EU Fit for 55
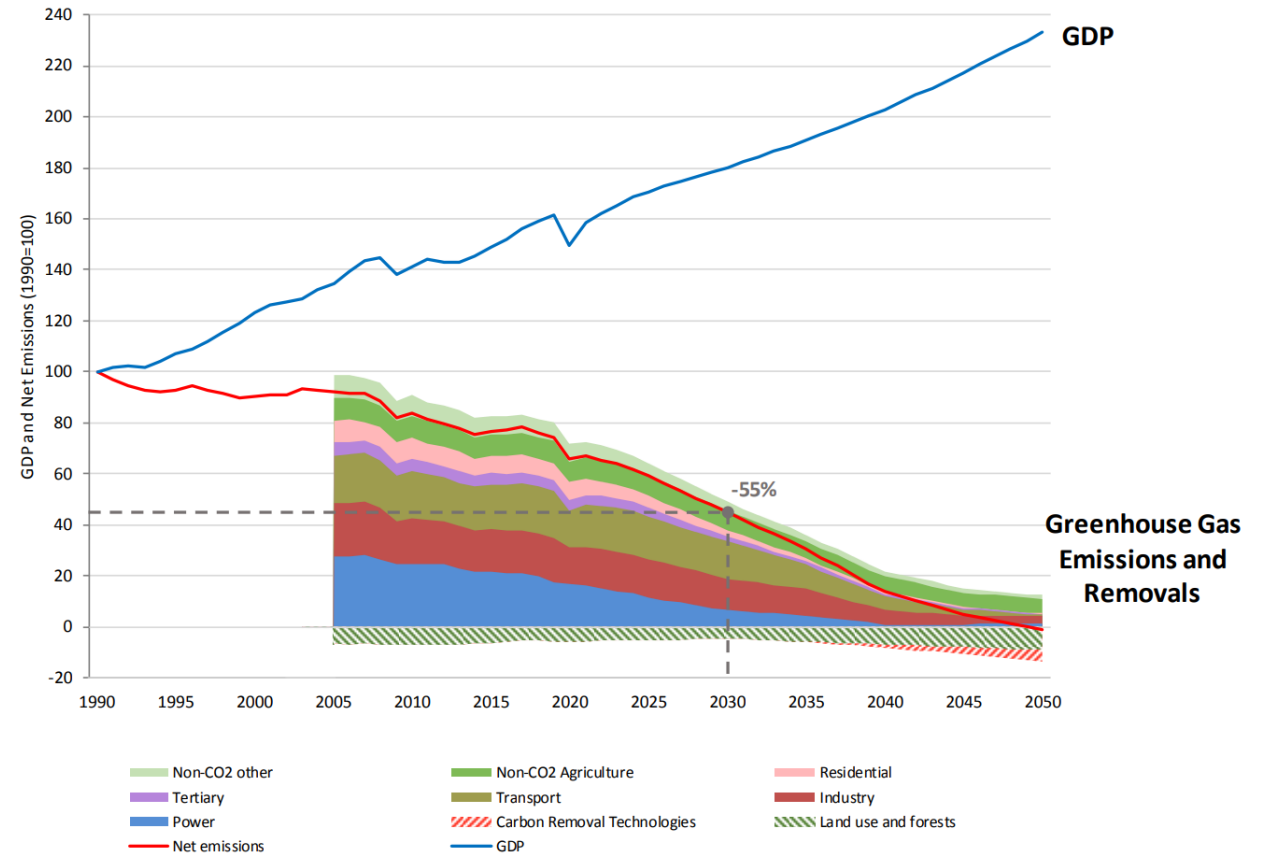
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EU Green Deal – a climate neutral Europe by 2050

Fit for 55 package proposed by Commission in July 2021. Key elements for shipping:

- Inclusion of shipping in the **Emissions Trading System** – first reporting year 2024 - **agreed**

- **FuelEU Maritime:** requirements on lifecycle GHG intensity of energy – from 2025 - **agreed**

