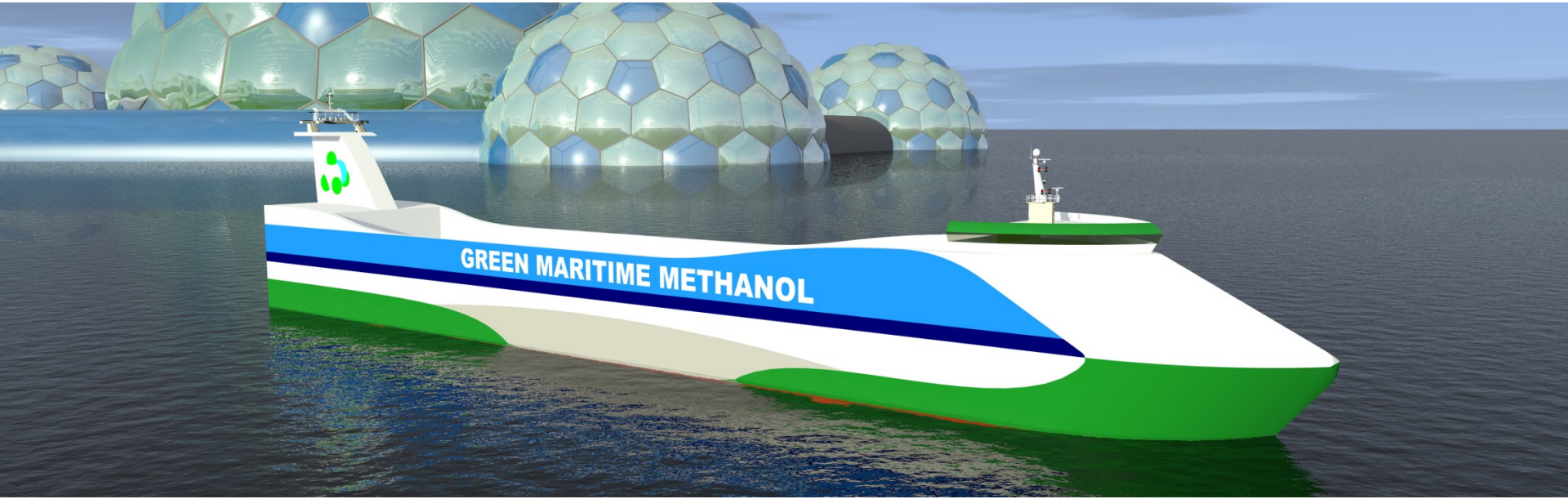
GREEN MARITIME METHANOL

Maritiem Kennis Centrum



Outlook on green methanol for shipping

Pieter ‘t Hart (NL Maritime Knowledge Centre)

