Germanischer Lloyd

The Energy Efficiency Indices of the IMO (design / operation) – useful tools also for inland navigation?

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Background

- The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 and entered into force in 1994. At the last count, UNFCCC has 194 members and 2 observer parties.
- The Kyoto Protocol was adopted in 1997 to supplement UNFCCC and entered into force in 2005. At the time of writing, the Protocol had 166 Parties. Annex-I-countries are required to reducing their overall greenhouse gas (GHG) emissions by an average of 5.2% below their 1990 level until 2012.
- In December 1997, UNFCCC tasked the "*Subsidiary Body for Scientific and Technological Advice*" (SBSTA) to elaborate on the inclusion of emissions from international bunker fuels in the overall inventories of Parties to the UNFCCC.
- In June 2002, SBSTA, invited IMO to report to SBSTA on its activities with regard to the reporting of emissions based upon fuel sold to ships engaged in international transport.
- IMO Assembly resolution A.963(23) (adopted in Dec. 2003) tasked the MEPC to identify and develop the necessary mechanisms needed to achieve limitation or reduction of GHG emissions from ships.
- IMO is committed taking the lead in developing GHG reduction strategies and mechanisms for international shipping

IMO Measures to reduce GHG - Emissions

Assembly Resolution A.963(23) sets the starting point for an CO_2-indexing scheme for shipping:

- EEDI (as a mandatory technical measure for new ships)
  - Energy Efficiency Design Index as "CO_2 - design Index"
  - first interim Guidelines published in 2009 as MEPC.1/Circ.681
- EEOI (as a voluntary technical measure for ships in service)
  - Energy Efficiency Operational Indicator as "operational CO_2-Indicator"
  - first interim Guidelines published in 2009 as MEPC.1/Circ.684

other measures aiming to reduce GHG-Emissions:

- SEEMP* (as a mandatory technical measure for existing ships; MEPC.1/Circ.683)
- MBM any "Market based Mechanism", e.g. Emission Trading, GHG-Fund, ...

*SEEMP: Ship Energy Efficiency Management Plan

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Energy Efficiency Indexing – the basic Concept

$$\text{EE Index} = \frac{\text{Air pollution (emitted } CO_2\text{)}}{\text{Transport work}}$$

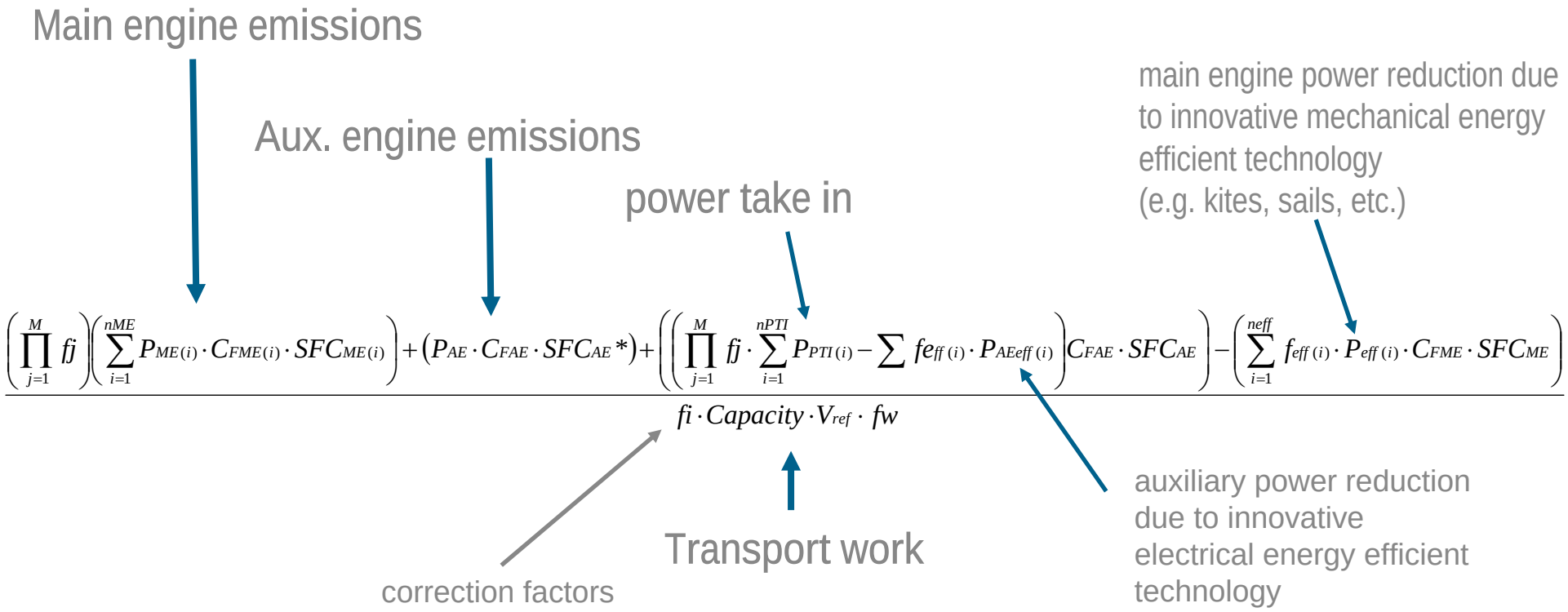
Energy Efficiency Design Index (EEDI)

