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# Decarbonisation of international shipping: Full speed ahead!

German Weisser

31.1.2024

# Presentation outline

- 1 The merchant marine business
- 2 Regulatory environment
- 3 Decarbonisation technology development
- 4 Relevance for Switzerland
- 5 Summary

# The merchant marine business



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# The merchant marine business

## Vessel types involved in international shipping

### Passenger and recreational vessels



Cruise vessels



Car ferries



Pass. ferries



Superyachts

### Fishing vessels



Large



Medium-size



Small

### Cargo vessels and their contribution along the value chain

raw materials, energy carriers

finished, consumer goods



Oil tankers



LNG carriers



Bulk carriers



General cargo vessels



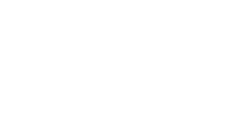
Chemical / product tankers



Container vessels



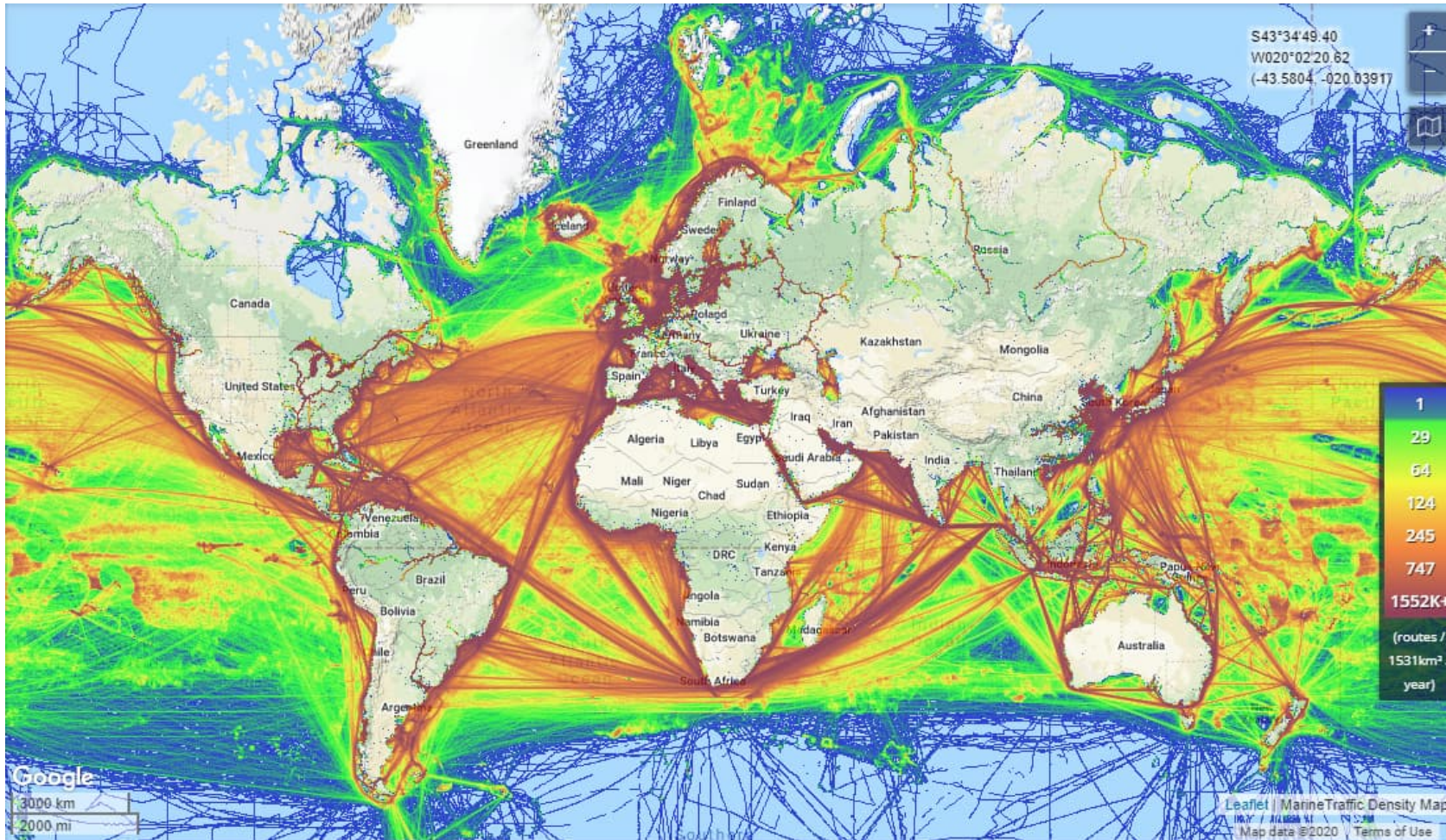
Reefers



Car carriers

# The merchant marine business

## Global shipping traffic density



Data for the full year 2017,

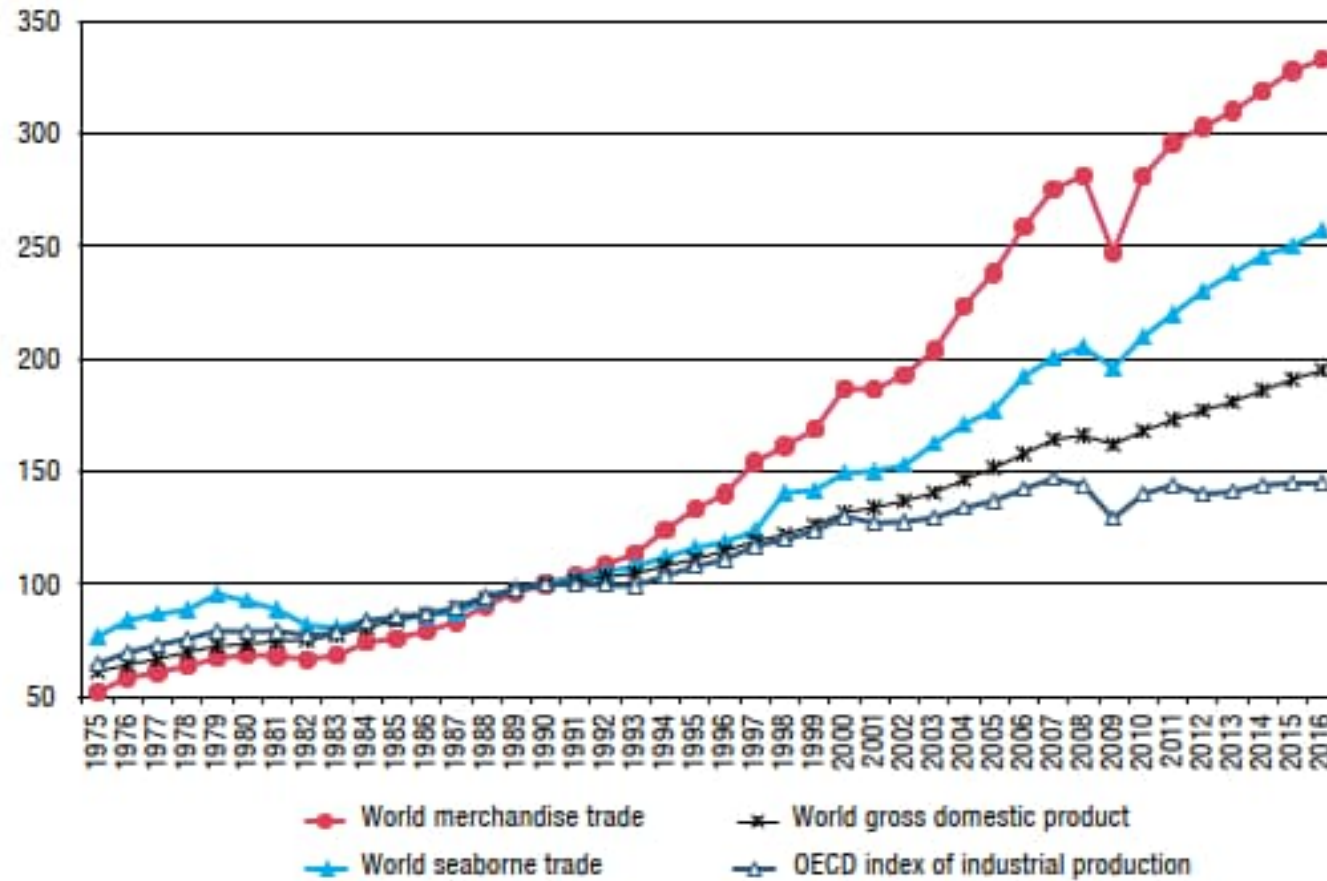
- All marine traffic
- Tracking of vessel positions by satellite based on automatic identification system (AIS) signals

