

Ordem dos Engenheiros

- Descarbonização Transporte Marítimo

Department 1: Sustainability and Technical Assistance

30 MAIO 2023



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1 – EMSA Activities and Strategy

1.1 OVERVIEW OF THE 5-YEAR STRATEGY



Modern organisational management

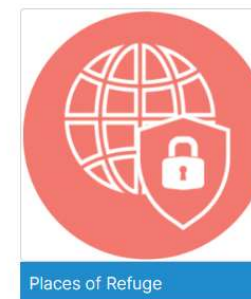
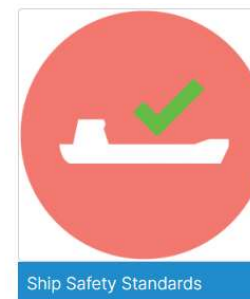
efficient, stakeholder oriented, smart, transparent
and gender balanced

1 – EMSA Activities

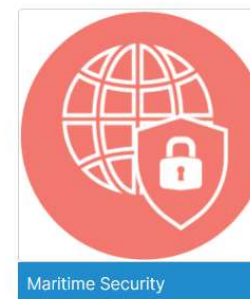
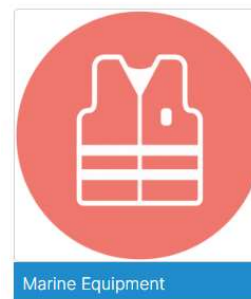
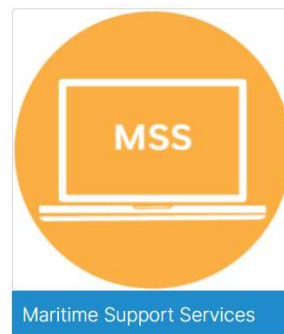
Dept. 1 - Sustainability & Technical Assistance



Dept. 2 - Safety Security & Surveillance



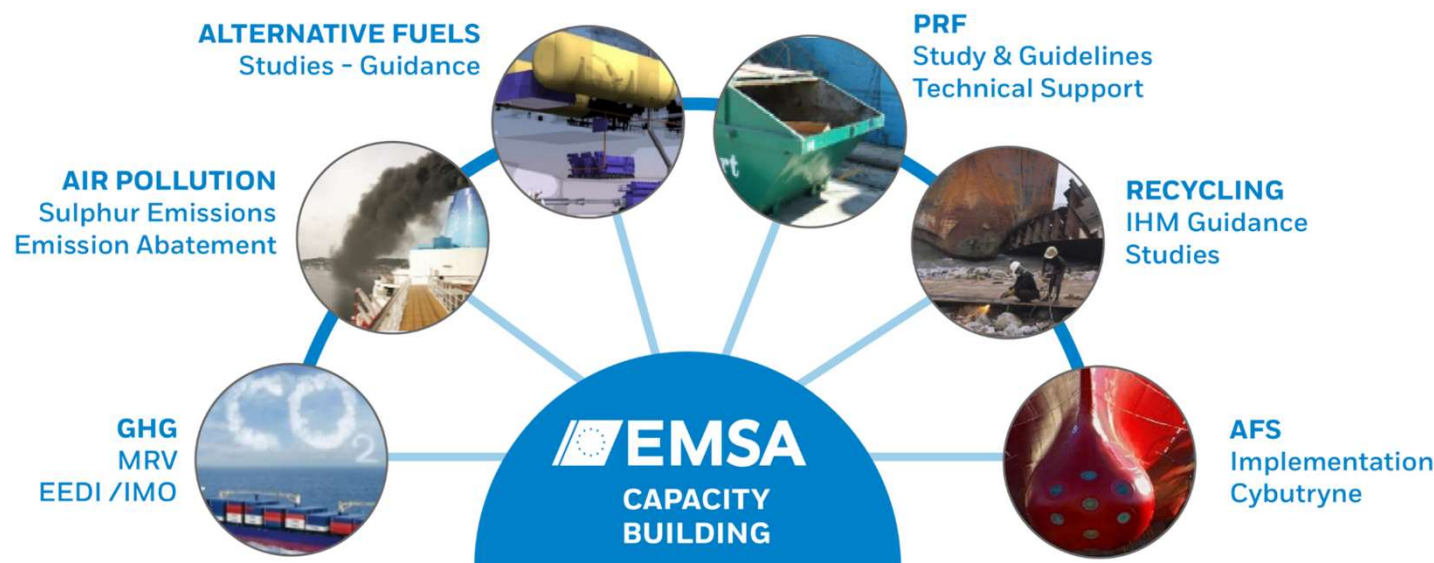
Dept. 3 - Digital Services & Simplification



2 - Sustainability and Technical Assistance

Prevention of Pollution by Ships

- Air Emissions
 - GHG
 - Air Pollutants
- Protecting the Marine Environment
 - Oil Pollution Response
 - Underwater noise
 - Ballast water
 - Anti Fouling
- Sustainable Shipping
 - Alternative Sources of Power
 - New technologies
 - Ship Recycling
- Sustainable Ports
 - Port reception Facilities
 - LNG bunkering and OPS
 - Port Call Optimisation



Air Emissions

GHG (Greenhouse Gases) - **CO₂** (Carbon Dioxide), **CH₄** (Methane), N₂O (Nitrous Oxide), HFCs (Hydro Fluorocarbons), PFCs (Perfluorocarbons) and SF₆ (Sulphur Hexafluoride)

Other Relevant Substances - **NO_x** (Nitrogen Oxides), **SO_x** (Sulphur Oxides), NMVOC (Non-Methane Volatile Organic Compounds), CO (Carbon Monoxide) and **PM** (Particulate Matter, including Black Carbon).

CO₂ equivalent concept & GWP100

Long lived GHG > 100y

CO₂ , N₂O

Short lived GHG ~20y

CH₄ , Aerosols

Global Warming Potential of 100y

1 ton Methane, equivalent to 28t CO_{2eq}

1 ton Óxido Nitroso, equivalent to 265t CO_{2eq}

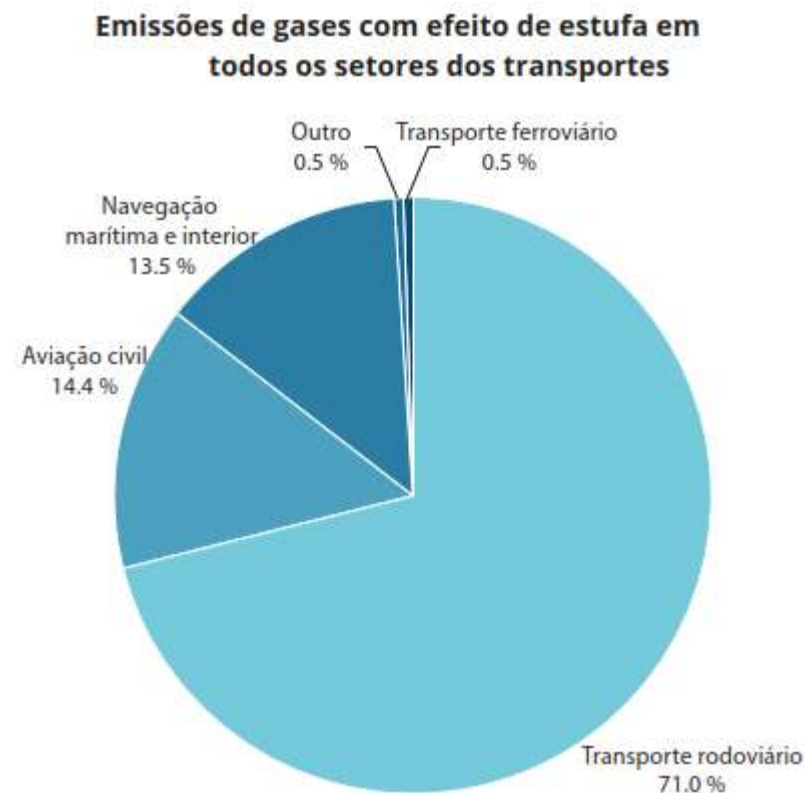
Air Emissions – THETIS-MRV overview

EU MRV

Vessels > 5000 GT
12,000 vessels
140 million tons CO₂ (2018)
18% world shipping emissions

