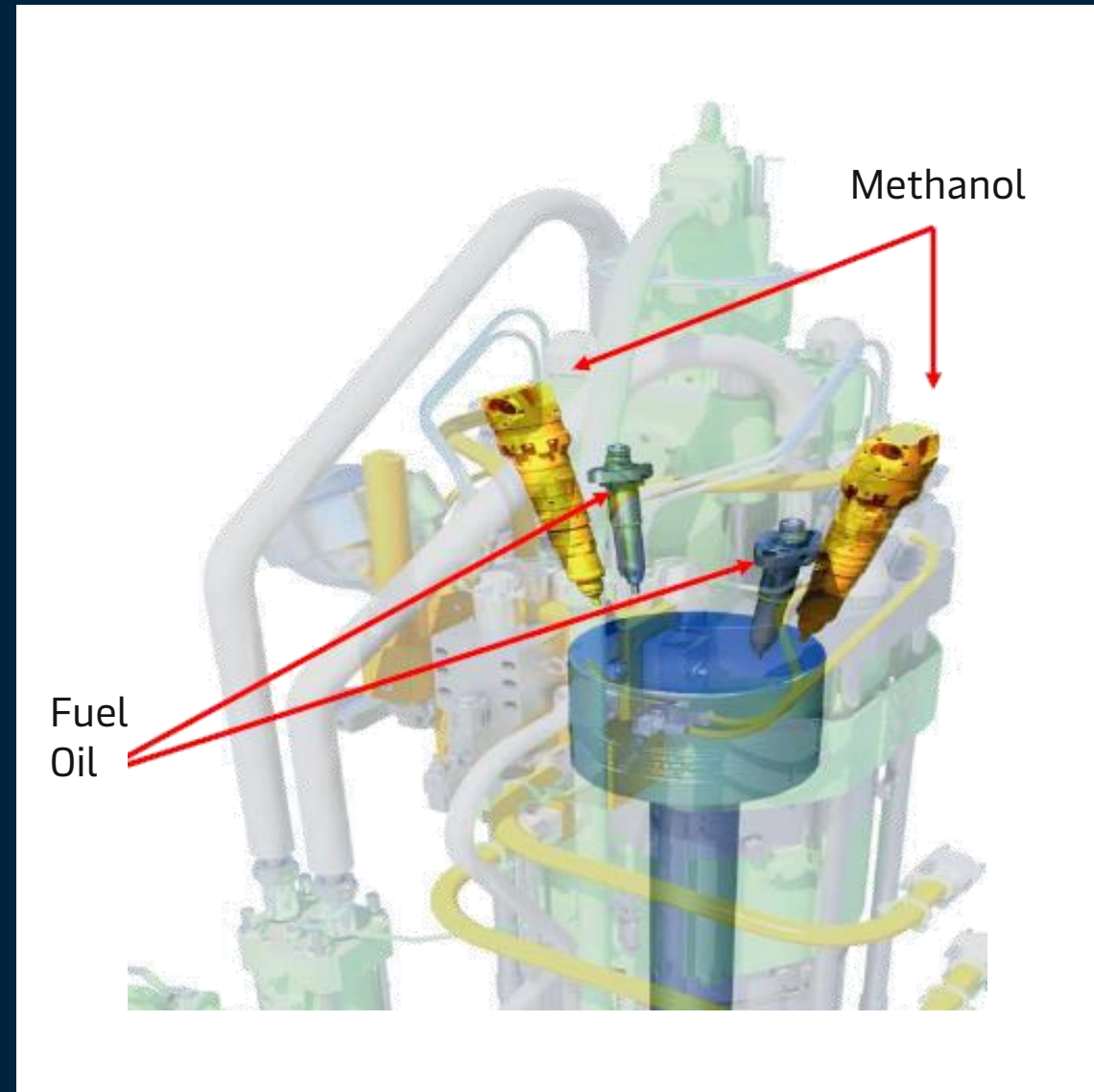
95% identical to standard ship's engine

Full capability on both fuel oil and methanol

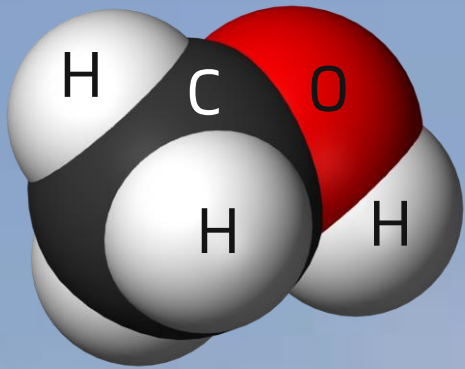
Separate injection system for methanol

Methanol needs pre-ignition, so oil fuel system is always in use

Vessels can run without restrictions on fuel oil alone