The EED Index (former design CO_2-Index) represents a theoretical transport-efficiency

$$EEDI = \frac{b_e \cdot P_{installed} \cdot c_{Carbon}}{Capacity \cdot v_{ref}}$$

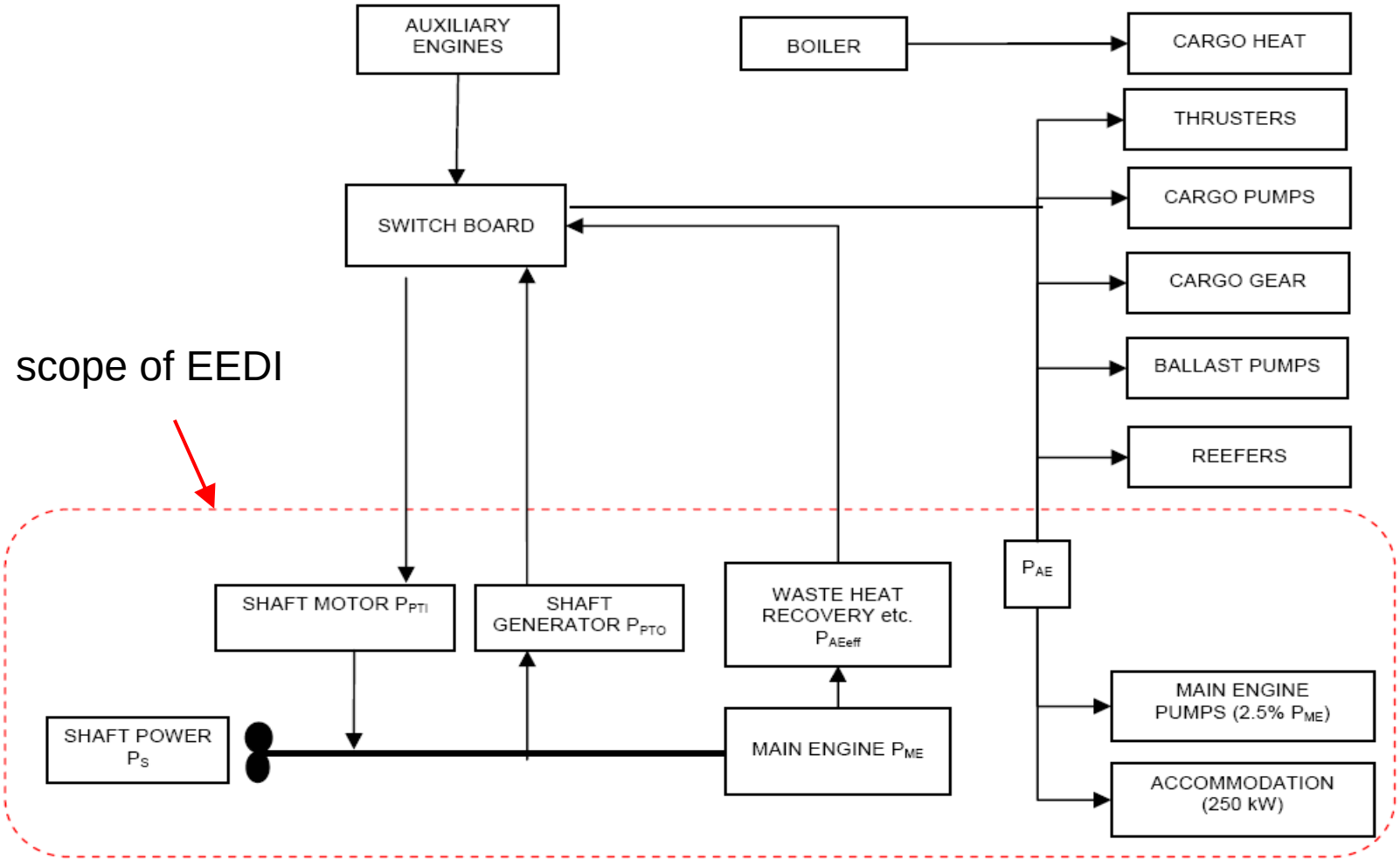
- The EEDI may be based on different cargo-units depending on ship type:
  - ➔ [gCO_2/t•nm], [gCO_2/TEU•nm], [gCO_2/m^3•nm], [gCO_2/lane m•nm], [gCO_2/pax•nm], ...
- The design index may be further used as benchmark between new ships.