EU Global overview

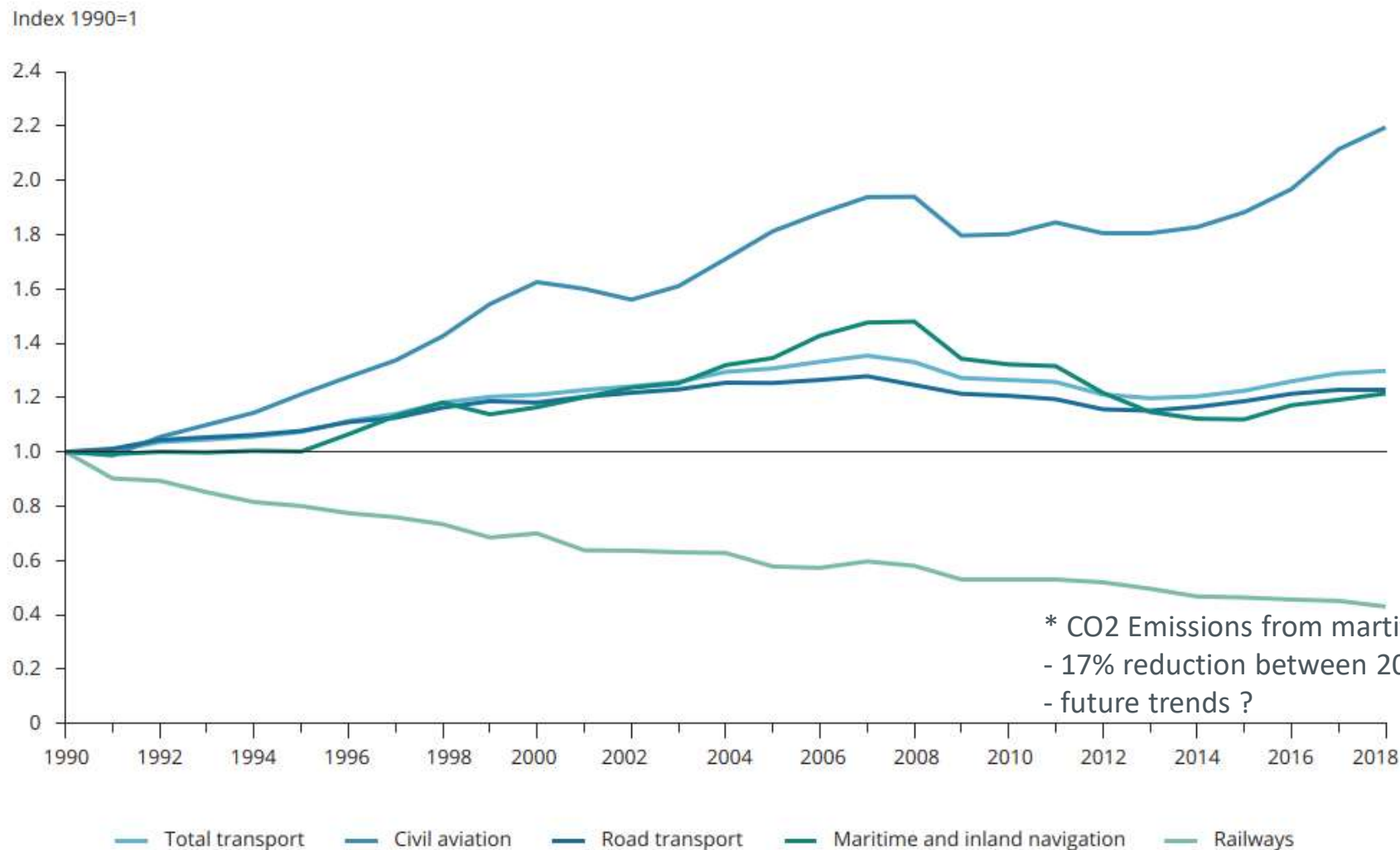
13.5% EU transport emissions
3-4% of EU GHG emissions



Source: 'EEA greenhouse gas — data viewer', European Environment Agency (<https://www.eea.europa.eu/data-andmaps/data/data-viewers/greenhouse-gases-viewer>)

EU GHG Emissions from different transport industries

EU GHG emissions from transport by mode, including international bunkers, relative to 1990



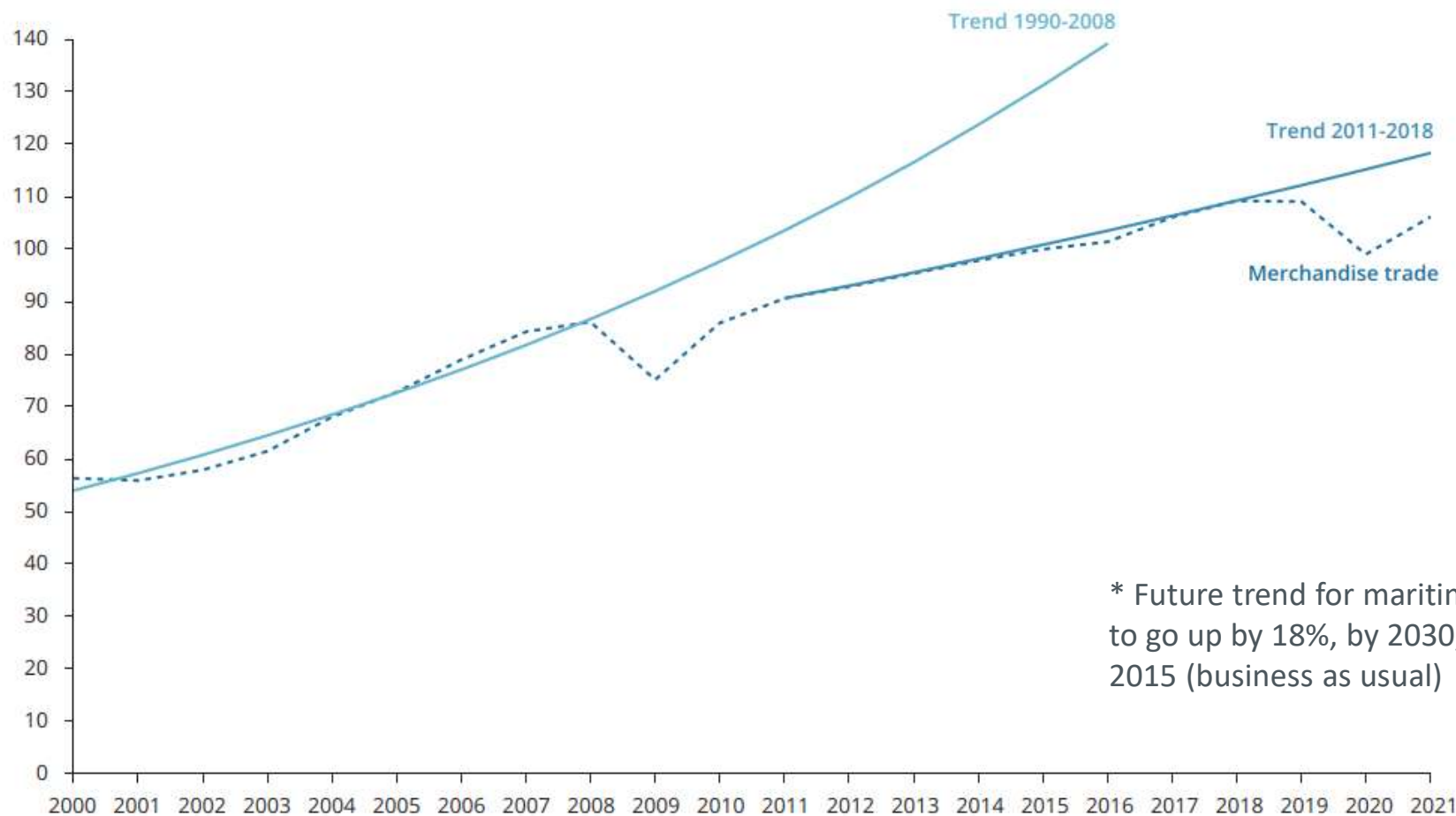
Source: EEA (2020a).