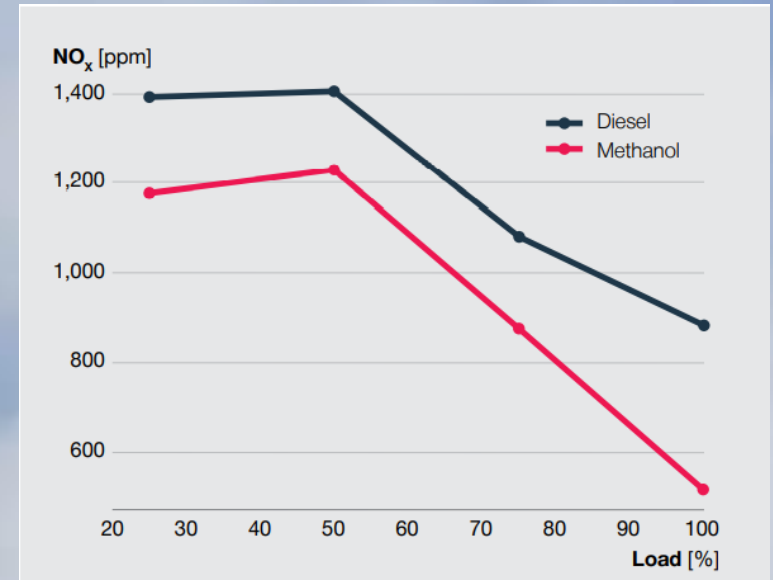


# ADDITIONAL ENVIRONMENTAL BENEFITS



Methanol has no soot formation as there is no strongly bound carbon strings in the fuel

Lower peak combustion temperatures of Methanol will give abt. 30% less NO<sub>x</sub> emissions

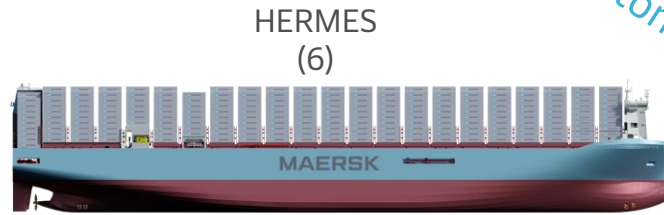
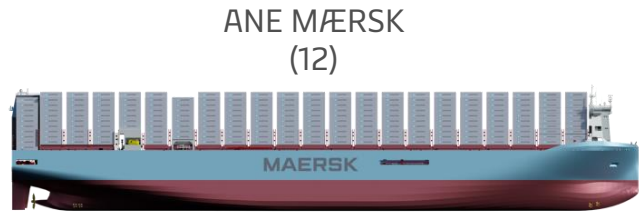