source:

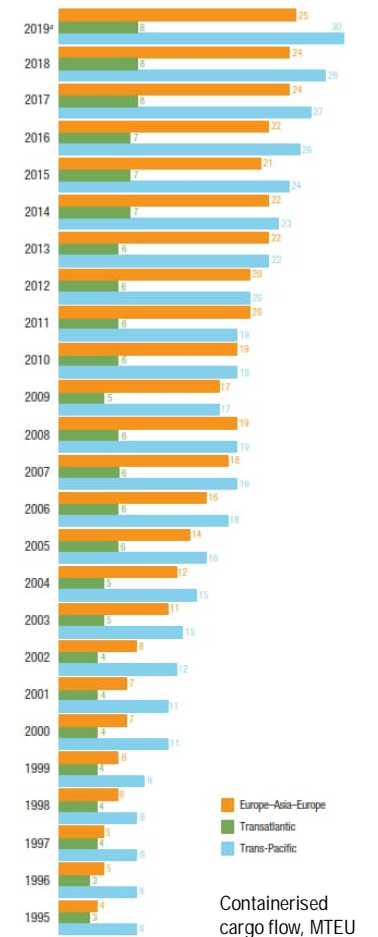
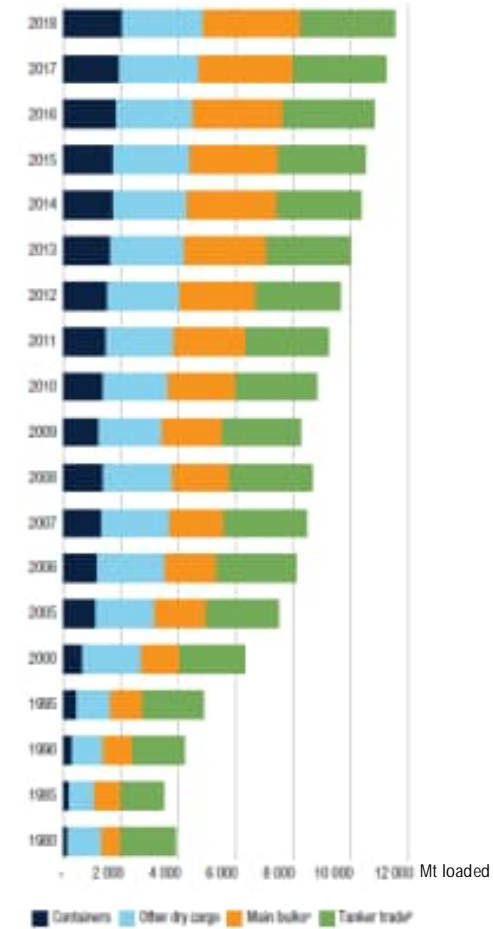
<https://www.marinetraffic.com/>

# The merchant marine business

## Correlation of world economy and goods transport indicators



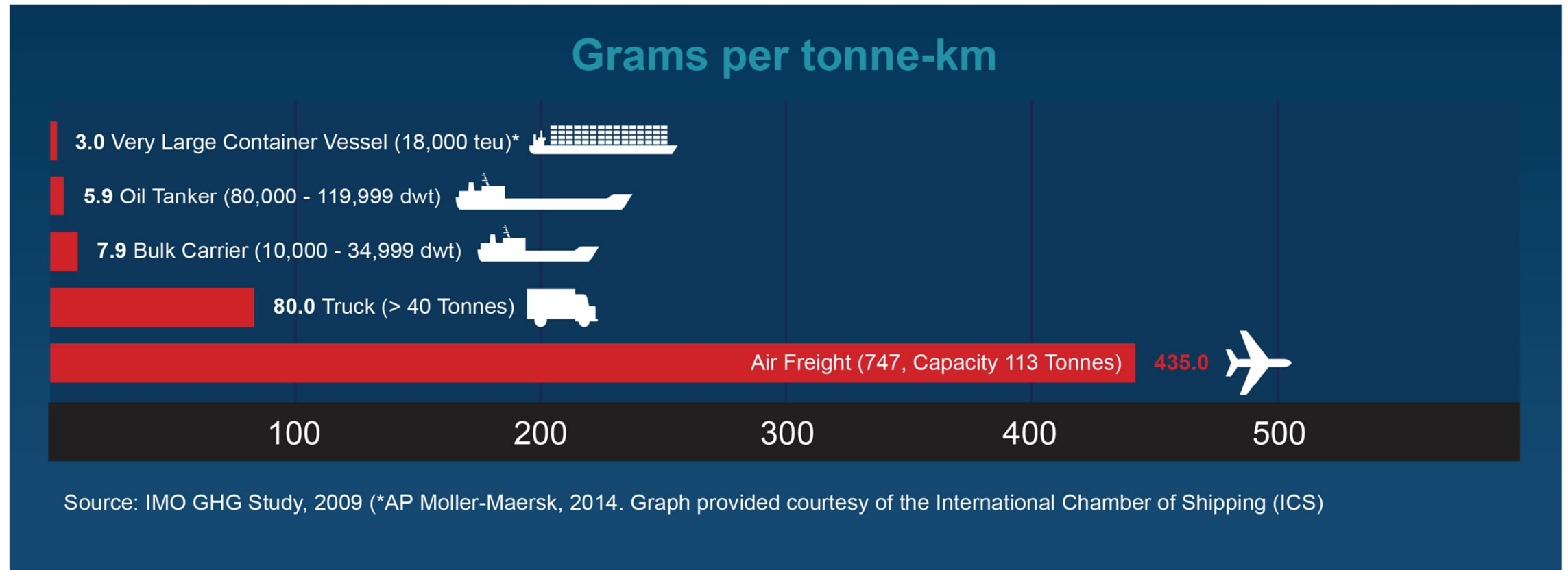
source: UNCTAD: Review of Maritime Transport, 2017 / 2019