* EMTER Report 2021

World trade and Maritime Transport demand

World merchandise trade volume (all trade)

Percentage global trade volume annual variation (Indices, 2015=100)



* Future trend for maritime GHG is to go up by 18%, by 2030, relative to 2015 (business as usual)

CO₂ emissions Forecast

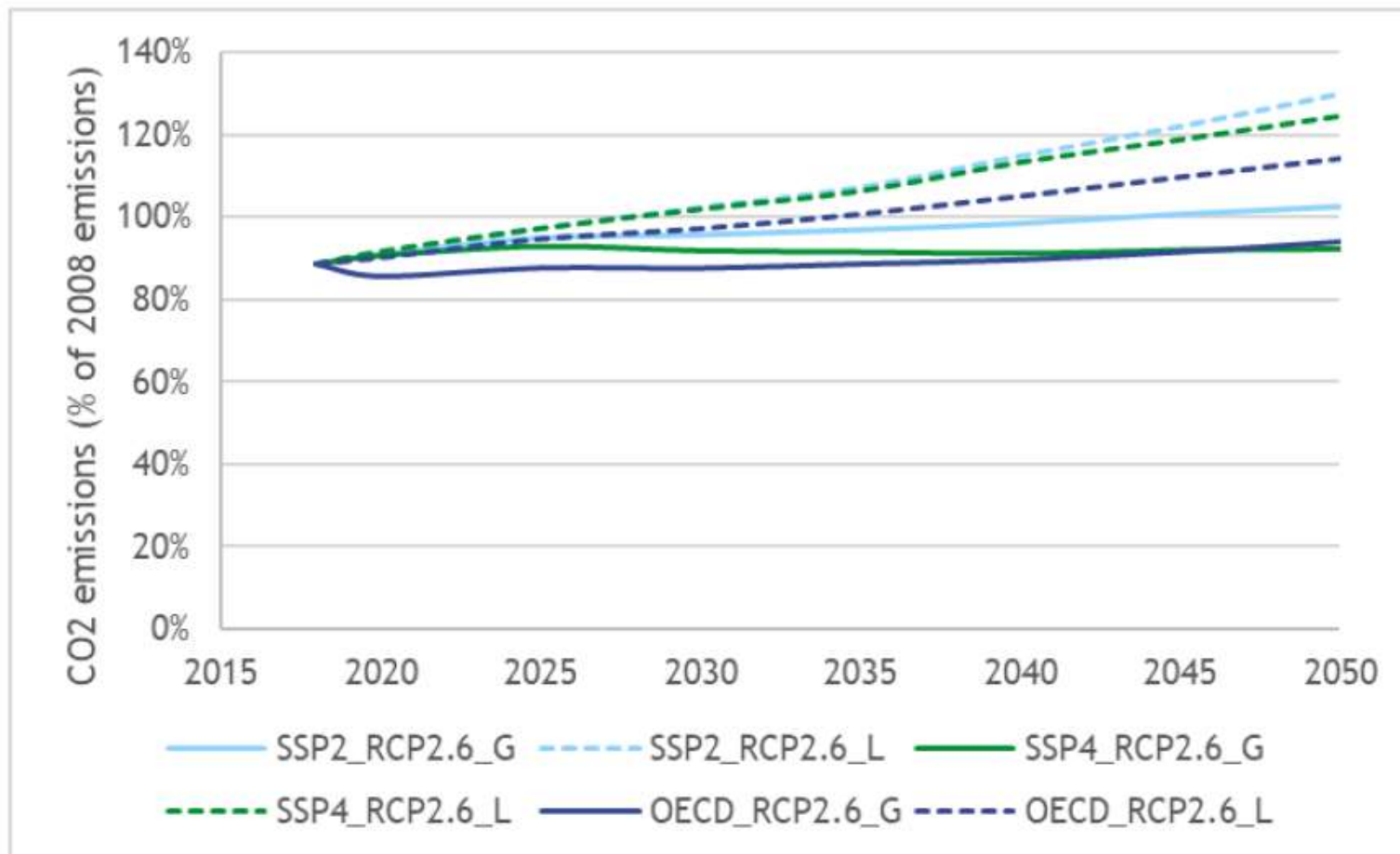
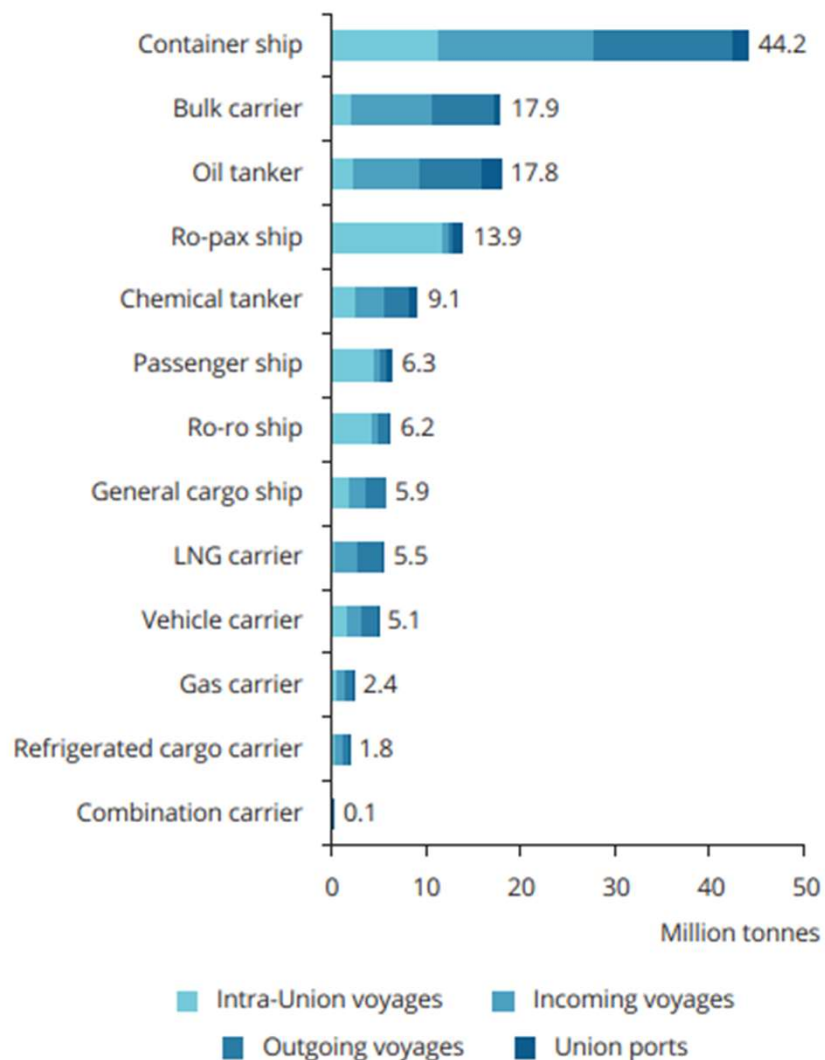