19-05-2022

Green Maritime Methanol participants

GMM 2.0 New entrants

ABS

Acta Marine

CATERPILLAR

FUGRO

MAERSK

oceAnco

SANLORENZO

thyssenkrupp VEERHAVEN

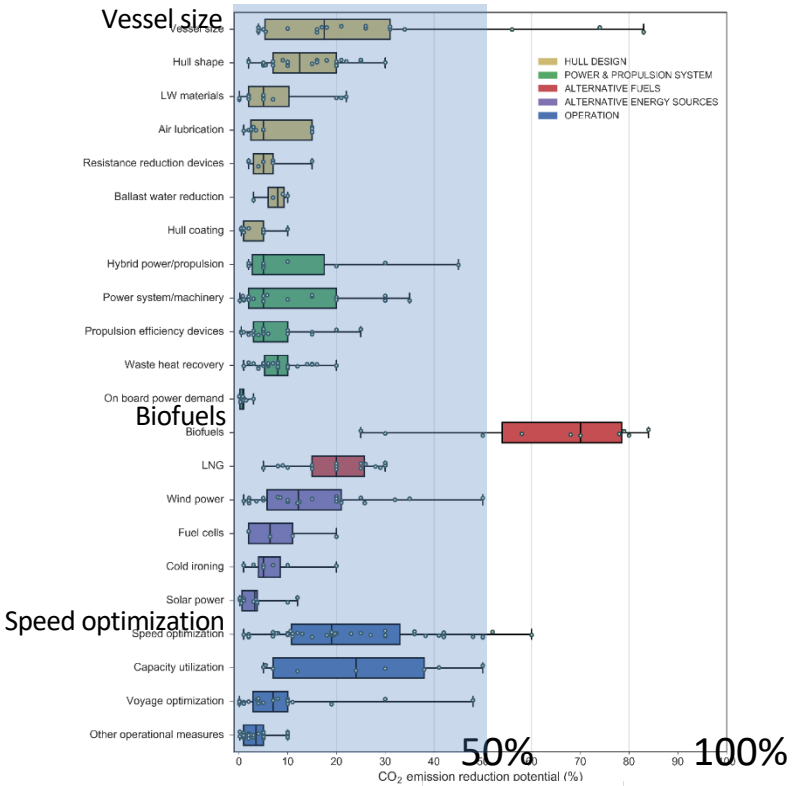
VICTROL

Objectives of the GMM project

- Benefits and feasibility of application of green methanol is being elaborated for the maritime sector.
- Technical development of the power train, but also on logistics and operational aspects.
- At the end of the project, system designs for several prototypes for methanol as a shipping fuel will be delivered.
- The project will work towards a follow-up with actual implementations in pilots.

Methanol as a green marine fuel in perspective

CO2 emission reduction potential in shipping (in %)



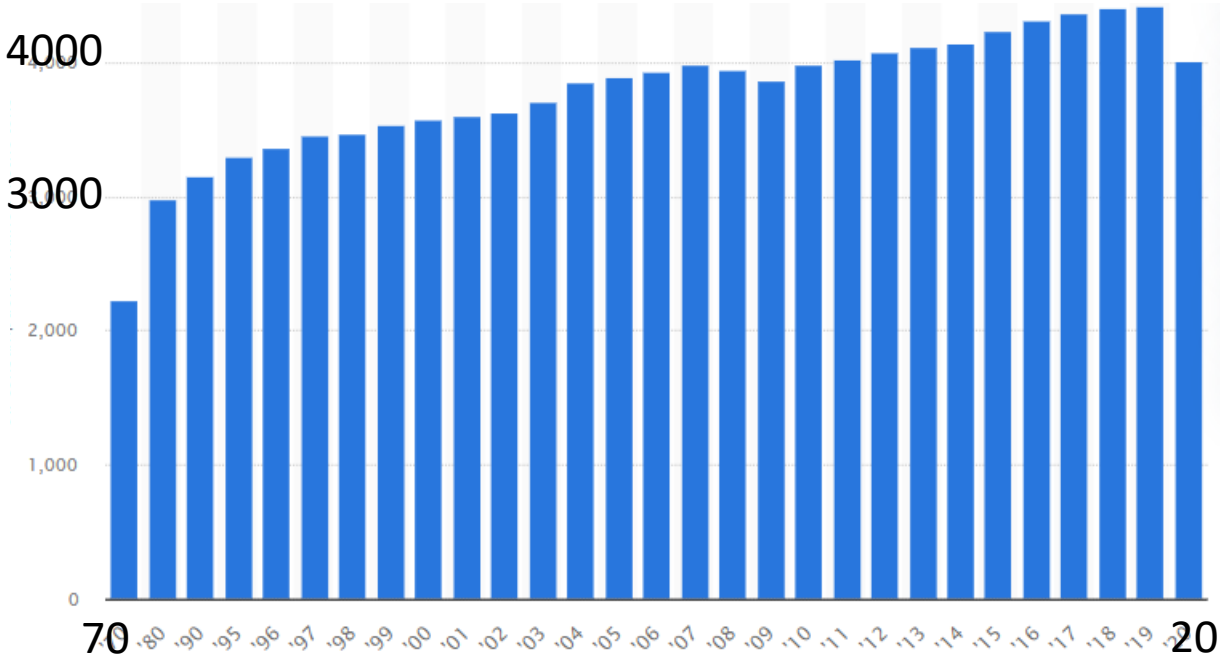
- Hull design
- Power & propulsion system
- Alternative fuels
- Alternative energy sources
- Operation

Ref. Bouman et al., 2017.