# The merchant marine business

## Efficiency of shipping transport

### CO<sub>2</sub> emissions of different transport modes



Source: International Chamber of Shipping, <https://www.ics-shipping.org>

# Regulatory environment

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# Regulatory environment

## Boundary conditions

United Nations bodies and instruments to combat climate change

Paris Agreement by Parties under the United Nations Framework Convention on Climate Change (UNFCCC):



- Hold the increase of global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C
- Agreement scope:  
Nationally determined contributions
- Out of scope:  
Contributions from international transport (shipping and aviation)

The International Maritime Organisation (IMO), the United Nations' specialised agency responsible for regulating shipping has initiated actions to contribute towards the reduction of global warming to an extent similar to the Paris agreement:



- First steps were taken in 2011 by implementing an Energy Efficiency Design Index (EEDI) for new-built vessels
- An Initial Greenhouse Gas Reduction Strategy was adopted in 2018
- This strategy was revised and strengthened in 2023

# Regulatory environment

## IMO's strategy on reduction of greenhouse gas (GHG) emissions from ships

Initial strategy (2018) – levels of ambition:

- 1 **carbon intensity of the ship to decline through implementation of further phases of the energy efficiency design index (EEDI) for new ships**  
to review with the aim to strengthen the energy efficiency design requirements for ships with the percentage improvement for each phase to be determined for each ship type, as appropriate;
- 2 **carbon intensity of international shipping to decline**  
to reduce CO<sub>2</sub> emissions per transport work, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008; and
- 3 **GHG emissions from international shipping to peak and decline**  
to peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out as called for in the Vision as a point on a pathway of CO<sub>2</sub> emissions reduction consistent with the Paris Agreement temperature goals.

# Regulatory environment

## IMO's strategy on reduction of greenhouse gas (GHG) emissions from ships

Amendments (~~deleted~~ / new text) as per Revised strategy (2023) – levels of ambition:

- 1 **carbon intensity** of the ship to decline through ~~implementation of further phases~~ further improvement of the energy efficiency ~~design index (EEDI) for new ships~~ to review with the aim to strengthen the energy efficiency design requirements for ships with the percentage improvement for each phase to be determined for each ship type, as appropriate;
- 2 **carbon intensity of international shipping** to decline to reduce CO<sub>2</sub> emissions per transport work, as an average across international shipping, by at least 40% by 2030, ~~pursuing efforts towards 70% by 2050~~, compared to 2008;
- 3 **uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources** to increase: uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources to represent at least 5%, striving for 10%, of the energy used by international shipping by 2030; and
- 4 **GHG emissions from international shipping** to ~~peak and decline~~ reach net zero to peak GHG emissions from international shipping as soon as possible and to ~~reduce the total annual~~ reach net zero GHG emissions ~~by at least 50% by or around, i.e. close to 2050 compared to 2008~~, taking into account different national circumstances, whilst pursuing efforts towards phasing them out as called for in the Vision ~~as a point on a pathway of CO<sub>2</sub> emissions reduction~~ consistent with the long-term temperature goal set out in Article 2 of the Paris Agreement ~~temperature goals~~.

Indicative checkpoints to reach net-zero GHG emissions from international shipping:

1. to reduce the total annual GHG emissions from international shipping by at least 20%, striving for 30%, by 2030, compared to 2008; and
2. to reduce the total annual GHG emissions from international shipping by at least 70%, striving for 80%, by 2040, compared to 2008.

# Regulatory environment

## IMO instruments / initiatives

EEDI – Energy Efficiency Design Index:

- measure of the CO<sub>2</sub> emissions potential per transport capacity by design (installed power, configuration, reference speed and fuel conversion efficiency)

EEXI – Energy Efficiency eXisting ship (design) Index:

- application of the same principles (and targets) to ships put in service before introduction of EEDI

CII – Carbon Intensity Indicator:

- actual CO<sub>2</sub> emissions per transport capacity and distance travelled during one year (total consumption of fuels, respective CO<sub>2</sub> conversion factors)
- combined with requirements for continuous reduction over the years and rating scheme as a basis for determining urgency for action

LCA – LifeCycle Assessment guidelines for marine fuels:

- includes the extension from CO<sub>2</sub> to CO<sub>2</sub> equivalents considering the additional contributions from methane and nitrous oxide
- basis for new instruments and to be possibly implemented in existing instruments, finalised in 2023