Figure 2: Projections of maritime ship emissions as a percentage of 2008 emissions; Source: Fourth IMO GHG Study

* 4th Annual report from EC on CO₂ emissions from Maritime Transportation (period 2018-2021)

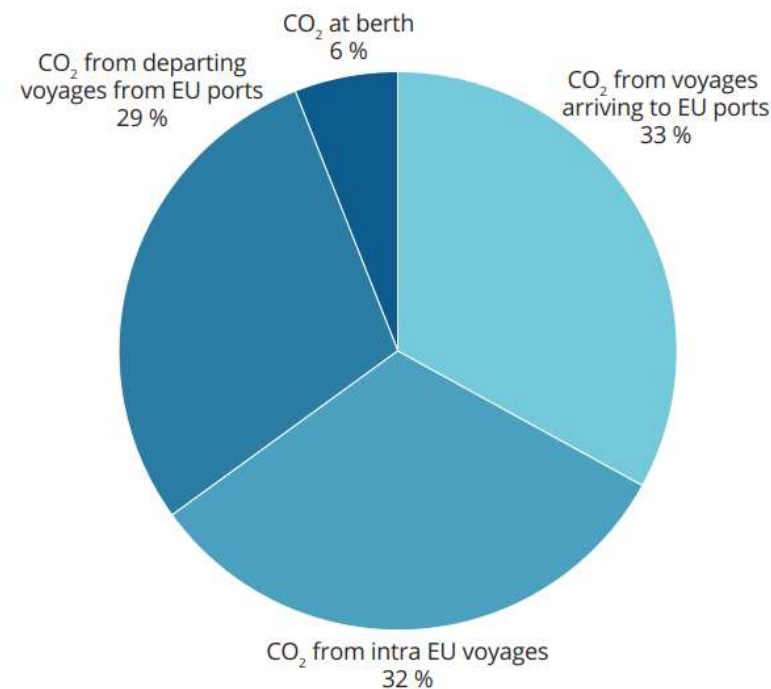
CO₂ emissions per vessel type



Note: Ro-ro, roll-on roll-off.

Source: EMSA/THETIS-MRV (2018).

Emissions distribution per voyage type, and at port



Source: EMSA/THETIS-MRV (2018).

THETIS-MRV (2018-2021)

AER – Annual Efficiency Ratio $\text{g CO}_2 / (\text{dwt} \cdot \text{nm})$

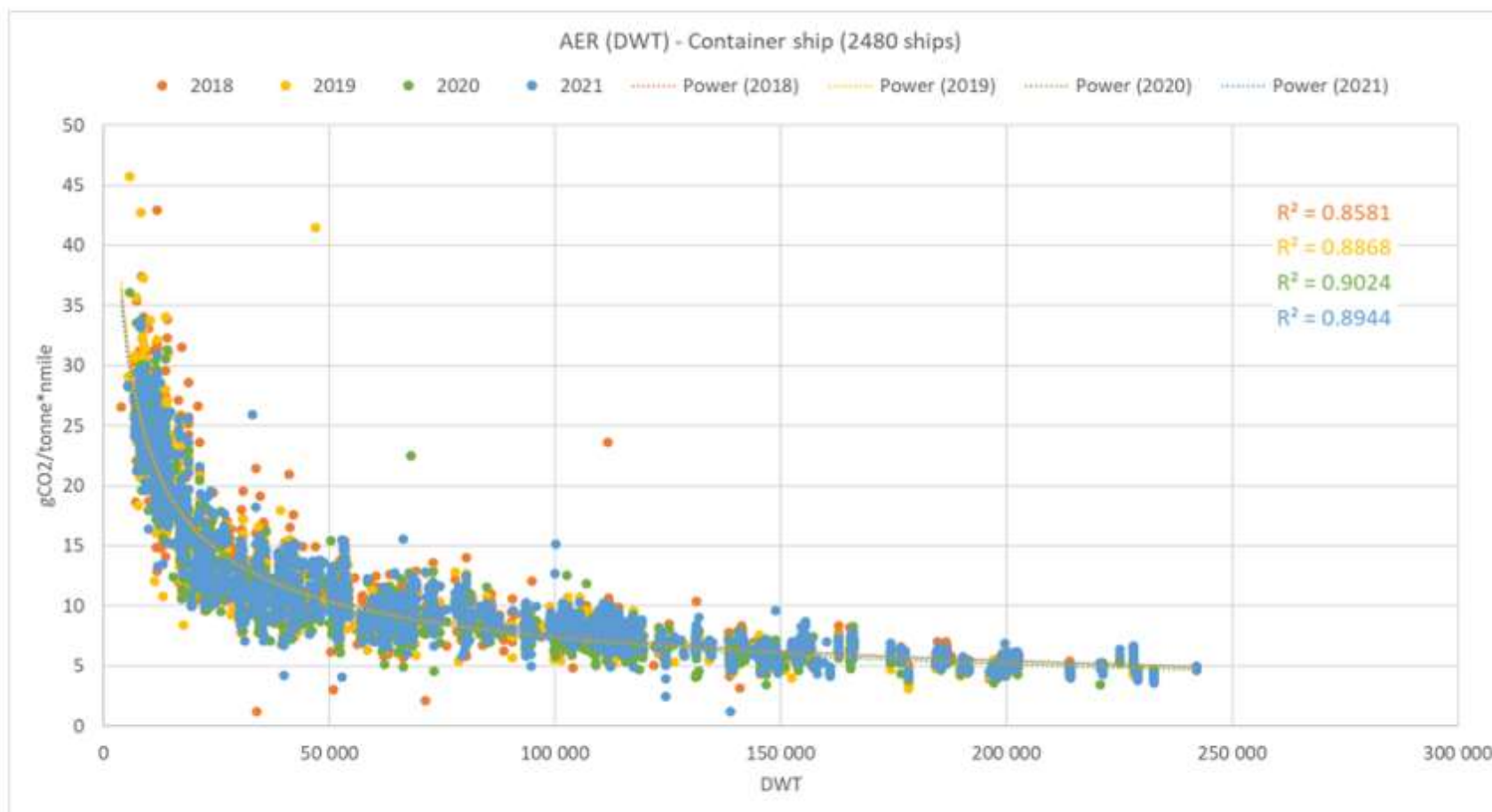


Figure 44: Plot of attained AER values of container ships over the four reporting years and according trends

* 4th Annual report from EC on CO₂ emissions from Maritime Transportation (period 2018-2021)

THETIS-MRV (2018-2021)