- Revision of **Alternative Fuels Infrastructure Regulation**: Shore side electricity and LNG in core network ports by 2030 (electricity) and 2025 (LNG) - **agreed**

- Revision of **Energy Taxation Directive**: Ending tax exemptions for marine fuels within EU – proposed from 2023, presently **delayed**
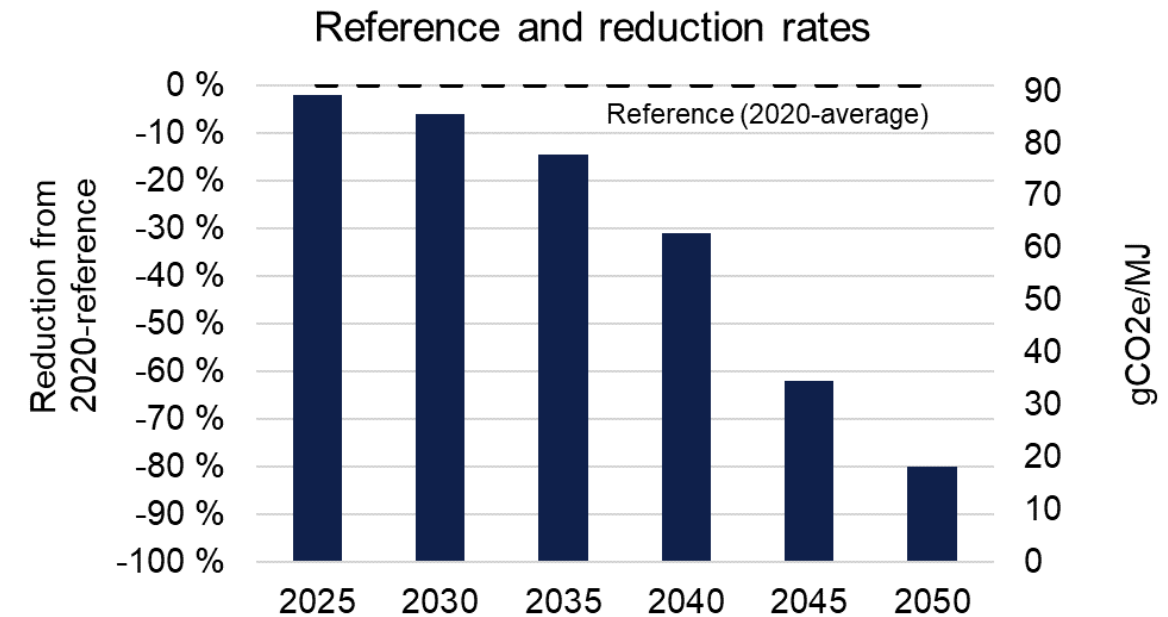

Source: EU Commission, COM(2020) 562 final

Note: the above is based on reporting from the political agreements reached between Commission, Parliament and Council