50%

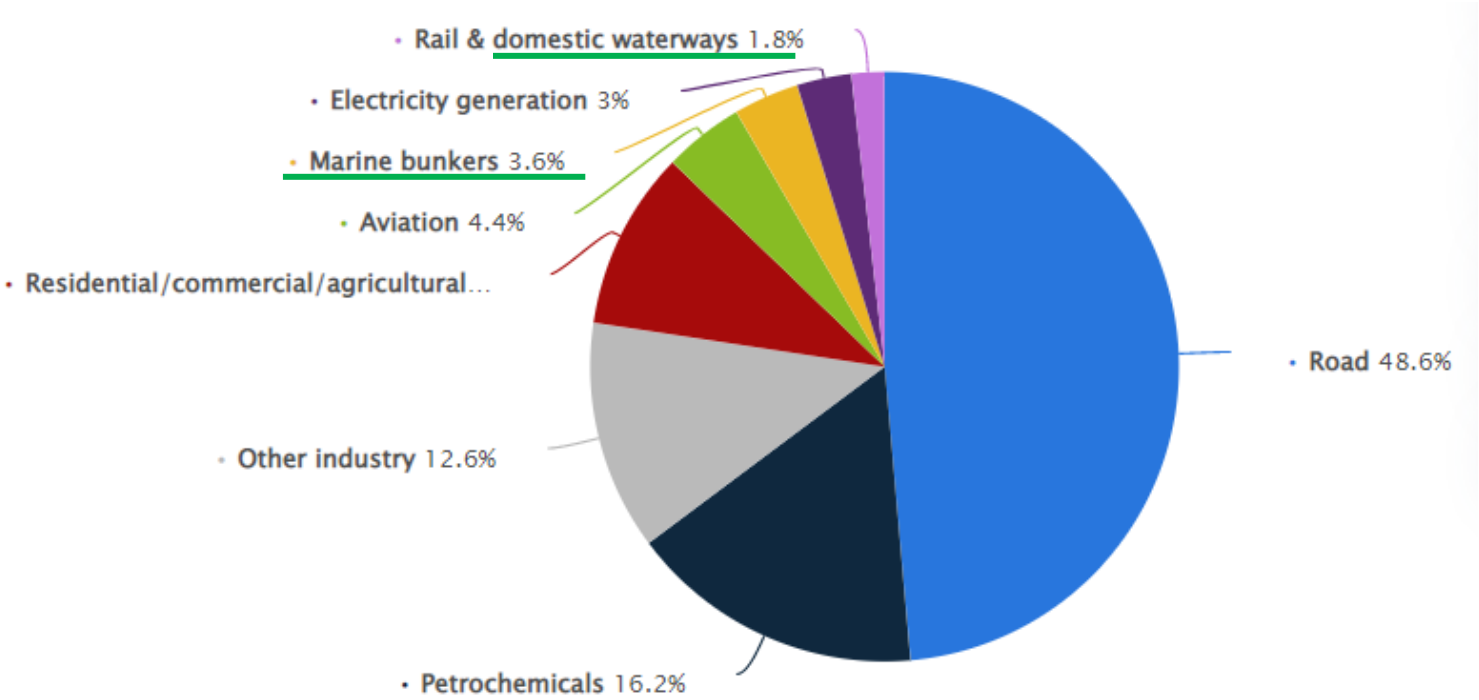
100%

Oil consumption worldwide (in mill. MT/yr)