Consumed fuel types / mix

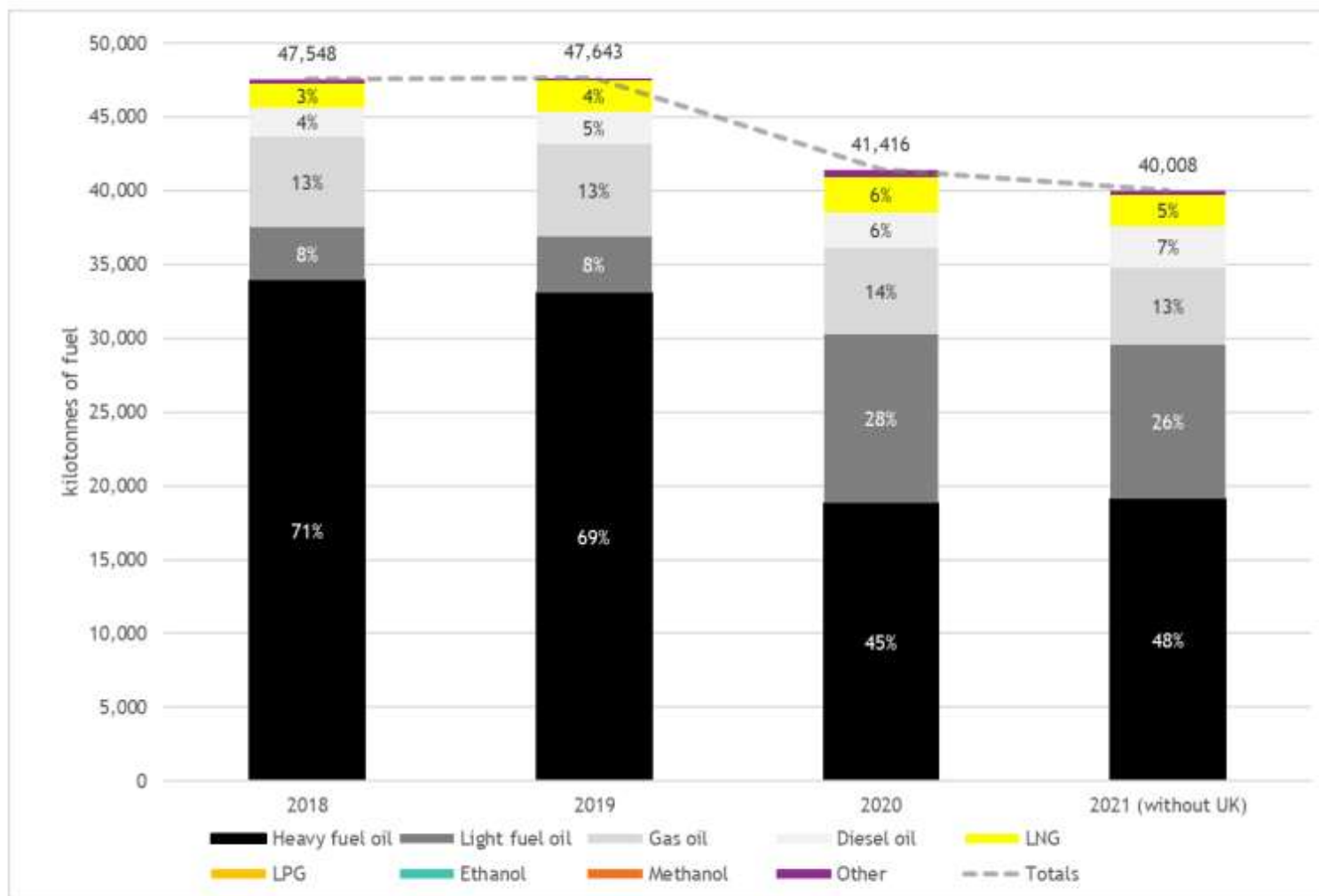


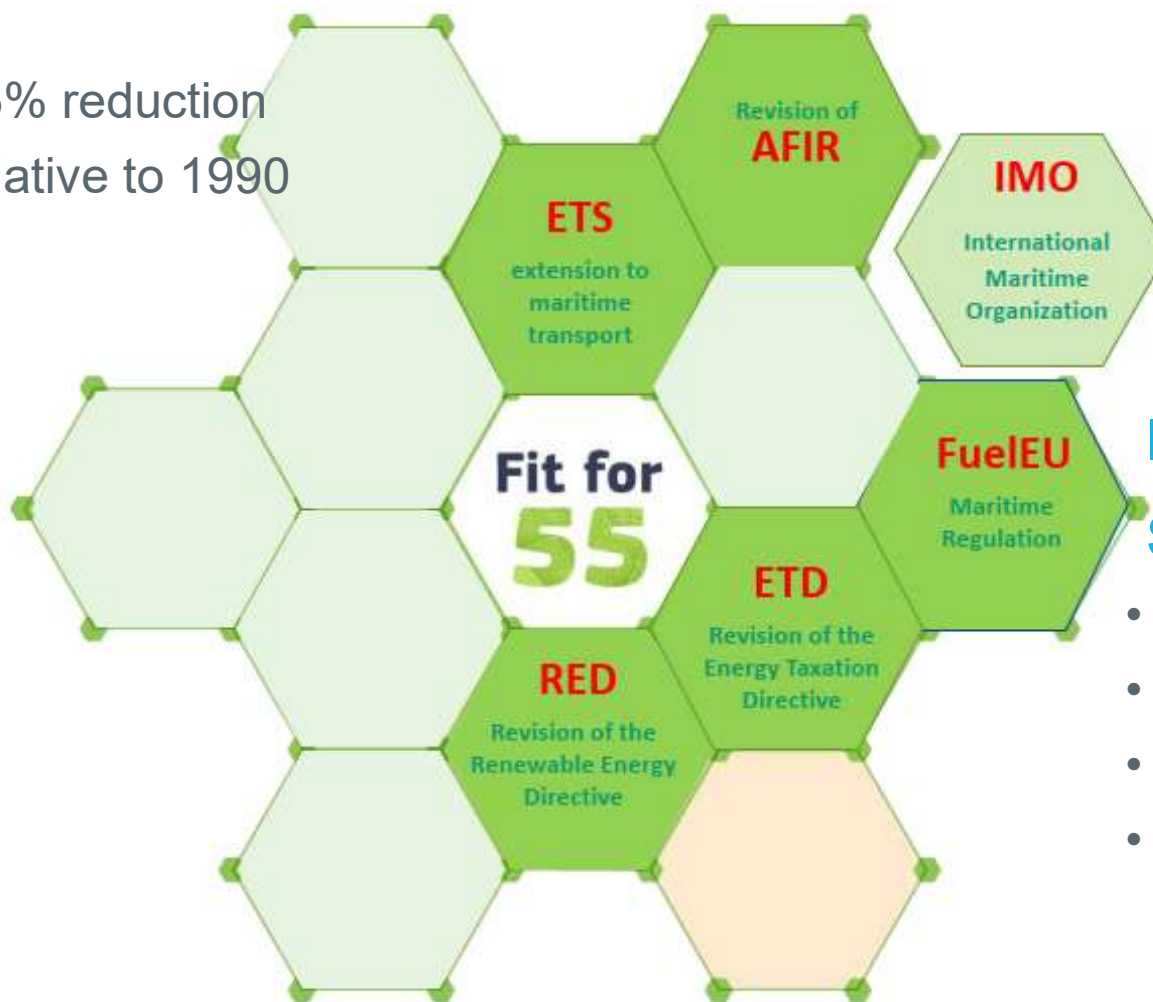
Figure 13: 2018 to 2021 total fuel consumption of EU MRV fleet and shares per fuel type

* 4th Annual report from EC on CO2 emissions from Maritime Transportation (period 2018-2021)

3 – Fit for 55

EU Strategy (2022)