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FuelEU Maritime

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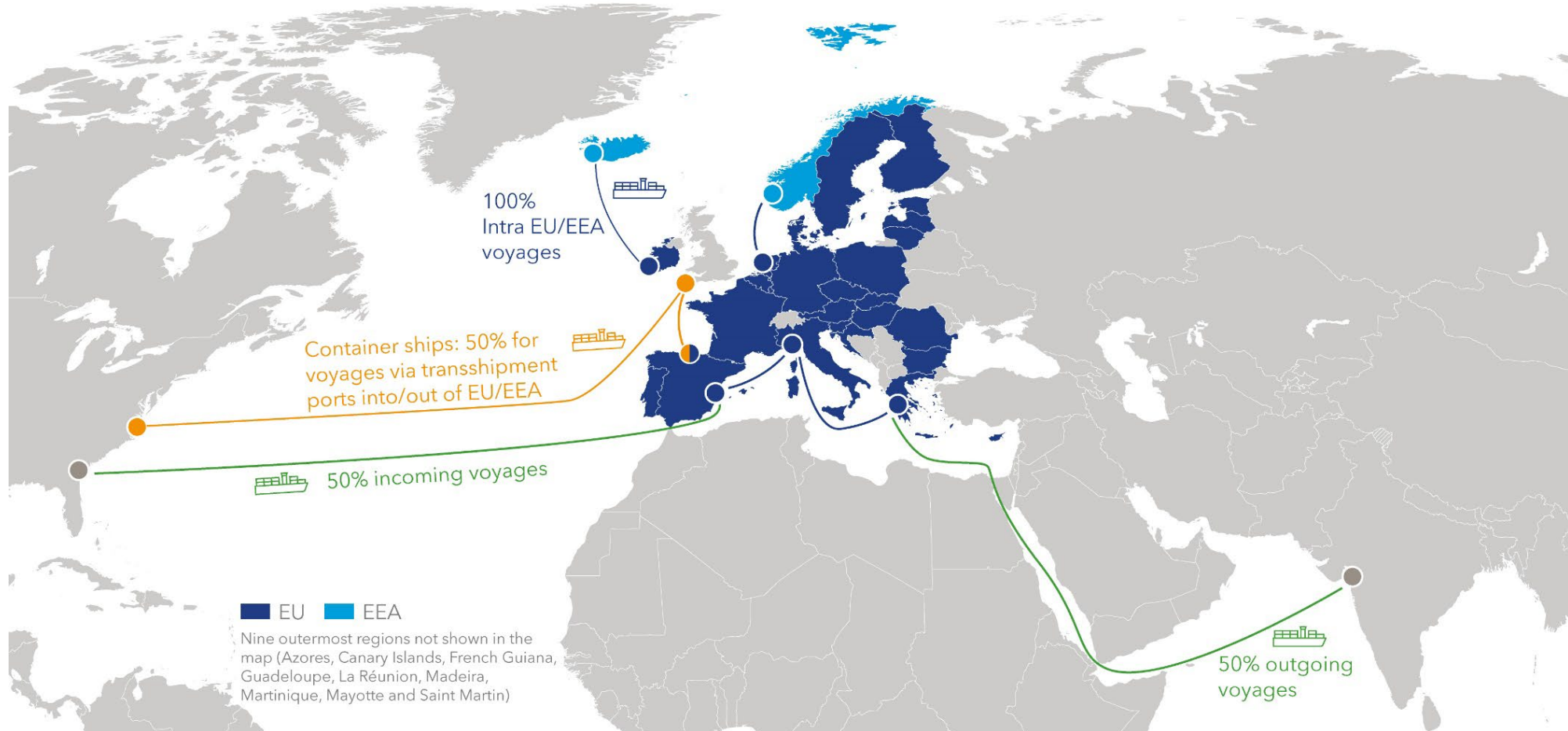# FuelEU Maritime – requirements to lifecycle GHG intensity of energy

- Requirement to the yearly **average well-to-wake GHG intensity of energy** used on-board:

  - All ships above 5000 GT transporting passengers or cargo

  - 50% of energy used on voyages between EU and non-EU ports, 100% of energy used on intra-EU voyages and when at berth

  - Includes CH_4 and N_2O and electricity received, rewards for wind power

  - **Compliance can be banked and pooled**, with some limitations across periods, ships and companies

  - Mandatory 2% RFNBO use from 2034, if sector use in 2031 is less than 1%. Equivalent fuels with a similar or higher decarbonisation potential can be accepted

- Requirement to the **use of shore power**:

  - From 1 January 2030 for **container and passenger ships** not using zero-emission technologies must **connect to shore power while at berth in TEN-T ports** for more than 2 hours

$$Well\ to\ Wake\ GHG\ intensity = \frac{gCO_{2}eq}{MJ}$$

Reference and reduction rates

Reduction	2025	2030	2035	2040	2045	2050
Reduction (%)	2%	6%	14.5%	31%	62%	80%
Required GHG intensity (gCO$_2$e/MJ)	89.3	85.7	77.9	62.9	34.6	18.2