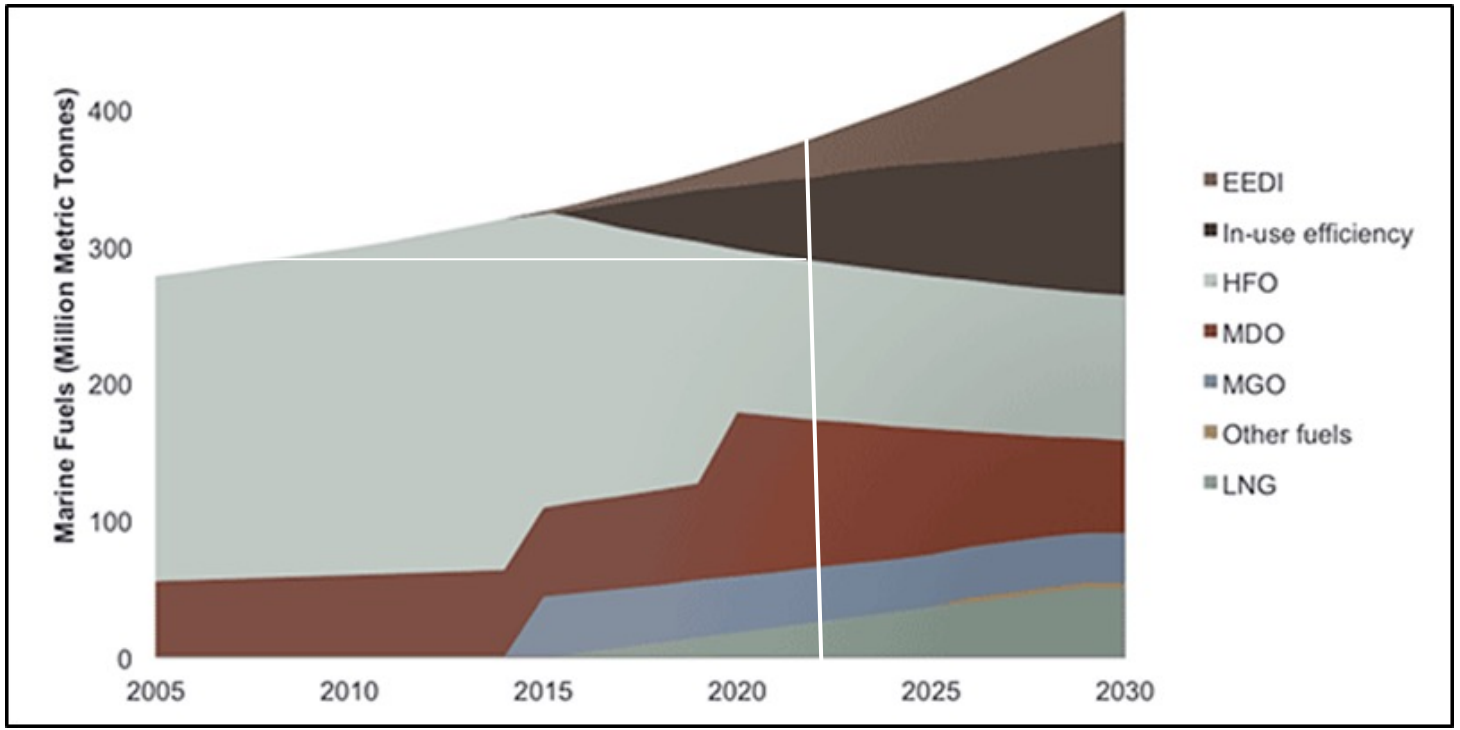
Ref: www.statista.com/statistics/265261/global-oil-consumption-in-million-metric-tons/

Distribution of oil demand in 2020



Ref: www.statista.com/statistics/307194/top-oil-consuming-sectors-worldwide/

Global consumption of marine fuels (mill. MT/yr)



