

Welcome to the web-seminar:

Defossilization of shipping and OCIMAC

27.10.2020

The web-seminar will start soon...

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Status quo

- GHG emissions from shipping globally 2012-2018: 9.6% increase
 - Share of global emissions: 2.89% in 2018
- Emissions from shipping projected to increase up to 130% in 2050 (compared to 2008)



International shipping emissions contribution of individual species, 2018



| Trend in world fleet CO | , emissions |
|-------------------------|-------------|
| | |

| IMO | Targets | Climate Action Fracker |
|--------------------|-------------|---|
| CARBON INTENSITY | 2030 target | At least 40% below 2008 average CO2 emissions per transport work |
| | Coverage | CO2 only |
| | 2050 target | 70% below 2008 average CO2 emissions per transport work |
| | Coverage | CO2 only |
| ABSOLUTE REDUCTION | 2050 target | At least 50% below 2008 levels |
| | Coverage | All GHGs as defined by the Kyoto Protocol |



Recognition of fuel switch as biggest lever

Overview of technologies and fuels and their GHG-reduction potential (%)

| % | | IN | |
|---------------------------------|------------------------|------------------------|-----------------------------|
| LOGISTICS AND DIGITALIZATION | HYDRODYNAMICS | MACHINERY | FUELS AND ENERGY SOURCES |
| Speed reduction | Hull coating | Machinery improvements | LNG/LPG |
| Vessel utilization | Hull-form optimization | Waste heat | Electrification |
| Vessel size | Air lubrication | Engine de-rating | Biofuel |
| Alternative routes | Cleaning | Battery hybridization | Hydrogen etc. |
| >20% | 10%-15% | 5%-20% | 0%-100% |
| | | | |

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Alternative fuel uptake (percentage of ships)^a

Ships in operation



Ships on order



to 2050



GHG Strategy Group - Overview

- Chair: Christoph Rofka, ABB; Deputy Chair: Prof. Kangki Lee
- Core group continuously working since summer 2019 on several documents





The bigger picture (simplified schematic view)



Biofuels – availability & sustainability

- 1st generation biofuels (crops produced on farmland)
- high land use
- issue of indirect land use change (ILUC)
- potential negative net impact on GHG emissions
- most 1st generation biofuels banned in EU by 2030
- 2nd generation biofuels (wastes and residues)
- traceability problem
- Imited global resources; e.g. in EU 6.3 7.8 Mtoe of adv. biofuels in 2030²⁾ not even enough to supply the targeted 3.6% for road and rail transportation in the EU
- ... and competition with increasing demand for nutrition social acceptance?

¹⁾ Best energy crops in NW Europe: 0.5 W/m2 [Sustainable Energy — without the hot air, Version 3.5.2. November 3, 2008]

²⁾ www.transportenvironment.org/sites/te/files/2017_06_Advanced_biofuels_target.pdf, accessed September 2019

The bigger picture (simplified schematic view)

Hydrogen – fuel pathways & efficiencies (non exhaustive)

Zero Carbon pathwaysNet-zero Carbon pathways

red = severe limitations / orange = maturity level to be further developed CCS = Carbon Capture & Storage / CCU = Carbon Capture & Usage

Hydrogen – fuel pathways & investments (non exhaustive)

Investments indicative only

CIMAC position on GHG reduction

- (Net) Zero carbon fuels = most promising energy carrier option for future shipping
 - ICE likely to remain major prime mover for deep-sea shipping + electrification and hybridization of the machinery and potentially fuel cells
- H₂ with a (net) zero carbon footprint as starting product for main future fuels
- increase of operational and technical efficiencies continue to be a main driver to reduce GHG emissions.
- Biofuels → volume constraints and a potentially negative net impact on GHG emissions
- For faster uptake of (net) zero carbon fuels: production of H₂with SMR combined with CCS or pyrolysis as an intermediate step
- IMO must adopt binding measures until 2023 to phase-in net zero and zero carbon fuels.
 - Otherwise no investment stimulated

01 | 2020 CIMAC Position Paper

Zero Carbon Energy Sources for Shipping From the Greenhouse Gas Strategy Group

This publication gives an overview regarding the topic of greenhouse gas reduction for shipping. The publication and its contents have been provided for informational purposes only and is not advice on or a recommendation of any of the matters described herein. CIMAC makes no representations or warranties express or implied, regarding the accuracy, adequacy, reasonableness or completeness of the information, assumptions or analysis contained herein or in any supplemental materials, and CIMAC accepts no liability in connection therewith.

The first edition of this CIMAC Position Paper was approved by the members of the CIMAC Council at its meeting on November 21, 2019.

IMO Engagement

 Submission to MEPC intersessional working group on GHG as document "ISWG-GHG 7/5/1" concerning agenda item 5 on proposals to encourage uptake of alternative low-carbon and zero-carbon fuels

Content:

- One-pager with main message submitted by EUROMOT
- Position Paper + White Paper 1 and 2 as annexes
- In line with other submissions highlighting importance of well-towake (w-t-w)
- Discussions on alternative fuels and w-t-w approach halted due to Covid-19

→ MEPC75 and ISWG-GHG 7 meetings postponed and now online with focus on short-term measures (not zero carbon fuels)

| INTERSESSIONAL MI WORKING GROUP O GHG EMISSIONS FR(7th session Agenda item 5 | EETING OF THE ISWG-GHG 7/5/ NEDUCTION OF 5 February 202 OM SHIPS ENGLISH ONL |
|--|--|
| FURTHER CONSIL UPTAKE OF ALTERI THE DEVELOPMEN ALL RELEVANT TY | DERATION OF CONCRETE PROPOSALS TO ENCOURAGE THE NATIVE LOW-CARBON AND ZERO-CARBON FUELS, INCLUDING IT OF LIFE CYCLE GHG/CARBON INTENSITY GUIDELINES FOR PES OF FUELS AND INCENTIVE SCHEMES, AS APPROPRIATE |
| Zero-carbo | n energy sources for shipping – Assessment by CIMAC |
| | |
| Executive summary: | Summer 1 This document adds further information to document MEPC 73/7/2, submitted by CESA and EUROMOT. Annexes 1, 2 and 3 of this document have been prepared by the International Council on Combustion Engines (CIMAC): Zero carbon energy sources for shipping (Annex 1), Production pathways for hydrogen with zero carbon footprint (Annex 2) and Zero and net zero carbon fuel options (Annex 3) |
| Strategic direction, if applicable: | 3 |
| Output: | 3.2 |
| Action to be taken: | Paragraph 6 |
| Related document: | MEPC 73/7/2 |
| Introduction | |
| 1 EUROMOT pr of lifecycle GHG intens types. The document feedback to date, engi future fuel options in a | ovided jointly with CESA, in document MEPC 73/7/2, a first assessmer ity of marine fuels and proposed in addition definitions of relevant tur is due to be discussed at ISWG-GHG 7. Notwithstanding the lack ne manufacturers recognize the need to develop an understanding of timely manner. |
| | |

Industry initiatives and collaboration are essential

Supported by CIMAC

Outlook on planned work:

- Continue White Paper Series
 - Overview of process efficiencies and well-to-wake perspective
- Continue engagement at IMO

Thank you for your attention!

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For more info contact the CCS via info@cimac.com