Note: the above is subject to final adoption by the Council

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FuelEU applies to voyages and port calls in EU/EEA and voyages to and from EU/EEA

100% Intra EU/EEA voyages

Container ships: 50% for voyages via transshipment ports into/out of EU/EEA

50% incoming voyages

50% outgoing voyages

EU **EEA**

Nine outermost regions not shown in the map (Azores, Canary Islands, French Guiana, Guadeloupe, La Réunion, Madeira, Martinique, Mayotte and Saint Martin)
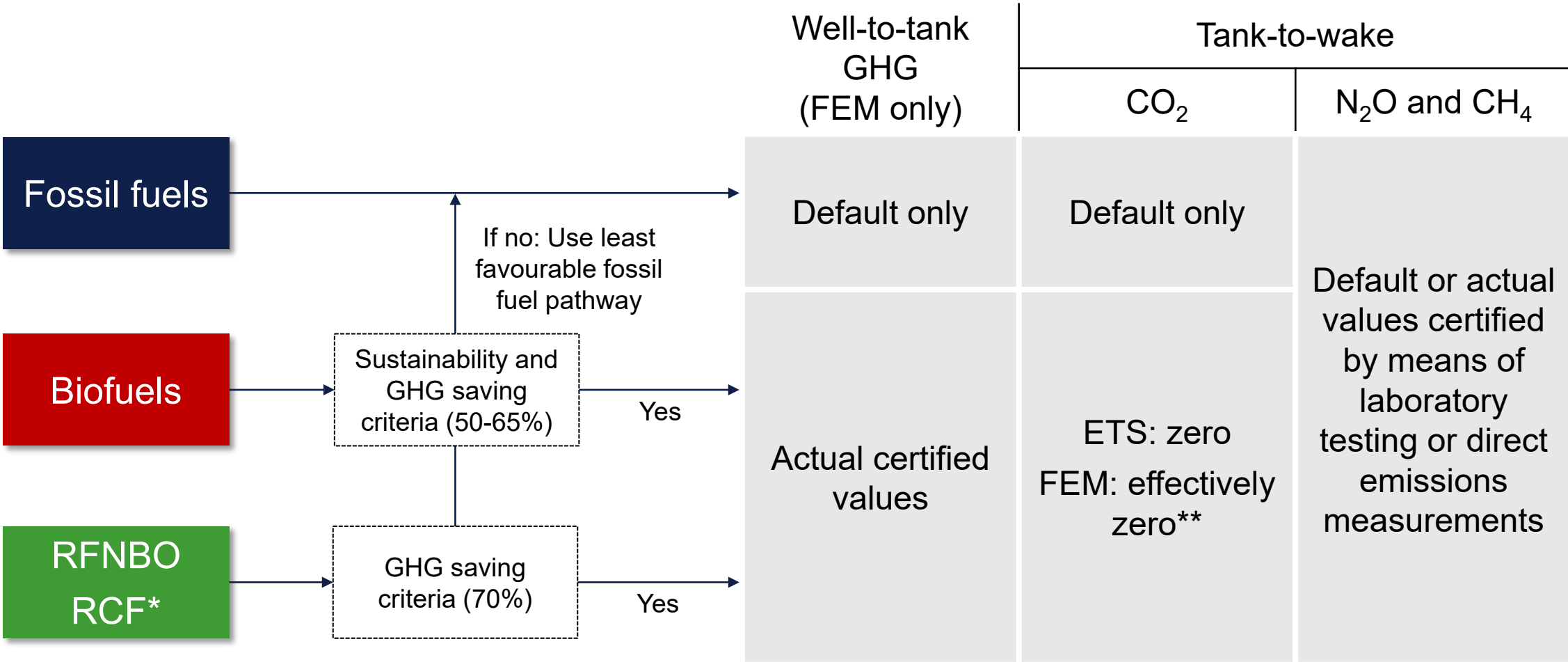
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Compliance options