EEDI formula



→ Don't be afraid, it isn't as complicated as it looks...

EEDI illustrative *

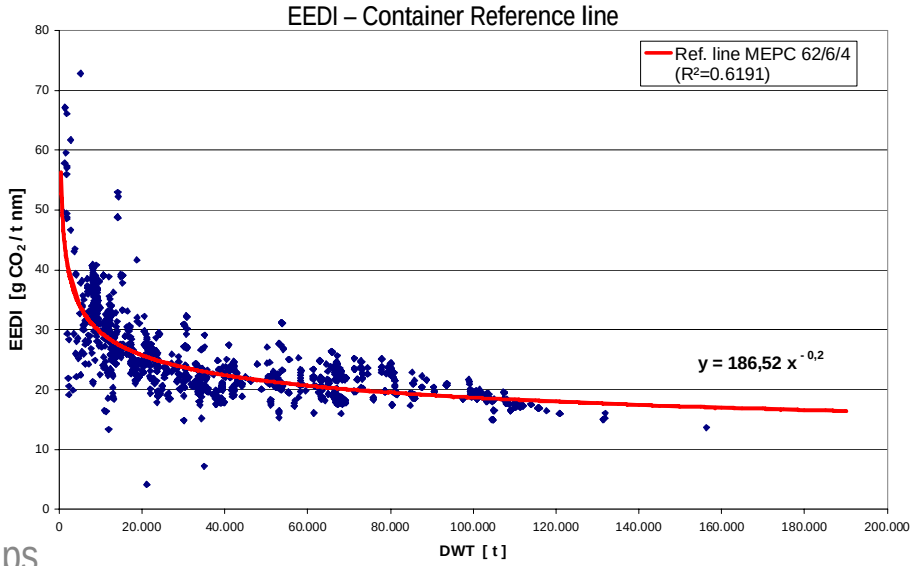


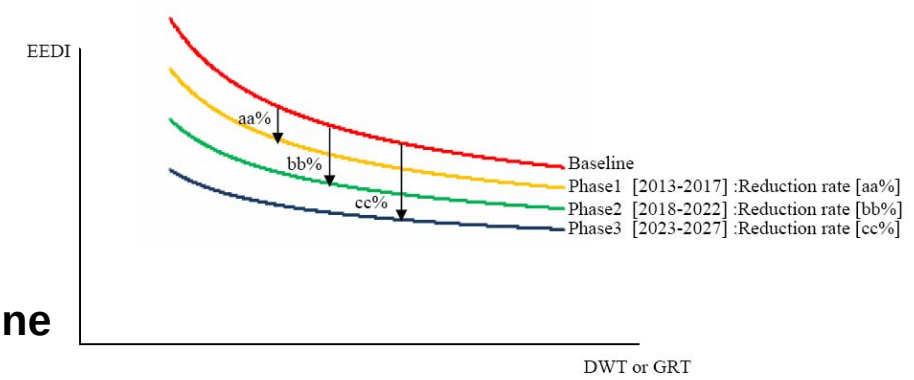
* MEPC.1/Circ.681

EEDI as mandatory instrument

How EEDI will be used as efficiency criteria for new build ships in the future:

- existing ship data (last 10 years*) will set a "reference line"
- each ship type are separated, e.g.
  - Bulk Carrier
  - Gas Tanker
  - Tanker
  - Container Ships
  - General Cargo Ships
  - Refrigerated Cargo Ships
  - Combination Carriers
- the required EEDI-line will be reduced further step wise





Attained EEDI
≦ Required EEDI = (1-X/100) × Reference line

* 1999-01-01 to 2009-01-01

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Energy Efficiency Operational Indicator (EEOI)

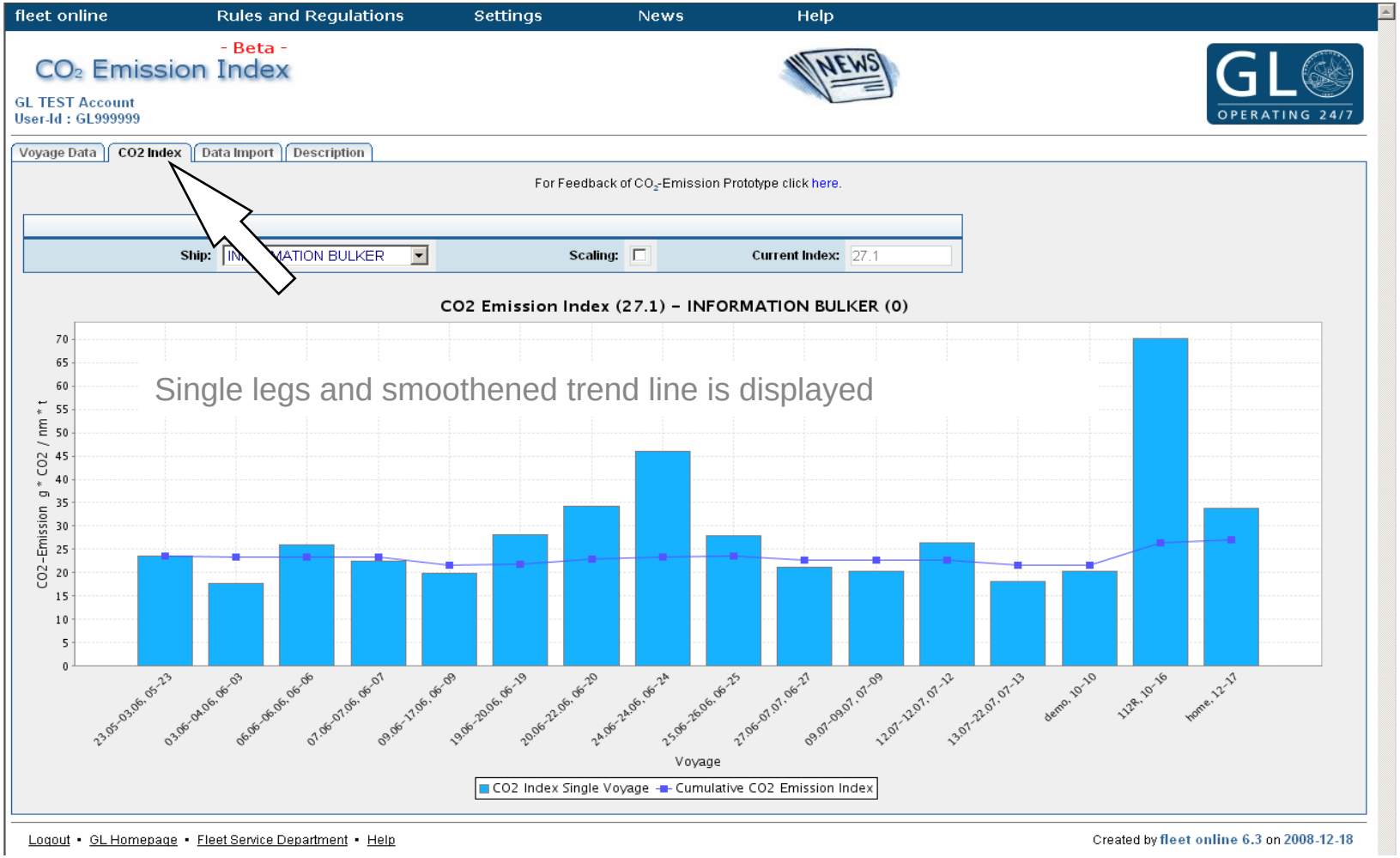
The EEOI (former operational CO_2-Index) represents the actual transport-efficiency of a ship in service *

$$EEOI = \frac{Fuel_{consumed} \cdot c_{Carbon}}{Cargo_{transported} \cdot Distance_{sailed}}$$

- The collected data will be averaged over a number of voyages.
- The CO_2 -Index may be based on different cargo-units depending on ship type:
  - ➔ [gCO_2/t•nm], [gCO_2/TEU•nm], [gCO_2/m^3•nm], [gCO_2/lane m•nm], [gCO_2/pax•nm], ...