55% reduction
relative to 1990



IMO GHG Strategy

Short term measures

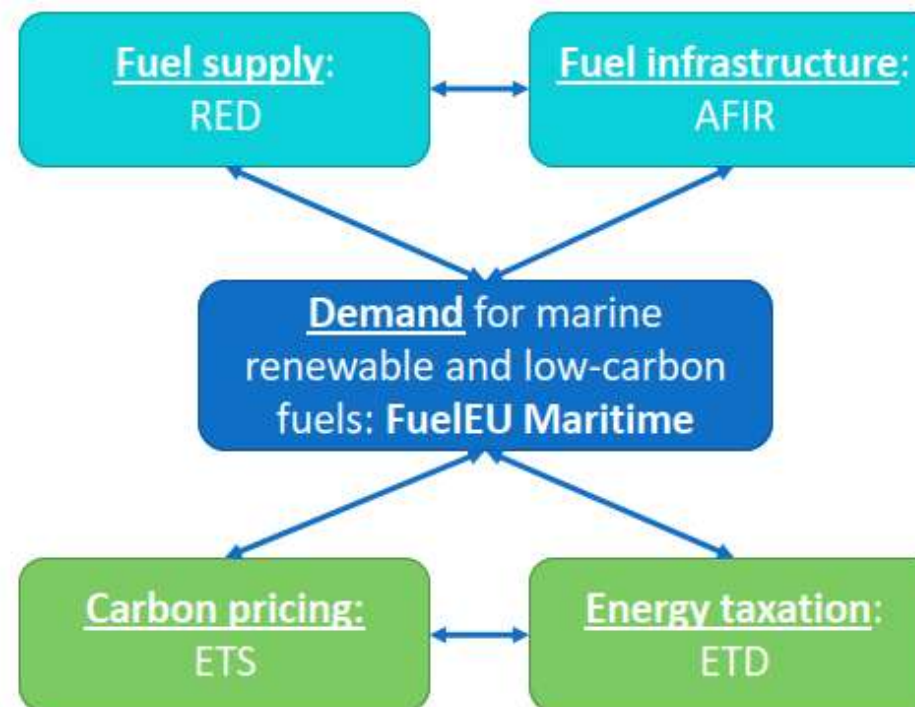
- SEEMP Plan
- EEDI
- CII
- 2030 reduce Carbon Intensity by 40%, relative to 2008

Fit for 55

- **RED** – Renewable Energy Directive
- **AFIR** – Alternative Fuels Infrastructure (Onshore power supply + bunkering)

Specific regulation to the maritime industry

- **EU ETS – MRV**
Carbon Emission Trading System
- **FuelEU**



Recap - THETIS-MRV (2018-2023)

- Ships > 5000 GT, calling EEA ports
- International voyages from and to EEA ports, and intra-EU
- Monitoring Plan / Emission Report (CO₂ only) / Verification and DoC

EU-ETS MRV (New on 01-01-2024)*

- Application of EU ETS 2003/87/EC, to the maritime transport
- Phase-in 2024 (40%), 2025 (70%), after 2026, to consider 100% emissions
- Process*: Monitoring Plan, Ship Emission Report, Company Emission Report, Verification Procedure, ETS allowance surrendering
- Administration of shipping companies by a specific “Administering Authority”, (assigned MS). Criteria*: first the country of registration of the shipping company, second the n^o of port calls for non-EU companies, third the 1st time.

* Under development, secondary legislation

EU-ETS MRV (1-01-2024)*

Scope:

- Cargo and passenger ships > 5000 GT, calling EEA ports
- 100% of emissions, intra-EEA ports, and emissions at berth
- 50% of emissions, international voyages from and to EEA ports
- GHG emissions:
 - CO₂ ,+ methane CH₄ , nitrous oxide N₂O
- After 2025, cargo ships 400 < GT < 5000, and offshore vessels > 400GT*
- Emissions based on Tank to Wake principle
- Transshipment Ports: > 300 nm from EEA port

Exemptions and derogations:

- Small islands, outermost regions, public service, ice class

*Under development , secondary legislation

EU-ETS MRV *

Calculations : base concept CO_{2eq} (to include CO₂ and CH₄, N₂O)

GHG = Tonnes of Fuel x **Emission Factor** + C_{slip} (considering Gas slip)

$$GHG_{MRV} = CO_{2MRV} + CH_{4MRV} \times GWP_{CH_4} + N_2O_{MRV} \times GWP_{N_2O}$$

$$CO_{2MRV} = \sum_i (M_i - M_{i,NC}) \times EF_{CO_2,i}$$

$$CH_{4MRV} = \left[\sum_i (M_i - M_{i,NC}) \times EF_{CH_4,i} \right] + CH_{4S}$$

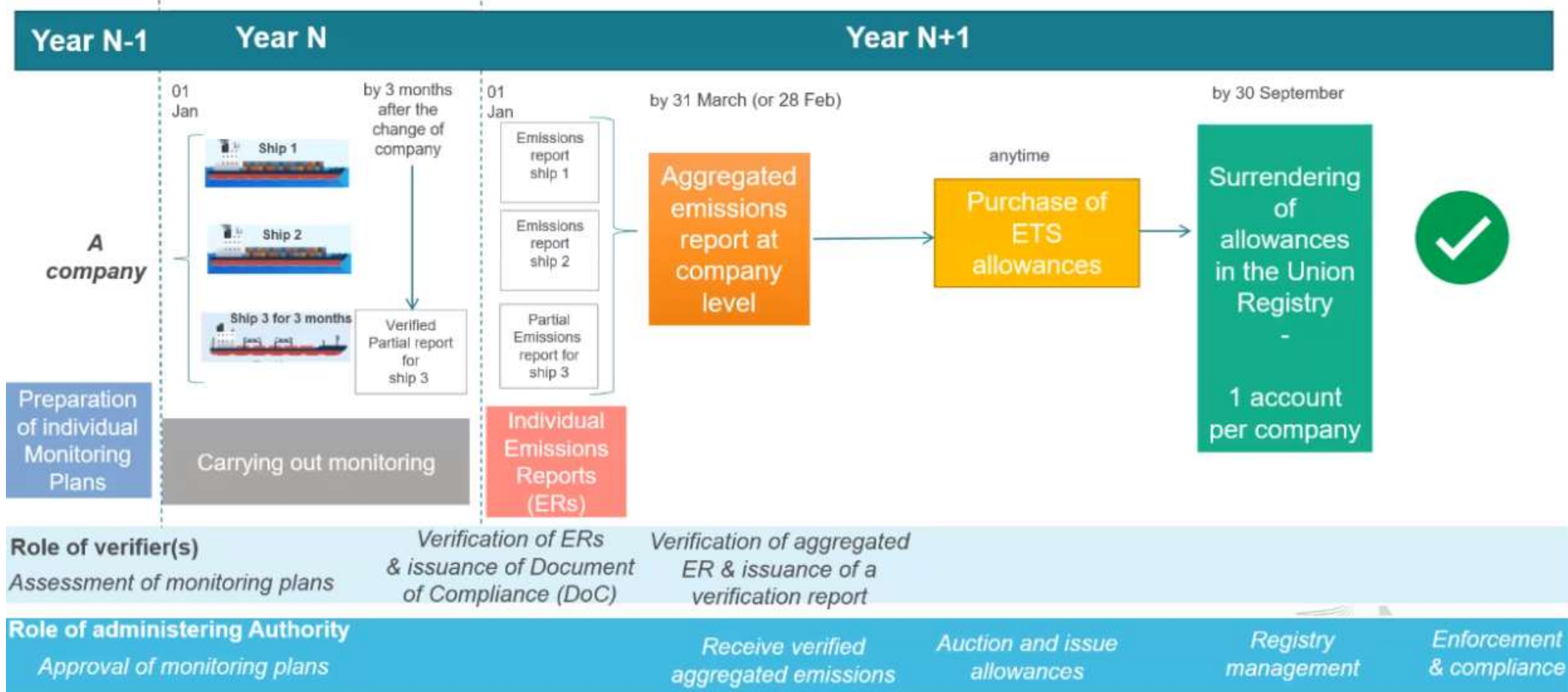
$$N_2O_{MRV} = \sum_i (M_i - M_{i,NC}) \times EF_{N_2O,i}$$