- **Use fuels/energy with lower WtW GHG intensity**
  - Sustainable biofuels
  - Renewable fuels of non-biological origin (RFNBO) (e.g. e-methanol)
  - Recycled carbon fuels (RCF)
  - Fossil LNG/LPG
  - Shore power
  - Wind assisted propulsion
  - Onboard carbon capture and storage (rules to be clarified)

- **Compliance balance**
  - Borrow compliance surplus from next year
  - Use banked compliance surplus from last year
  - Compliance pooling with other ships

- **Pay penalty**

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Emission factors
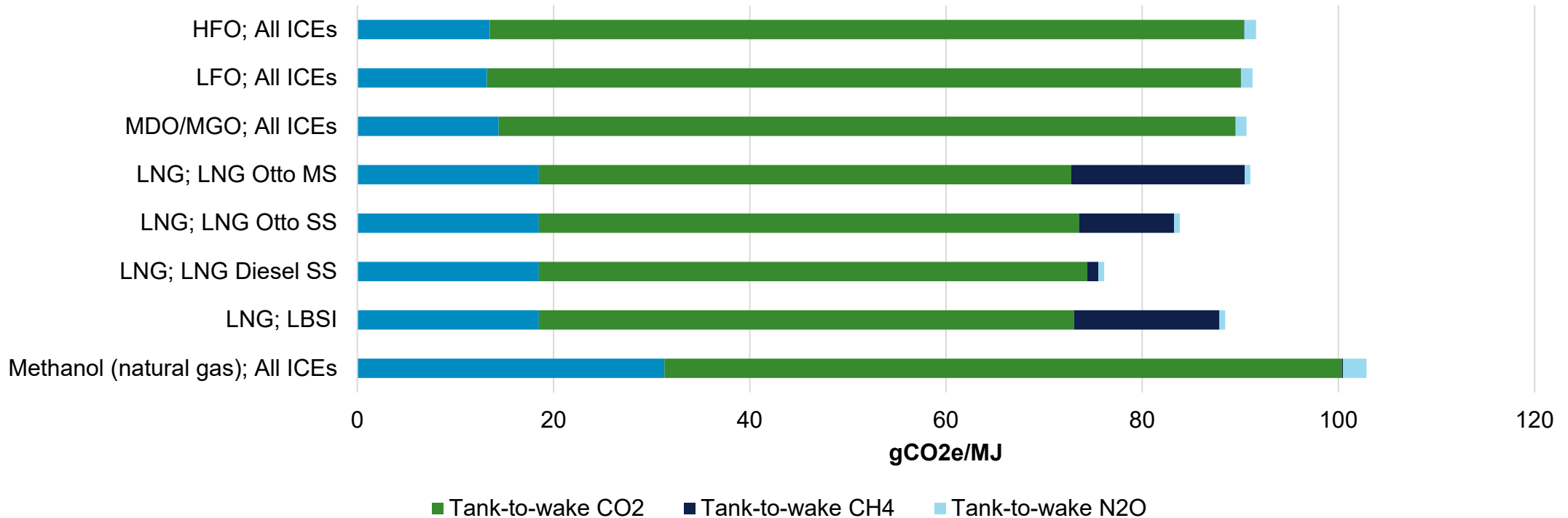
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Fuels and emission factors under FEM and ETS

	Well-to-tank GHG (FEM only)	Tank-to-wake	
		CO_2	N_2O and CH_4
Fossil fuels	Default only	Default only	Default or actual values certified by means of laboratory testing or direct emissions measurements
Biofuels / **RFNBO RCF***	Actual certified values	ETS: zero FEM: effectively zero**	

Sustainability and GHG saving criteria (50-65%)

GHG saving criteria (70%)

If no: Use least favourable fossil fuel pathway

Yes

Yes

*) Renewable fuels of non-biological origin (RFNBO) (e.g. e-methanol), Recycled carbon fuels (RCF)

**) For FuelEU the CO_2 emission is first deducted for WtT and then added under TtW.

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Default emission factors for fossil fuels

Chart: Default emission factors (gCO2e/MJ)