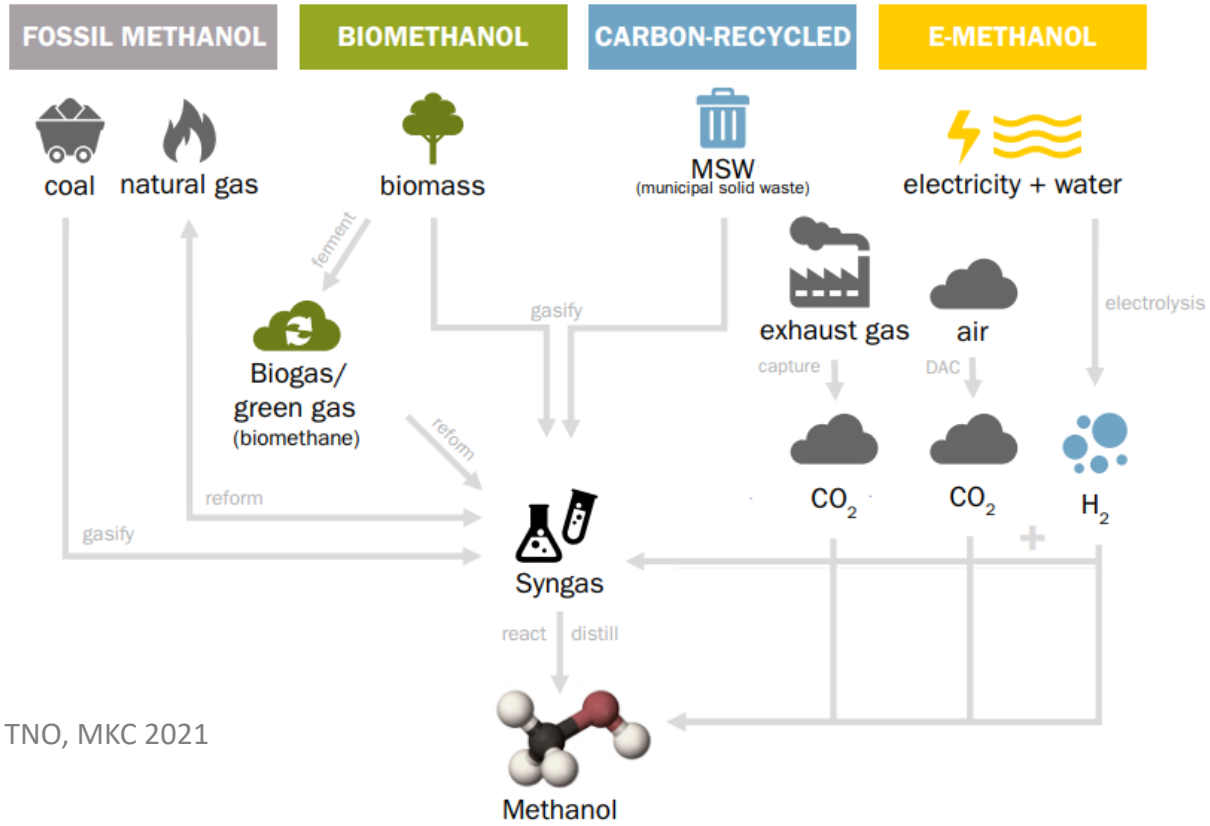
Ref. Wang, 2013

Global fuel production capacities (in MT/yr)

Fuel type	Global production in million tons/yr
Heavy Fuel Oil (HFO)	160
Marine Diesel Oil (MDO)	60
Marine Gas Oil (MGO)	50
Liquefied petroleum gas (LPG)	25
(Bio) Ammonia	176
(Bio) Hydrogen and fuel cell	53
(Bio) Formic Acid	0,7
Biodiesel	32
(Bio) Methanol	60
Bio Ethanol	110
(Bio) Liquefied Natural Gas (LNG)	130
Bio-Crude – Pyrolysis oil	< 5 (est.)
(Bio) Dimethyl ether	15
SVO/PPO	170

Ref. MKC, 2018

Four transitional methanol production routes



Ref. TNO, MKC 2021

GHG emissions of fuel chains CO_2 eq. (in g/MJ)