1	2	3	4	5	6
Fuel Class	Type of Fuel	EF_{CO_2} $\left[\frac{gCO_2}{gFuel} \right]$	EF_{CH_4} $\left[\frac{gCH_4}{gFuel} \right]$	EF_{N_2O} $\left[\frac{gN_2O}{gFuel} \right]$	C _j As % of the mass of the fuel used by the emissions source
	HFO ISO 8217 Grades RME to RMK	3,114	0,00005	0,00018	-

*Under development

EU-ETS MRV

Process *



*Under development , secondary legislation

EU ETS-MRV

Relevant Timeline *

- Monitoring Plan (MP) and submission to Verifier -
- Publication of Administering Authorities (AA) 01-02-2024
- Submission the assessed MP to AA 01-04-2024
- 1st Recording Period y 2024
- Ship Specific Emission Report (ER) 30-01-2025
- Aggregated Company Report at Company level 31-03-2025
- Submission to AA, the verified Aggregated ER 31-03-2025
- Surrendering of Allowances 30-09-2025

*Under development

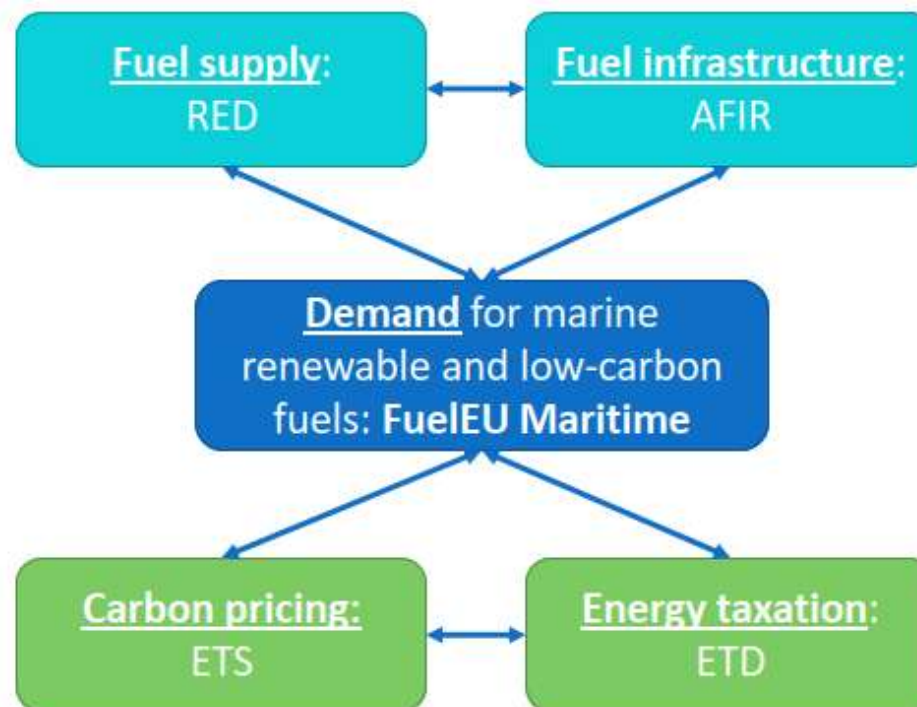
FueIEU* (1-Jan-2025)

Complement ETS-MRV

- ETS promotes energy efficiency and fuel reduction by carbon price measures
- FueIEU promotes new fuel technologies, renewables and low carbon

Complements RED e AFIR

- FueIEU is promoting the demand for marine renewable fuels
- RED defines the supply of new fuels
- AFIR promotes the development of infrastructures to supply new fuel technologies

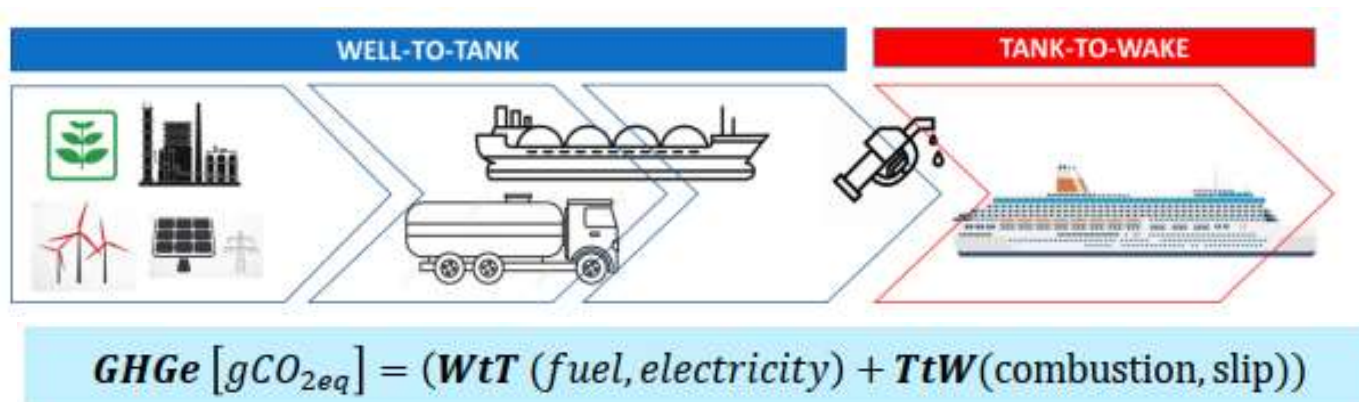


*Under development, secondary legislation

FuelEU (1-Jan-2025)

Scope:

- Cargo and passenger ships > 5000 GT, calling EEA ports
- 100% of emissions, intra-EEA traffic, and emissions at berth
- 50% of emissions, international voyages from and to EEA ports
- GHG intensity of energy :
 - CO₂ ,+ methane CH₄ ,Nitrous oxide N₂O, based on **Well to Wake**