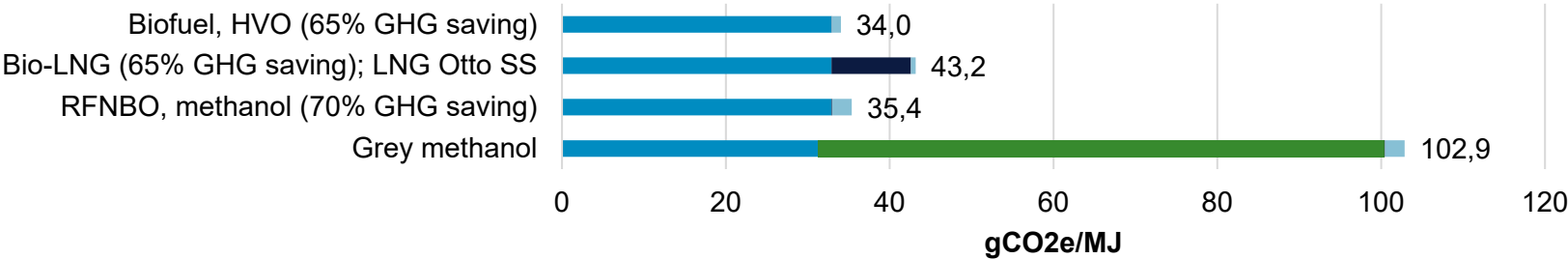| Fuel	Tank-to-wake CO2	Tank-to-wake CH4	Tank-to-wake N2O

Source: FuelEU Maritime Annex II

- Specific tank-to-wake CH_4 and N_2O emission factors can be used based on laboratory testing or direct emissions measurement (details on certification to be provided in delegated act)
- Only default factors allowed for well-to-tank GHG and tank-to-wake CO_2 emissions

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Specific certified well-to-tank GHG values for non-fossil fuels

- Based on fuel definitions in EU's Renewable Energy Directive (RED)

- Must fulfil sustainability and GHG saving criteria – otherwise considered according to the least favourable fossil fuel type pathway

- Default factors from RED can be used during certification

Fuel		GHG saving criteria
Fossil fuel comparator		*94 gCO$_2$e/MJ*
Biofuels	Installations starting operation before 5 October 2015	50%
	Installations starting operation between 6 October 2015 and 31 December 2020	60%
	Installations starting operation from 1 January 2021	65%
Renewable fuels of non-biological origin		70%
Recycled Carbon Fuels		70%

Emission factors examples

- Well-to-tank GHG
- Tank-to-wake CO2
- Tank-to-wake CH4
- Tank-to-wake N2O

Calculation examples

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GHG intensity calculation Fossil MGO

- **Intensity based on default emission factors:**
  - WtT GHG: 14.4 gCO2e/MJ
  - TtW CO_2: 3.206 / 0.0427 = 75.08 gCO_2e/MJ
  - TtW CH_4: 0.00005 / 0.0427 x 28 = 0.03 gCO_2e/MJ
  - TtW N_2O: 0.00018 / 0.0427 x 265= 1.12 gCO_2e/MJ

- **WtW GHG intensity: 90.63 gCO_2e/MJ**

$$Well\ to\ Wake\ GHG\ intensity = \frac{gCO_{2eq}}{MJ}$$

Default emission factors

1	2	3	4	5	6	7	8	9
			WtT		TtW			
Fuel Class	Pathway name	LCV $\left[\frac{MJ}{g}\right]$	$CO_{2eq\,WtT}$ $\left[\frac{gCO2eq}{MJ}\right]$	Fuel Consumer Unit Class	$C_{f\,CO_2}$ $\left[\frac{gCO2}{gFuel}\right]$	$C_{f\,CH_4}$ $\left[\frac{gCH4}{gFuel}\right]$	$C_{f\,N_2O}$ $\left[\frac{gN_2O}{gFuel}\right]$	C_{slip} As % of the mass of the fuel used by the engine
	MDO MGO ISO 8217 Grades DMX to DMB	0,0427	14,4	ALL ICEs	3,206	0,00005	0,00018	-