Energy storage type/chemical structure	Energy content, LHV [MJ/kg]	Energy density, [MJ/L]	Fuel tank size relative to MGO	Supply pressure [bar]	Flash-point [°C]	Vapour pressure at 20°C [bar]	Auto-ignition temperature [°C]	Emission reduction compared to HFO Tier II [%]			
								SO <sub>x</sub>	NO <sub>x</sub>	CO <sub>2</sub>	PM
Ammonia (NH <sub>3</sub> ) (liquid, -33°C)	18.6	12.7(-33°C) / 10.6 (45°C)	2.8 (-33°C) / 3.4 (45°C)	80	132	0.13 / 0.13	630 / 470	100	Compliant with regulation	~90	~90
<b>Methanol (CH<sub>3</sub>OH) (65°C)</b>	19.9	14.9	2.4	10	9	2.2-8.5		90-97	30-50	11	90
LPG (liquid, -42°C)	46.0	26.7	1.3 <sup>1</sup>	50	-104		410-580 (depending on the composition)	90-100	10-15	13-18	90
LNG (liquid, -162°C)	50.0	21.2	1.7 <sup>1</sup>	300				90-99	20-30	24	90
LEG (liquid, -89°C)	47.5	25.8	1.4 <sup>1</sup>	380				90-97	30-50	15	90
MGO	42.7	35.7	1.0	7-8							

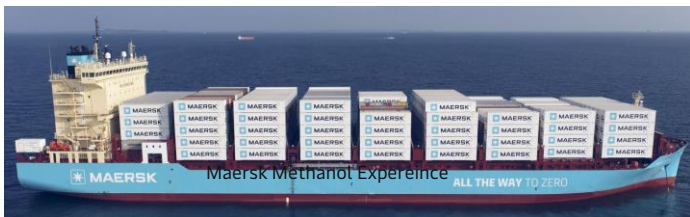
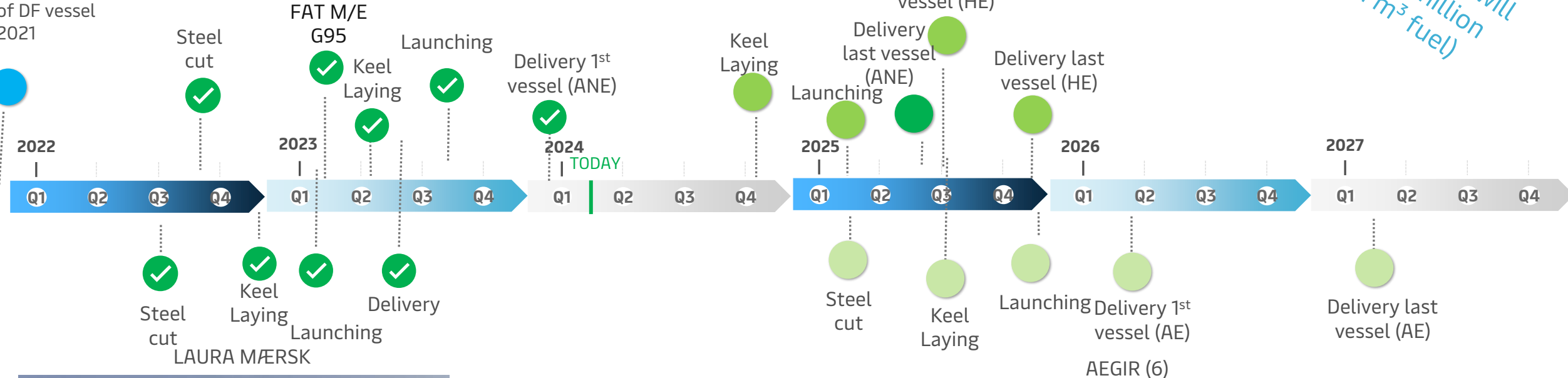


# Maersk methanol fueled newbuilding program

The 25 Dual Fuel vessels on order will enable abatement of abt. 2.5 million tons CO<sub>2</sub> per year (1 million m<sup>3</sup> fuel)



First order of DF vessel 2021





# BUILDING THE FIRST VESSEL

Some gaps and immaturities in design rules and regulations

Good cooperation with flag authority (Denmark)