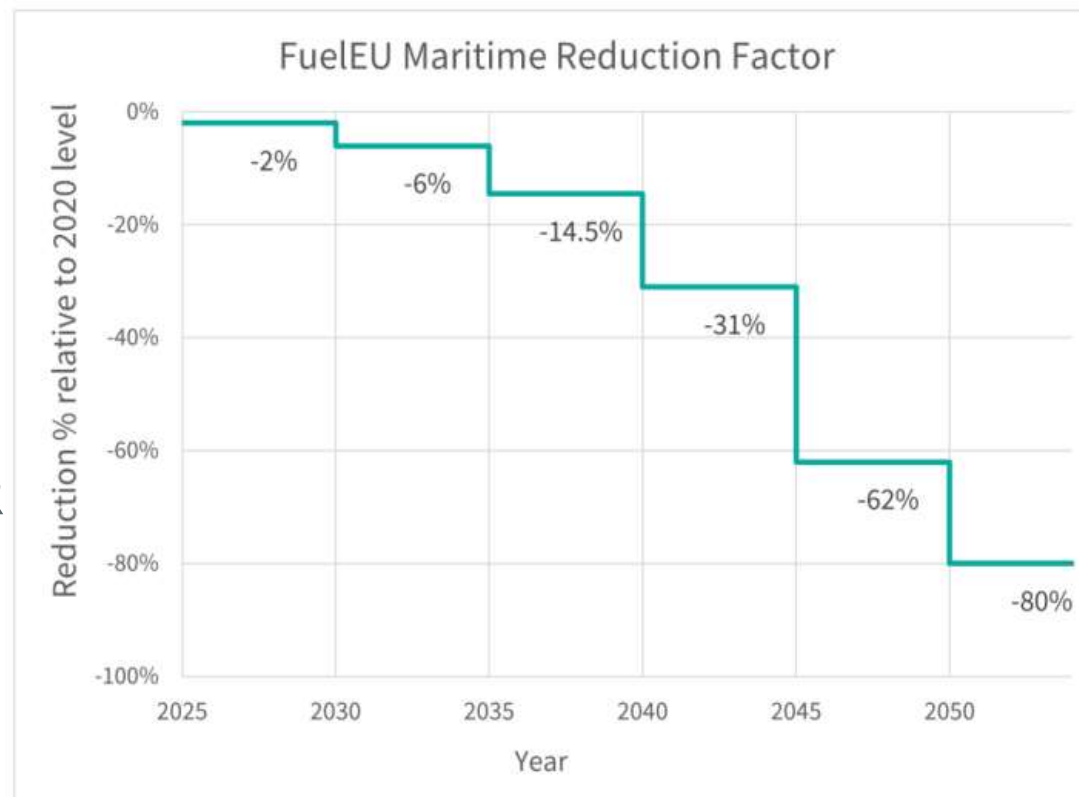


- Establishes limits on the annual GHG intensity of the energy used.
 - Reference Value: 91.16 g CO_{2eq} / MJ

FuelEU

Targets

- Progressive reduction of GHG intensity limit, to be reviewed every 5 years
- Zero emissions on port, or Onshore Power Supply, at AFIR after 2030 (TEN-T Ports)



Calculation (base concept):

GHG intensity index	WtT	TtW
$GHG \text{ intensity index } \left[\frac{gCO_2eq}{MJ} \right] =$	$\frac{\sum_i^n fuel M_i \times CO_{2eq \text{ WtT},i} \times LCV_i + \sum_k^c E_k \times CO_{2eq \text{ electricity},k}}{\sum_i^n fuel M_i \times LCV_i + \sum_k^c E_k}$	$\frac{\sum_i^n fuel \sum_j^m engine M_{i,j} \times \left[\left(1 - \frac{1}{100} C_{engine \ slip \ j} \right) \times (CO_{2eq,TtW,j}) + \left(\frac{1}{100} C_{engine \ slip \ j} \times CO_{2eq \ TtW,slippage,j} \right) \right]}{\sum_i^n fuel M_i \times LCV_i + \sum_k^l E_k}$

*Under development, secondary legislation

FuelEU

Relevant Timeline *

- Monitoring Plan and submission to Verifier 31-08-2024
- 1st Recording Period y 2025
- Ship specific FuelEU report 30-01-2026
- Company emission report 30-03-2026
- Verification report 30-04-2026
- Non compliance penalty 01-05-2026
- Issue FuelEU DoC 30-06-2026

*Under development, secondary legislation

4 – Complementary Studies

European Maritime Safety Agency

UPDATE ON POTENTIAL OF BIOFUELS IN SHIPPING

BY ABS, CE-DELFT & ARCSILEA

EMSA/Biofuels - 2021/2022 - 4837444
Date: 16/09/2022

European Maritime Safety Agency

POTENTIAL OF AMMONIA AS FUEL IN SHIPPING

BY ABS, CE-DELFT & ARCSILEA

EMSA/Ammonia - 2021/2022 - 4837444
Date: 16/09/2022

European Maritime Safety Agency

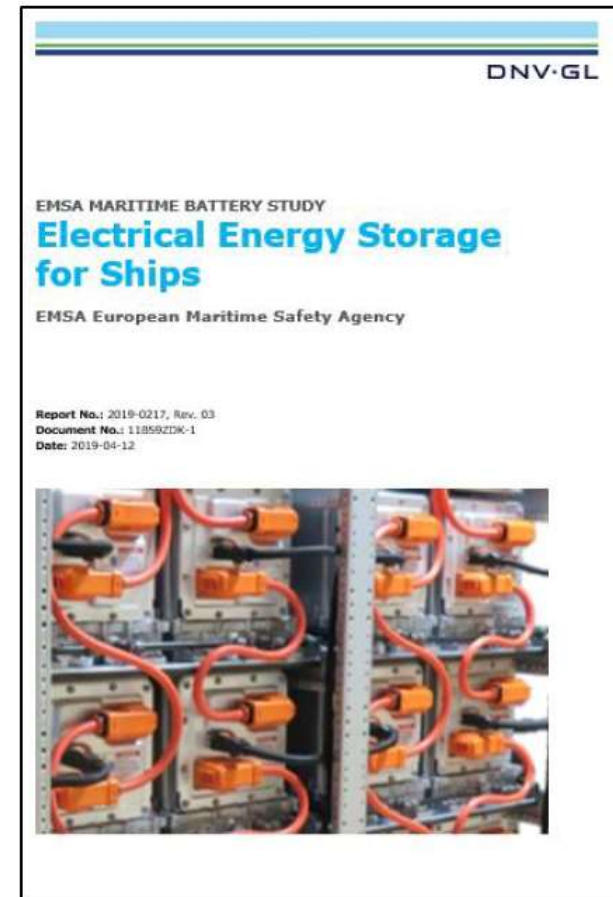
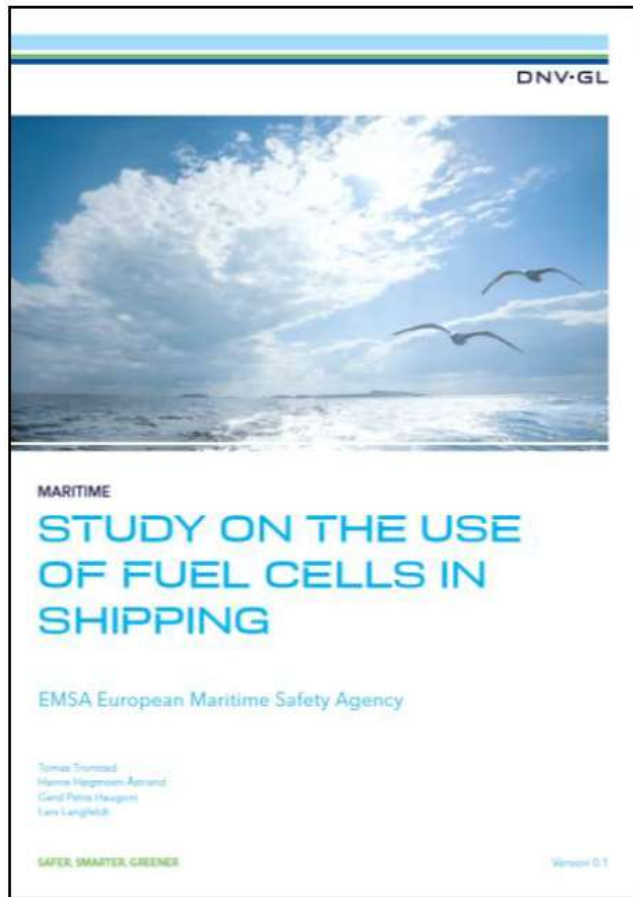
Shore-Side Electricity

Guidance to Port Authorities and Administrations

Part 1 – Equipment and Technology

Version 1
June 2022

4 - Complementary Studies



4 - Complementary Studies

Other studies under evaluation/progress :

- EMTER 2.0
- Hydrogen fuel solutions
- Wind assisted power



Obrigado.

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