GHG intensity calculation Sustainable biofuel

$$Well\ to\ Wake\ GHG\ intensity = \frac{gCO_{2}eq}{MJ}$$

- **Intensity based on default emission factors:**
  - WtT GHG: 32.9 – 70.80 = – 37.90 gCO2e/MJ
  - TtW CO_2: 3.115 / 0.044 = 70.80 gCO_2e/MJ
  - TtW CH_4: 0.00005 / 0.044 x 28 = 0.03 gCO_2e/MJ
  - TtW N_2O: 0.00018 / 0.044 x 265= 1.08 gCO_2e/MJ

- **WtW GHG intensity: 34.01 gCO_2e/MJ**

Default emission factors

1	2	3	4	5	6	7	8	9
			WtT		TtW			
Fuel Class	Pathway name	LCV $\left[\frac{MJ}{g}\right]$	$CO_{2eq\ WtT}$ $\left[\frac{gCO2eq}{MJ}\right]$	Fuel Consumer Unit Class	$C_{f\ CO_2}$ $\left[\frac{gCO2}{gFuel}\right]$	$C_{f\ CH_4}$ $\left[\frac{gCH_4}{gFuel}\right]$	$C_{f\ N_2O}$ $\left[\frac{gN_2O}{gFuel}\right]$	C_{slip} As % of the mass of the fuel used by the engine
Biofuels	Hydrotreated Vegetable Oil (HVO) Production Pathways of Directive (EU) 2018/2001	Value as set out in Annex III of Directive (EU) 2018/2001	$E - \frac{C_{fCO_2}}{LCV}$	ALL ICEs	3,115	0,00005	0,00018	-

LCV_{HVO} = 0.044 MJ/g

Assumed produced with 65% GHG saving

94 x (1-65%) = 32.9 gCO_2e/MJ

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GHG intensity compliance calculation example

- **Fuel consumption:**
  - Voyages **in and out of EU**: 10 000 t MGO
  - Voyages and port calls **in EU**: 3 500 t MGO, 1 500 t HVO (5 000 t B30 blend)

- **Energy use:**
  - $(10000 \times 0.0427 \times 50\%) + (3500 \times 0.0427 \times 100\%) + (1500 \times 0.044 \times 100\%) = \textbf{429.0} \times \textbf{10}^{\textbf{6}} \textbf{ MJ}$

- **Calculated GHG intensity:**
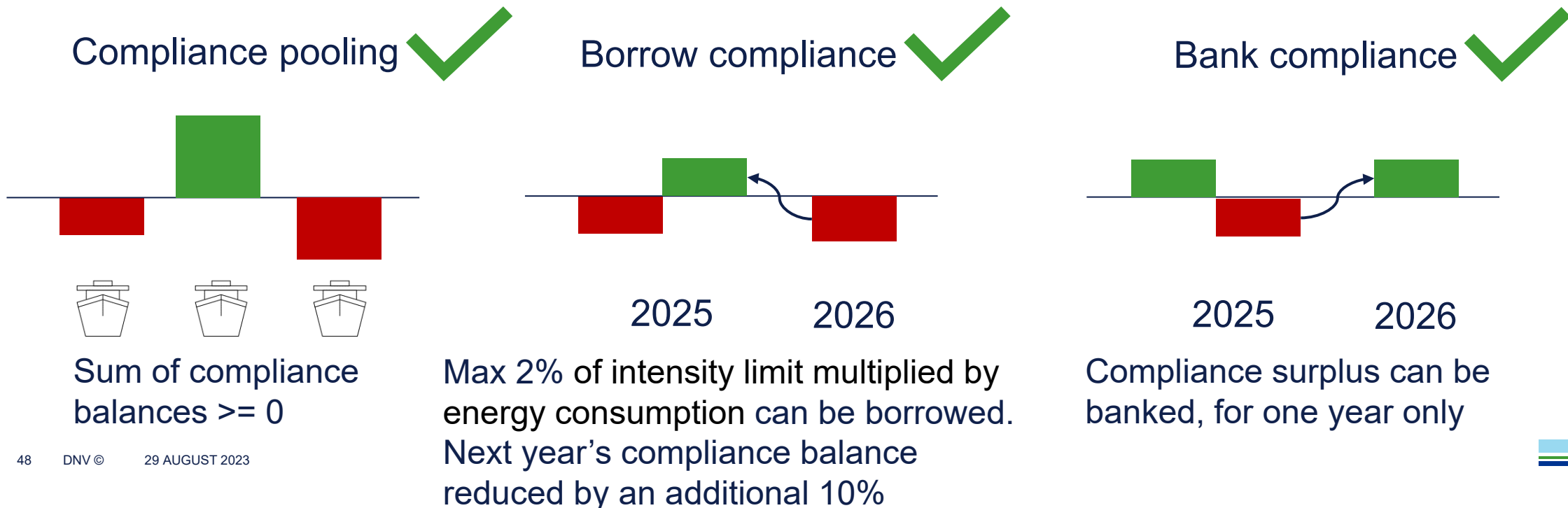 - $(90.63 \times 8500 \times 0.0427 + 34.01 \times 1500 \times 0.044) / 429 = \textbf{81.91 gCO}_{\textbf{2}}\textbf{e/MJ}$