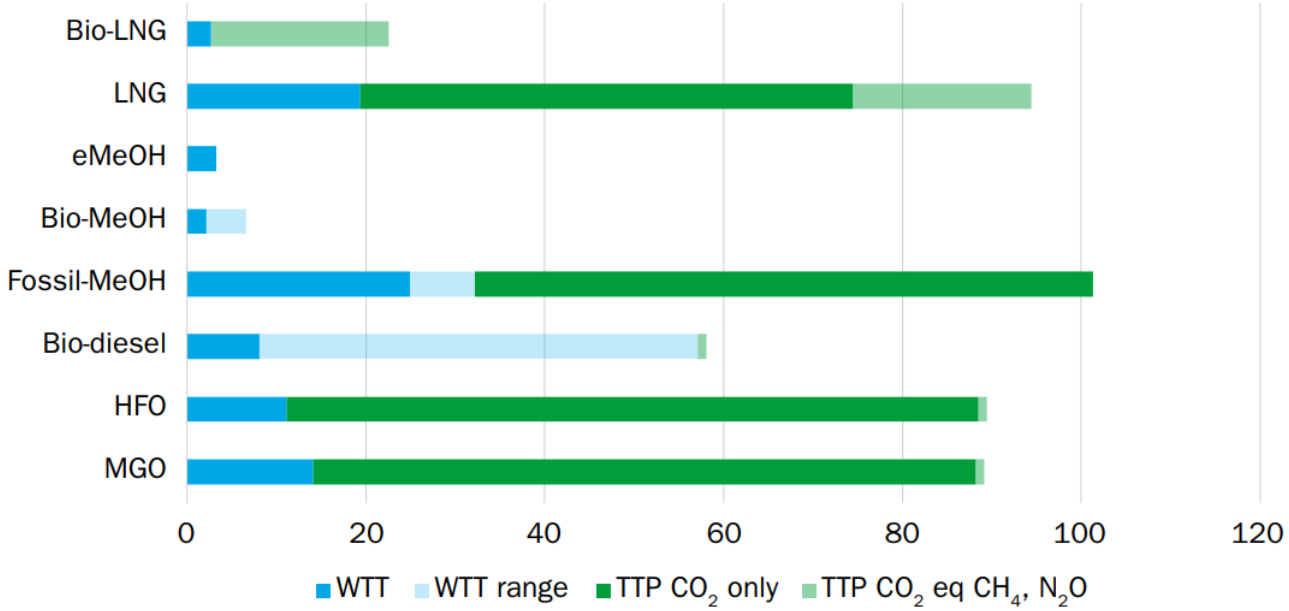


Figure 12: Well-to-propeller CO_2-equivalent emissions for different energy carriers with 100-year Global Warming Potential, GWP (CO_{2eq} g/MJ).

Ref. TNO, MKC 2021

Biomethanol essential (w.r.t. availability and price)

Current priority in NL is for electrification and green hydrogen

1. Personal energy & service sector
2. Energy for industry
3. Oil products and chemical feedstock
4. Freight transport (air & shipping)

Methanol type	Cost range	Cost dependent on
Fossil methanol	€ 9-22/GJ	Policy, Natural gas price
Biomethanol	€ 11-33/GJ	Policy, Biomass & green gas price
E-methanol	€ 27-68/GJ	Sustainable electricity and CO_2 costs

Ref. TNO, MKC 2021

Six case studies in GMM 1.0

Figure 13: Ship types evaluated in detail for methanol solutions

Ref. TNO, MKC 2021

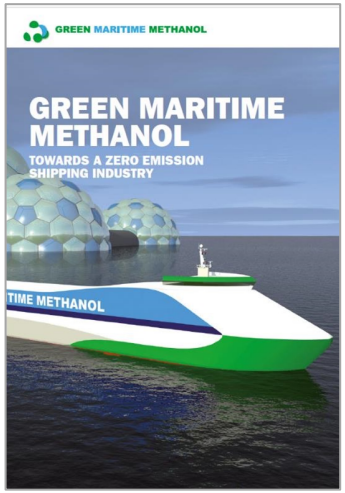
Recommendations

The consortium considers methanol to be a promising option and aims to make a follow-up on the project, in close coordination with other initiatives such as the Horizon 2020 project FASTWATER. The following topics have been identified as part of this follow-up:

- There are some remaining safety and ship design issues that need to be tackled. This includes solutions for venting during the bunkering and ventilation during operations on board.
- Additional knowledge is needed on the engine performance of both spark-ignited and direct separated injection in a compression ignited engine. These tests should be performed in several engine classes.
- More real-life experience is needed with application of methanol in operational circumstances for different vessel types. Therefore, pilot projects are needed.
- There are still uncertainties concerning the availability and pricing of sustainable methanol. Additional research is needed in setting up different supply chains. Because policies and legislation are very important in the steps towards implementation, results will be discussed with policy makers.

Ref. TNO, MKC 2021

Available GMM Reports



GREEN MARITIME METHANOL WP 2
INITIATION AND BENCHMARK ANALYSIS

GREEN MARITIME METHANOL WP 3
FACTSHEET AND COMPARISON WITH DIESEL AND LNG

GREEN MARITIME METHANOL WP 3
UNCONVENTIONAL BUNKER FUELS, A SAFETY COMPARISON

GREEN MARITIME METHANOL WP 3
IMPACT OF METHANOL ON THE COMBUSTION PROCESS – AN EXPERIMENTAL STUDY

GREEN MARITIME METHANOL WP 3
EXPERIMENTAL STUDY ON A RETROFITTED MARINE SIZE SPARK-IGNITION ENGINE RUNNING ON PORTINJECTED 100% METHANOL

GREEN MARITIME METHANOL WP 4
OPERATION ASPECTS AND THE FUEL SUPPLY CHAIN

GREEN MARITIME METHANOL WP 5
SYSTEM DESIGN FOR SHORT SEA SHIPPING – SIX CASE STUDIES OF SHIPS USING METHANOL AS A FUEL

GREEN MARITIME METHANOL WP6
BUSINESS CASE ANALYSIS

www.greenmaritimemethanol.nl/sample-page/

GREEN MARITIME METHANOL WP 6
FINAL REPORT – GREEN MARITIME METHANOL – TOWARDS A ZERO EMISSION SHIPPING INDUSTRY

THANK YOU FOR YOUR ATTENTION

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