Construction proceeded with few problems

Good initial operation experience

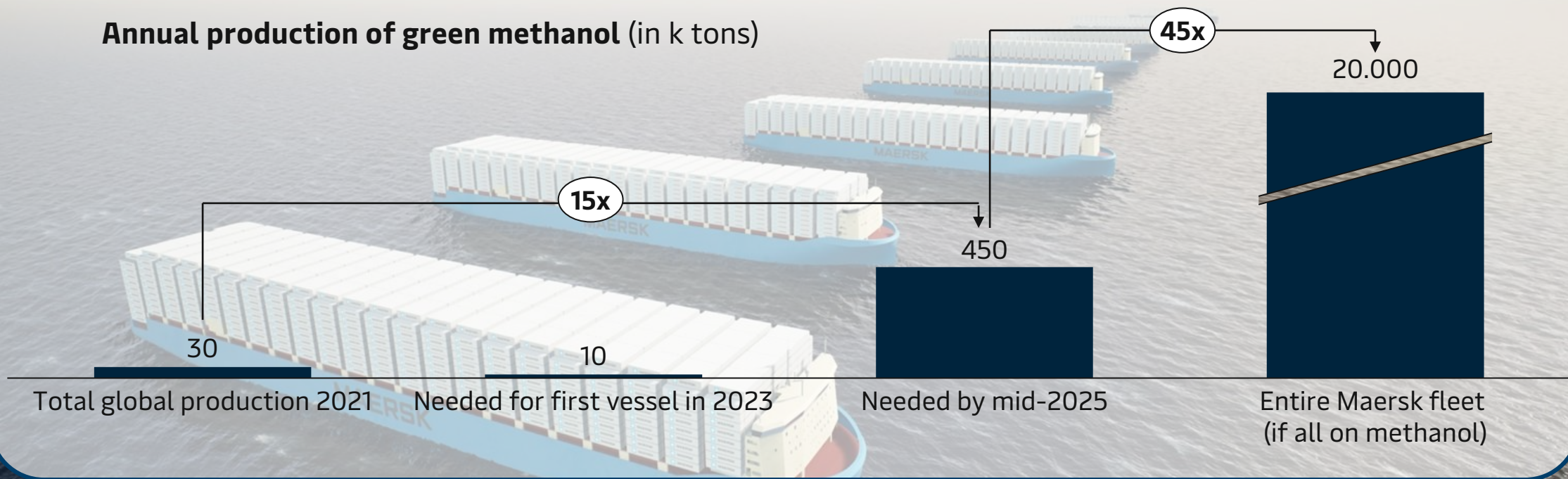
Maersk Methanol Experience





# It will be quite a leap to get to scale on green fuels

## Annual production of green methanol (in k tons)





# New infrastructure for green methanol is challenging



Lead time for land based infrastructure is long (*longer than ship construction*)

- Zoning permits and other construction clearances
- Critical customer mass for commercial viability
- Maersk need to ensure the entire chain is "green"



# GREEN METHANOL PRODUCTION

GREEN POWER

BIOGENIC CARBON

GREEN METHANOL

Major infrastructure  
Factory site  
Power gen. & distribution  
Carbon collection & transport  
Product transport

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Picture source: European Energy



# Last mile infrastructure – port storage, bunkering vessels not in place yet



First dedicated methanol bunker vessel attending Ane Mærsk (Shanghai, SIPG)



Small chemical tanker (used for Laura Mærsk in Singapore)

Laura Mærsk at tanker jetty (Ulsan, OTK)





No regulations for bunkering methanol

As yet, no way to licence a bunker operator

Every bunkering event is a “special project”

Each operation is preceded by extensive joint planning and review

Sometimes there are unclarities what permits are needed and who is authorised to issue them





# Singapore bunker operation experience

Bunkering at the outermost anchorage

Large surrounding area cordoned off by port

Lot of trust and confidence gained from the event

Food for thought - where did the bunker vessel load the methanol and how?





Thank you

Time for some questions



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