Fuel GHG limit agreed

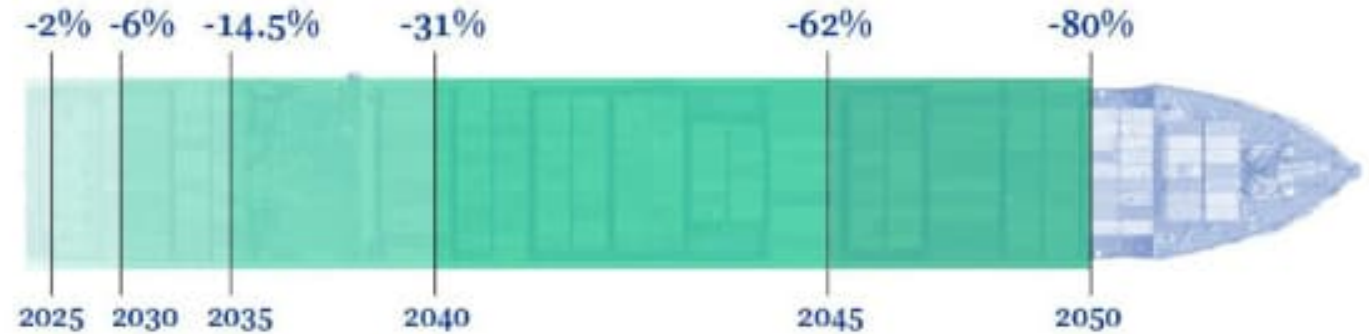
Economic measure agreed

# Regulatory environment

## EU / EEA instruments / initiatives

### Fuel EU maritime:

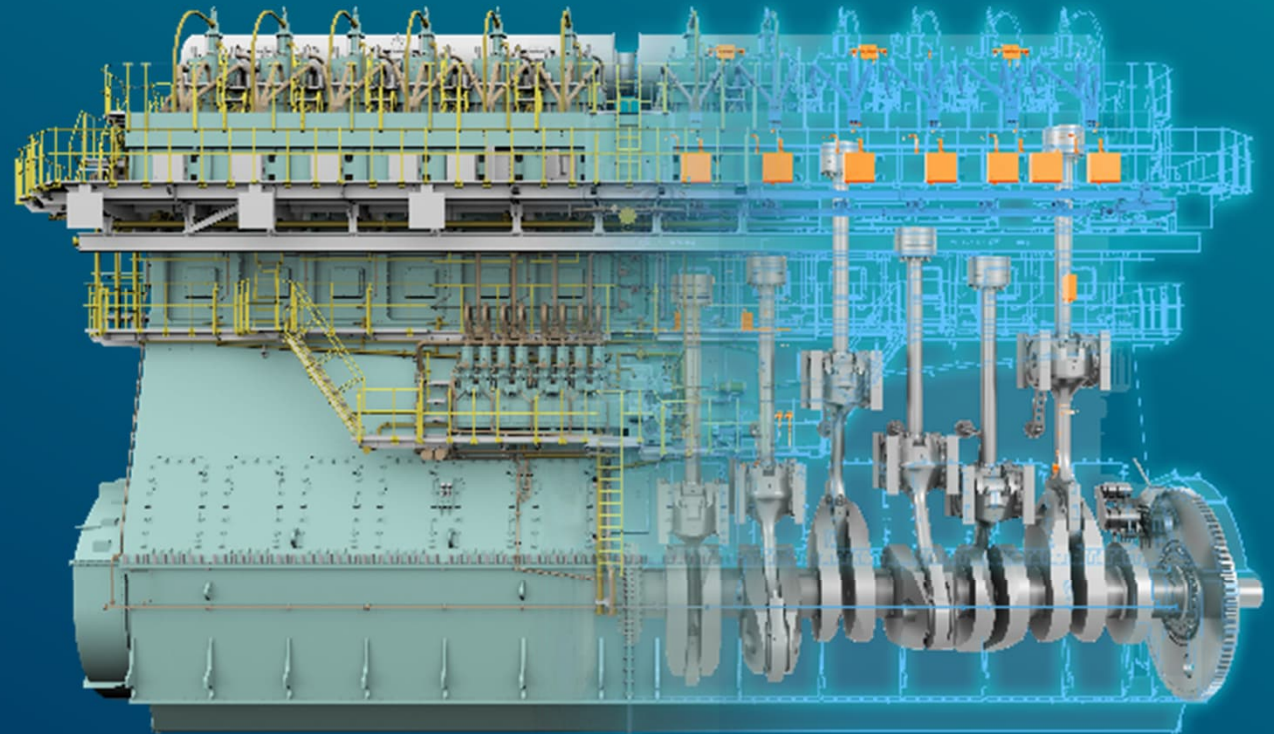
- Establishing limits on the annual average GHG intensity of the energy used on board, starting from reference value of 91.16 gCO<sub>2</sub>eq/MJ
- Specific provisions for promoting the use of renewable fuels from non-biological origin (RFNBO)
- Zero emissions at berth requirement from 2030 onward for passenger and container ships



### Inclusion of emissions in EU emissions trading system (ETS):

- Applicable to all vessels sailing to, from and between European Economic Area (EEA) ports
- EU Allowances – carbon credits – to be purchased and surrendered for 100% of emissions for all voyages between EEA ports, and 50% of voyage emissions between EEA and non-EEA ports
- Tank-to-wake CO<sub>2</sub> equivalent emissions, including methane and nitrous oxide
- Data to be collected and reported from 2024 on, phase-in of inclusion in ETS up to 2026

# Decarbonisation technology development



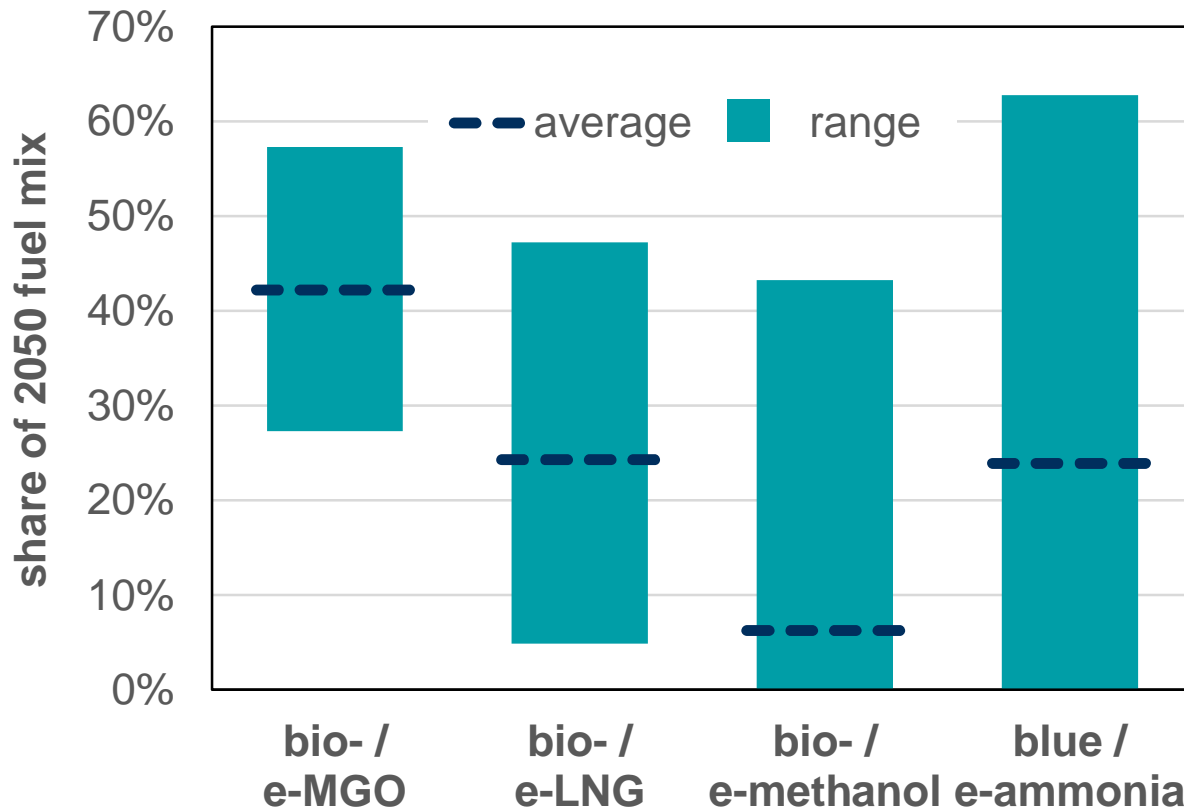
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# Decarbonisation technology development

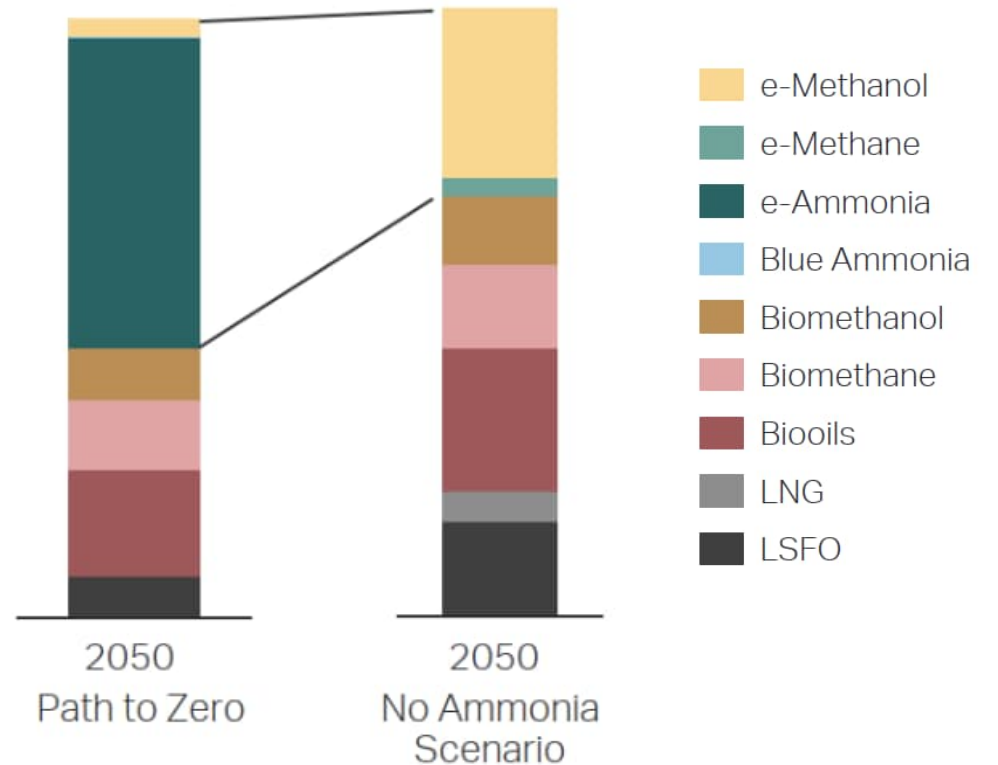
## Future fuel mix – expected shares of main fuel types in decarbonisation scenarios