* (and shall be part of the SEEMP)

EEOI Monitoring



EEOI Example Calculation *

A simple example including one ballast voyage, for illustration purpose only, is provided below. The example illustrates the application of the formula based on the data reporting sheet.

NAME AND TYPE OF SHIP						
Voyage or day (i)	Fuel consumption (FC) at sea and in port in tonnes				Voyage or time period data	
	Fuel type (HFO)	Fuel type (LFO)	Fuel type ( )		Cargo (m) (tonnes or units)	Distance (D) (NM)
1	20	5			25,000	300
2	20	5			0	300
3	50	10			25,000	750
	10	3			15,000	150

$$EEOI = \frac{100 \times 3.114 + 23 \times 3.151}{(25{,}000 \times 300) + (0 \times 300) + (25{,}000 \times 750) + (15{,}000 \times 150)} = 13.47 \times 10^{-6}$$

unit: tonnes CO_2/(tons • nautical miles)

* MEPC.1/Circ.684

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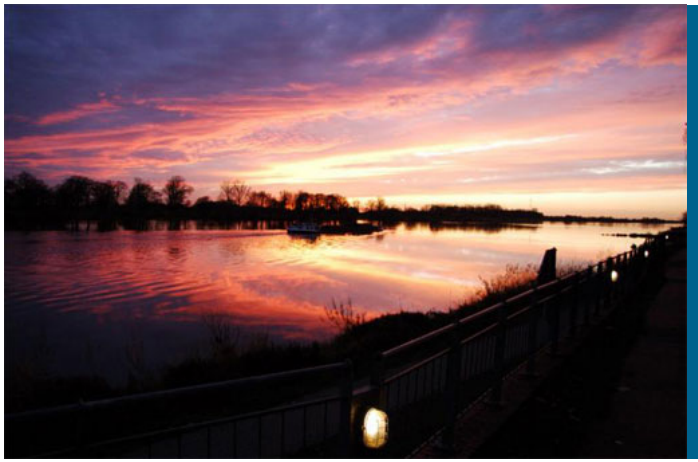
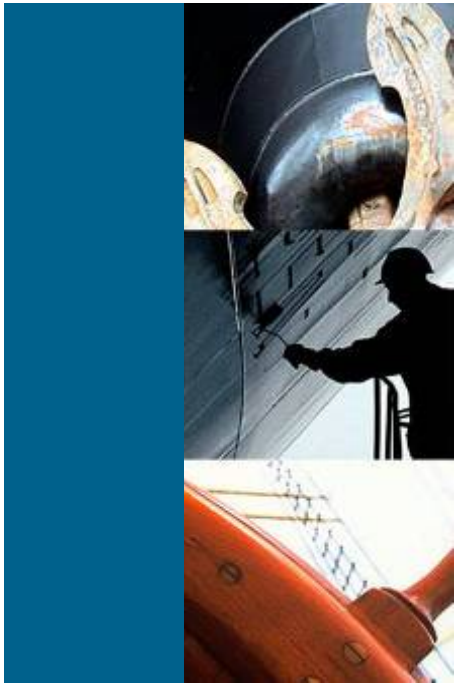
Conclusion



- EEDI just before adoption as mandatory regulation (MEPC 62)
- still some challenges to resolve
  - refinement on verification process
  - not all ship types included yet
    (Pax, RoRo's, diesel-electric, turbine or hybrid propulsion)

- EEOI is finalised and application has been proven and tested
- EEOI displays real CO_2 – emissions in relation to transported cargo
  - some more administrative burden
  - comparability to other modes of transport hampers, as competing sectors offer only "emissions for defined design conditions"
- EEOI could be easily adapted for the use of inland waterway vessels



Thank you for your kind attention.

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