Evaluation of DNV Maritime Forecast to 2050 (2022) scenarios

MMMC Path to Zero scenarios (2021)

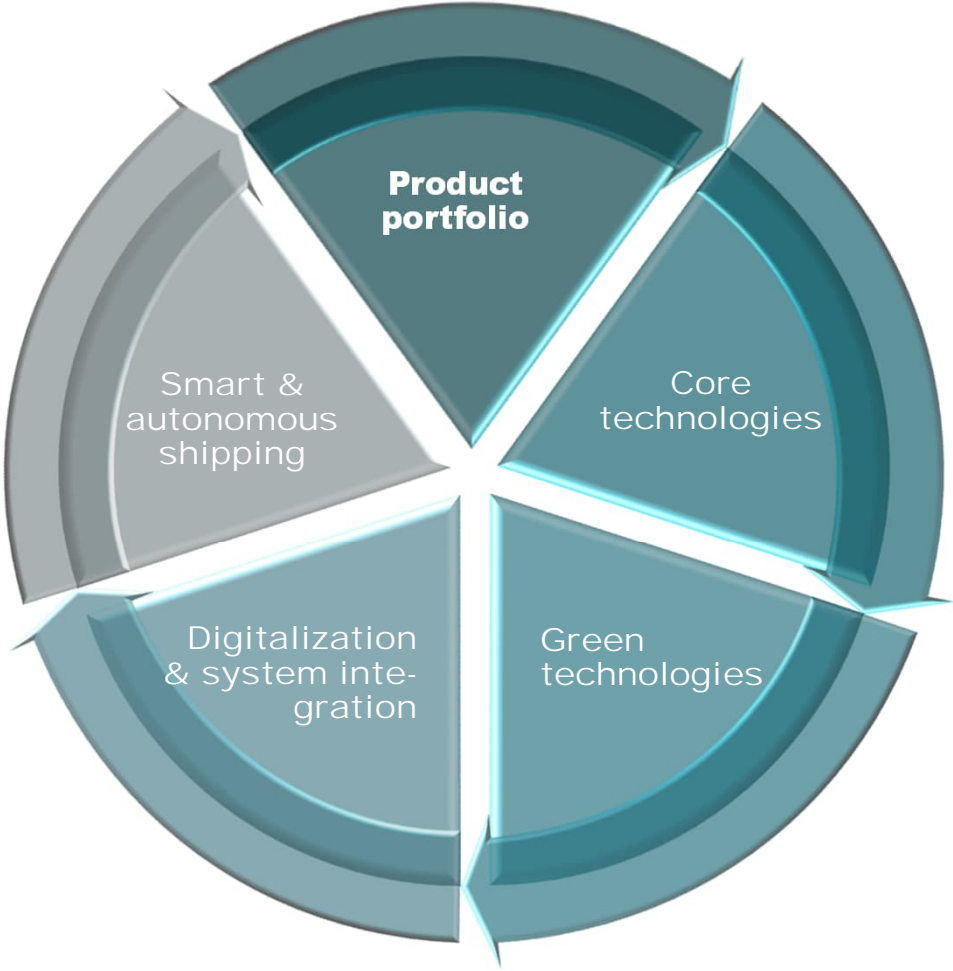
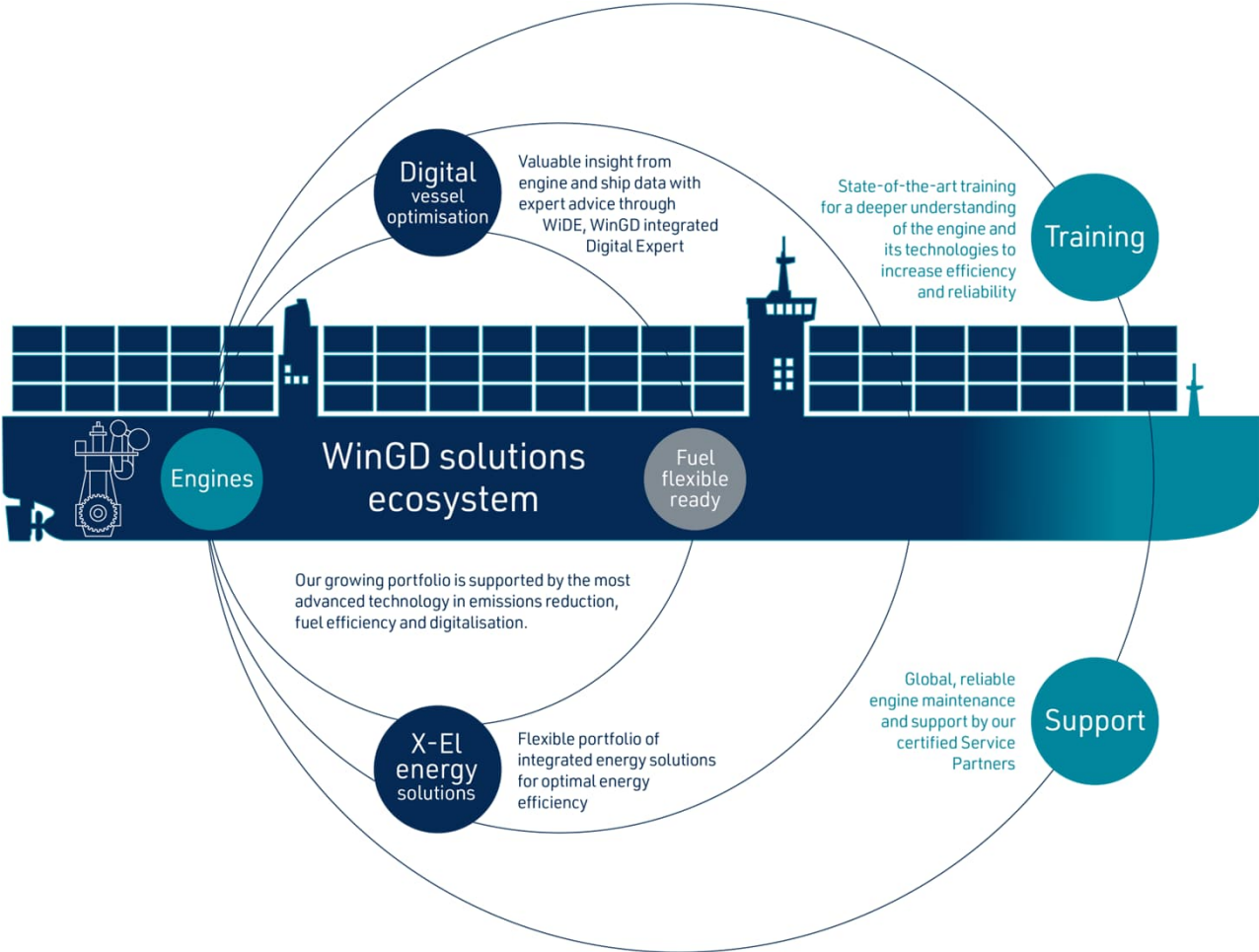


No Ammonia Acceptance



# Decarbonisation technology development

The WinGD solutions ecosystem and X-Act holistic approach towards development





# Decarbonisation technology development

## Further development of technology

**Decarbonisation technology development**  
Further development of technology for currently used fuels – LNG dual fuel engines

X-DF2.0 with ICER technology as main feature successfully introduced and significant progress made compared to first development stage in terms of efficiency and methane slip reduction (total GHG emissions reduced by ca 10%)  
More compact solution developed in collaboration with HHI

**Decarbonisation technology development**  
Further development of engine technology

Variable compression ratio (VCR) technology  
• highly integrated, cost-efficient and robust solution developed in close collaboration with IHI Corporation and Diesel United Ltd.  
• allows realisation of the efficiency benefits of X-DF engine urban

**Decarbonisation technology development**  
Hybridisation and system optimisation

Comparison of standard and hybridisation-enabling electrical system layouts

**Decarbonisation technology development**  
Hybridisation and system optimisation – specifically tailored hybrid solutions

Commercial project configuration: In-service optimisation potential

**Decarbo Hybridisation**  
Potential of hybrid

**Decarbo Making use of**  
Expansion to future by applying Macin algorithms allowing

**Decarbo Making use of**  
Conceptual picture

Sensors and Systems DCM

WIDE On board EDS

data sharing

operating cost reduction

increased availability

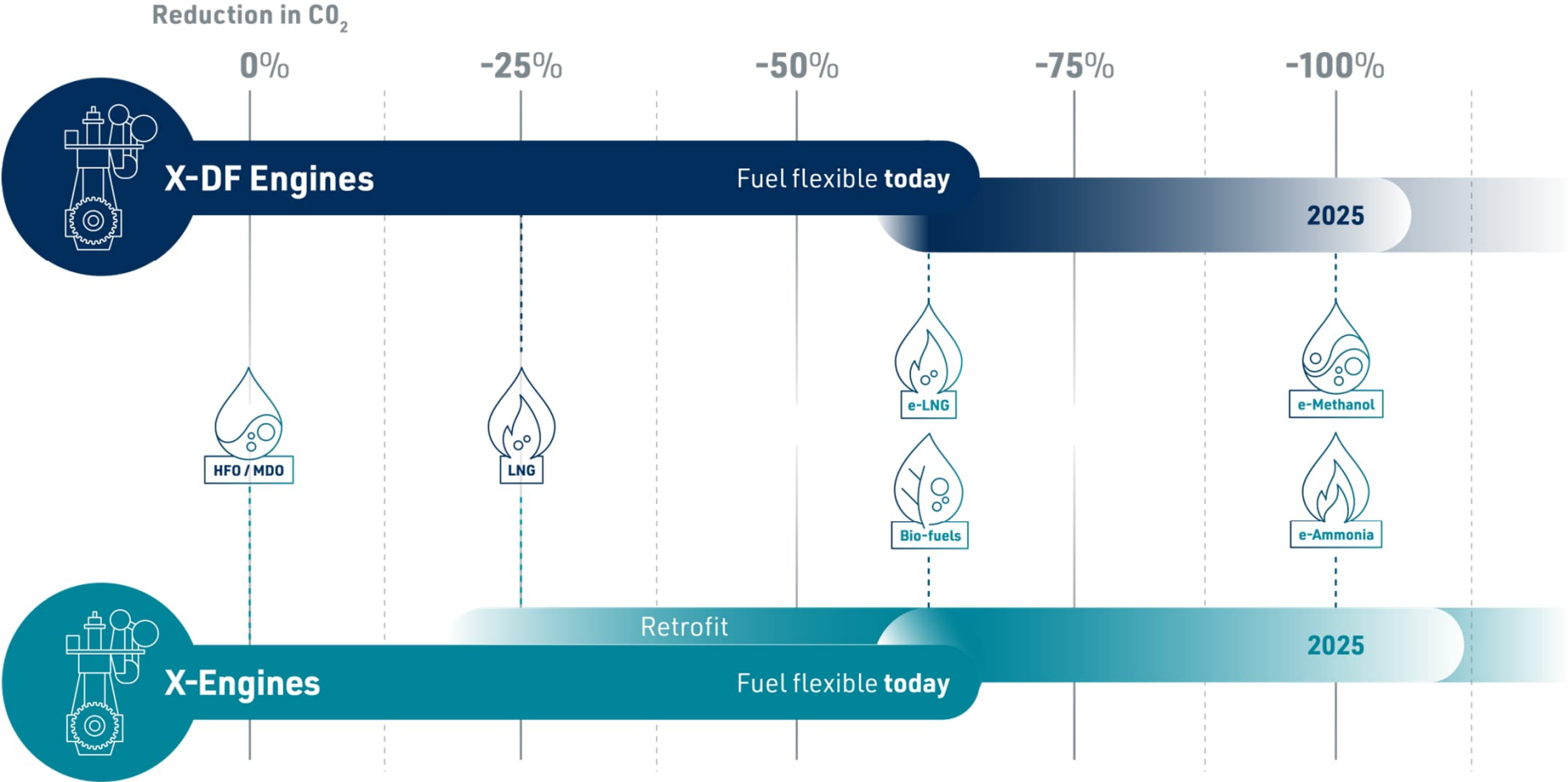
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Examples of technology development for existing products and for extending the scope:

- Further development of technology for natural gas fuelled engines:
  - X-DF2.0 – second generation involving exhaust gas recirculation for higher performance and lower emissions
  - X-DF next generation development for realising significant further performance benefits
- Variable compression ratio (VCR) technology allowing performance optimisation throughout the operating range
- Making use of data for overall system optimisation:
  - Application of AI tools for maximising asset utilisation
  - Integration with other data sources as well as overarching management systems for optimising asset efficiency and fleet / freights transport logistics
- Hybrid systems and advanced system integration for improving the utilisation of energy on board

# Decarbonisation technology development

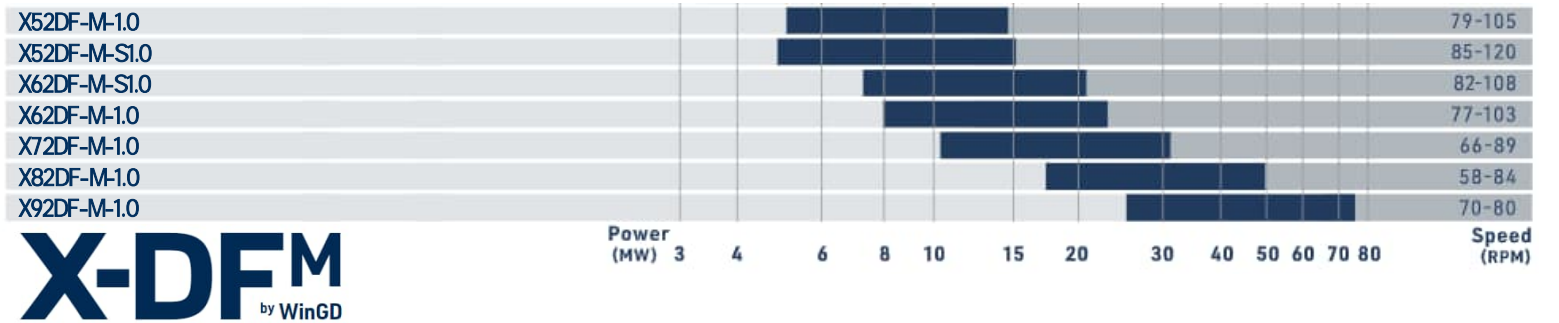
## The WinGD decarbonisation roadmap



# Decarbonisation technology development

## Additional product lines added to the WinGD portfolio

Methanol dual-fuel engines



Ammonia dual-fuel engines



# Decarbonisation technology development

## Order intake status as per January 2024

### Methanol dual-fuel engines:

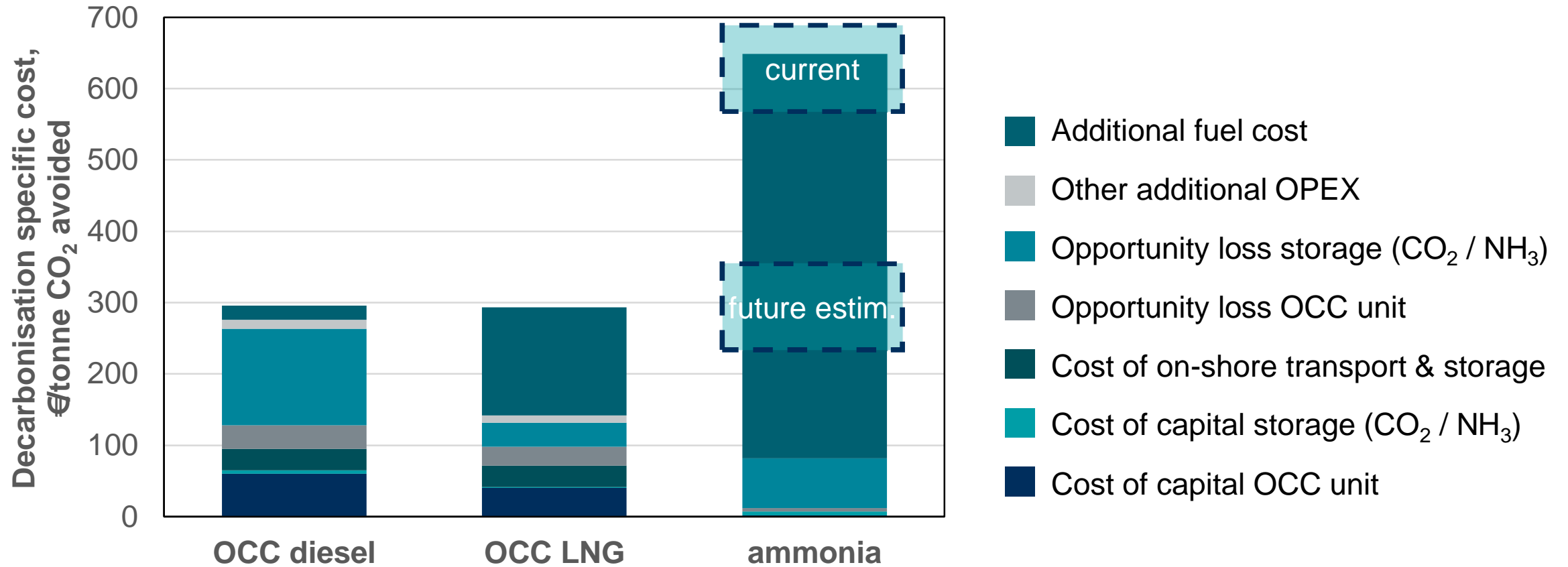
- 4 x 10X92DF-M engines for a series of 16'000 TEU container vessels (for COSCO Shipping), to be delivered in Q2-3/2025
- 6 x 6X82DF-M engines for a series of 9'000 TEU container vessels (for MAERSK), to be delivered between Q3/2025 and Q3/2026
- Shipyard contracts for four additional series of vessels (including other ship types) signed, extending also the size range down to X62DF-M engines

### Ammonia dual-fuel engines:

- 2 x 6X52DF-A engines for a series of two 46'000 m3 LPG/ammonia carriers (for Exmar LPG), to be delivered in Q2/2025
- 2 x 6X72DF-A engines for a series of 210'000 DWT bulk carriers (for CMB.TECH), to be delivered in 2025/26
- Further projects committed, extending the size range to include X62DF-A engines

# Decarbonisation technology development

## On-board carbon capture (OCC) - initial assessment of viability



# Relevance for Switzerland

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# Relevance for Switzerland

## Maritime Strategy



For the first time in history, a maritime strategy for Switzerland was adopted (approval by Federal Council on June 2, 2023, see corresponding [press release](#) for further information)

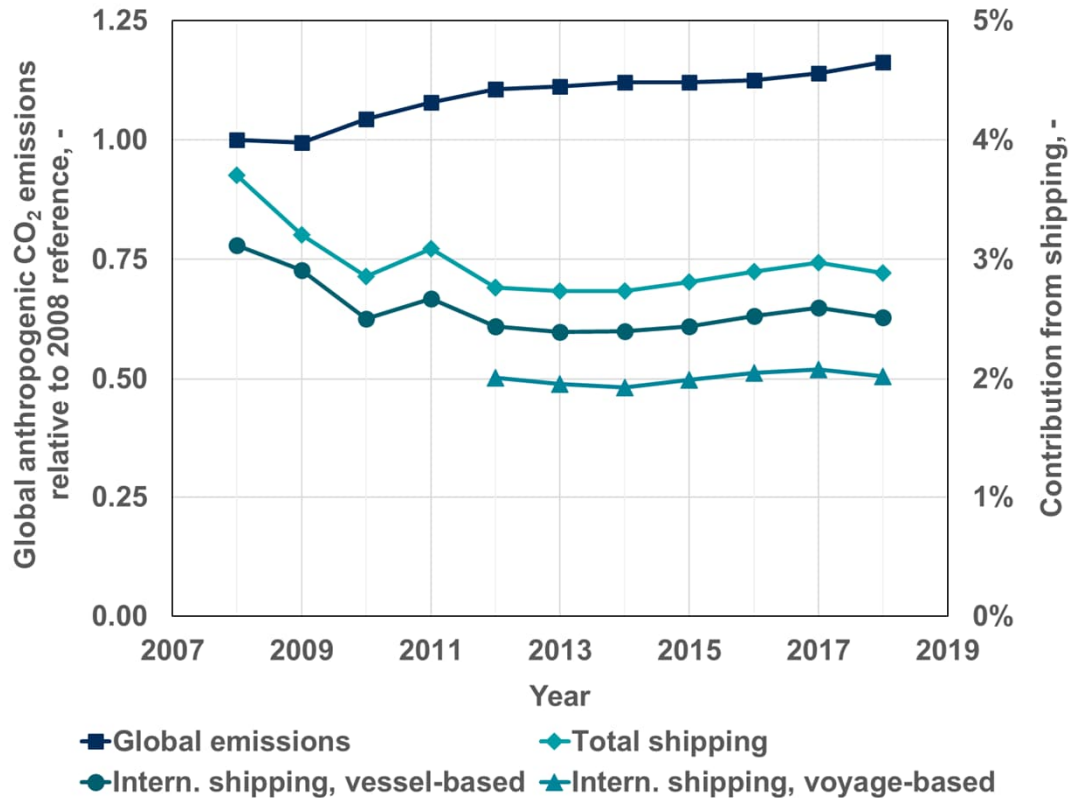
structured around five thematic focus areas, for which measures and targets are set:

- International law
- Maritime economy
- Environmental concerns for marine life and society
- Maritime science and research
- Swiss-flagged vessels

The maritime strategy for the years 2023–27 is based on the objectives set out in Switzerland's foreign policy strategy and shall contribute to greater coherence of foreign policy in maritime issues

# Relevance for Switzerland

## Potential impact



source: own analysis of data from IMO's Third (2014) and Fourth (2020) GHG Studies

Total shipping accounting for ca 3% of global anthropogenic CO<sub>2</sub> emissions

International shipping covering the largest part, between 2 and 2.5%

Share of non-propulsion contributions to international shipping emissions in single digit range

WinGD positioned as strong No. 2 in three-player market of two-stroke propulsion engine designers

➡ An impact out of Switzerland in the range of 1% is fully realistic considering WinGD alone

This potential is almost an order of magnitude higher than the effect of a hypothetical complete decarbonisation of Switzerland

Total impact even higher in view of large number of successful Swiss maritime equipment companies



# Relevance for Switzerland

Swiss maritime community

The very active group of Swiss maritime equipment companies and associated academic institutions



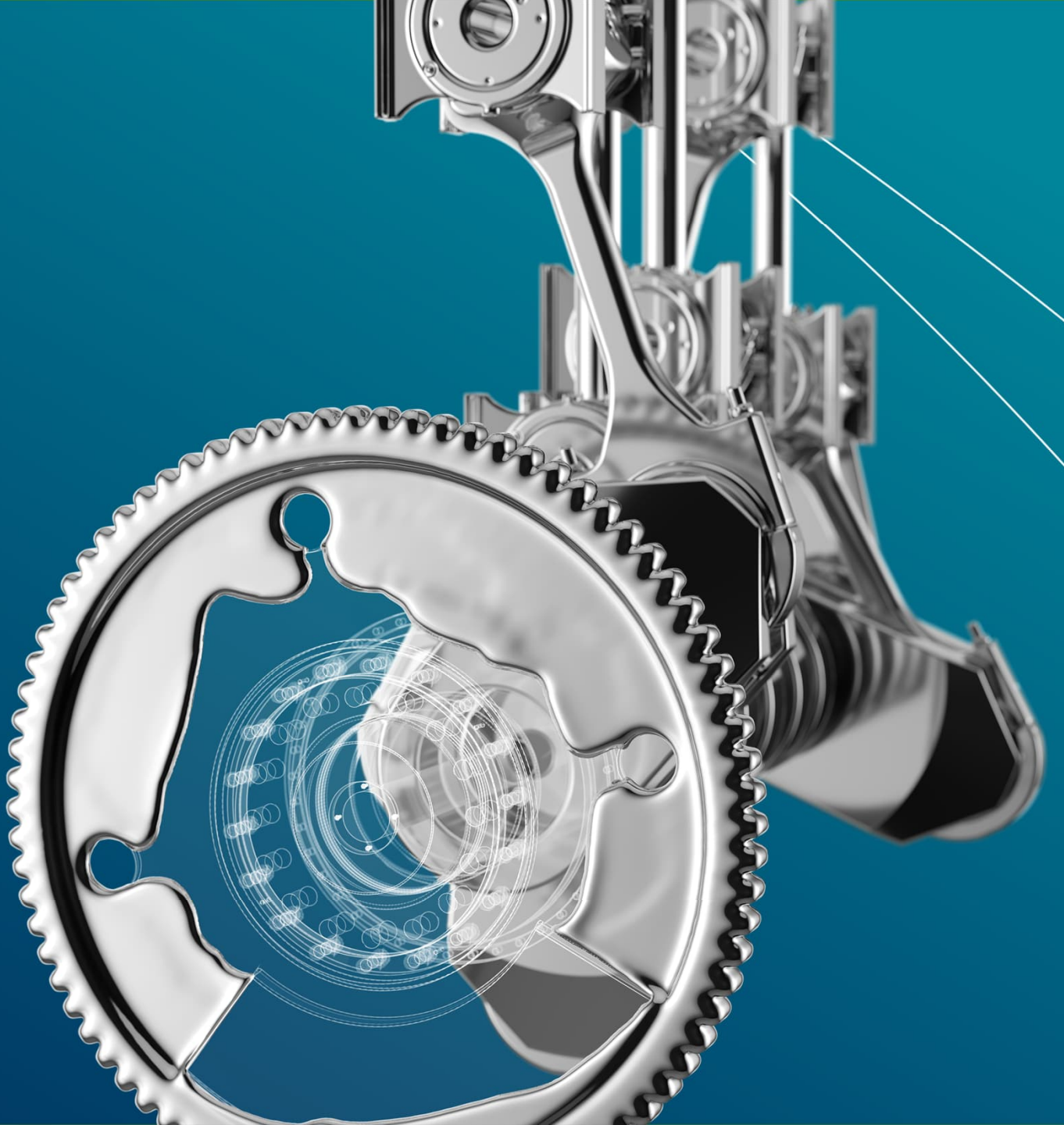
Fachgruppe Verbrennungsmotoren



managed to bring the most important conference in the industry to Switzerland (May 19-23, 2025)



# Summary



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# Summary

International shipping is the backbone of world economy and its relevance has increased further with progressing globalisation

The development of the regulatory framework towards decarbonisation has gained considerable speed with the introduction of the Revised greenhouse gas strategy by the International Maritime Organization (IMO), with regional action by the EU acting as additional promotion

This is a clear confirmation of the decisions taken earlier by companies such as WinGD to invest into decarbonisation technology development


Considerable efforts and resources are invested in the establishment of solutions and new products capable of dealing with future renewable fuels such as ammonia and methanol – without neglecting the further development of technologies applicable to the existing product portfolio

Alternative decarbonisation pathways such as on-board carbon capture are explored in parallel

The role that Switzerland can play in contributing to the decarbonisation of international shipping must not be underrated

# Thank you!

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