- **Required GHG intensity:**

Reduction	2025	2030	2035	2040	2045	2050
Reduction (%)	2%	6%	14.5%	31%	62%	80%
Required GHG intensity (gCO$_2$e/MJ)	89.3	85.7	77.9	62.9	34.6	18.2

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Compliance balance – options to comply
Example – 15000 t MGO annually (2025 – 2029)

- **Achieved GHG intensity (using 100% MGO):** 90.63 gCO_2e/MJ
- **Target GHG intensity (2025–2029):** 91.16 x (1 – 2%) = 89.34 gCO_2e/MJ
- **Energy use:** 429×10^6 MJ
- **Compliance balance:** (89.34 – 90.63) x 429×10^6 MJ = **–553.4 tCO_2e**

Compliance pooling ✓

Borrow compliance ✓

Bank compliance ✓

2025   2026

2025   2026

Sum of compliance balances >= 0

Max 2% of intensity limit multiplied by energy consumption can be borrowed. Next year's compliance balance reduced by an additional 10%

Compliance surplus can be banked, for one year only

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Compliance balance penalty – also a way to comply Example – 15000 t MGO annually (2025 – 2029)

- **Penalty value: 2400 € / t VLSFO**

- **Compliance balance:** $(89.34 - 90.63)$ x 429×10^6 MJ = **–553.4 tCO_2e**

- **Penalty:** $-553.4 \times 10^6 / (90.63 \times 41000)$ x 2400 = **357 433 €**

- **Equates to carbon cost: 646 €/tCO_2e**

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Adjustments

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Adjustments for ice class and sailing in ice conditions

- Additional energy due to ice class
  - Ice class IA or IA Super or an equivalent ice class
  - 5% of total energy when not sailing in ice conditions can be deducted

- Additional energy due to sailing in ice conditions
  - Ice class IC, IB, IA or IA Super or an equivalent ice class
  - Until 31 December 2034: Energy consumption when sailing in ice conditions can be deducted
  - Energy consumption in ice conditions can not exceed 30% of energy consumption sailing in open waters

- Note that the adjustments apply only to calculation of the compliance balance and the GHG intensity requirement still apply

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Wind assisted propulsion

- The GHG intensity for ships with wind assisted propulsion can be multiplied by a reward factor

- P_{Wind} is the available effective power of the wind assisted propulsion systems and corresponds to $f_{eff} * P_{eff}$ as calculated in accordance with MEPC.1/Circ.896*

- P_{Prop} is the propulsion power of the ship and corresponds to PME as defined for EEDI and EEXI. In case where shaft motor(s) are installed, $P_{Prop} = P_{ME} + P_{PTI(i),shaft}$
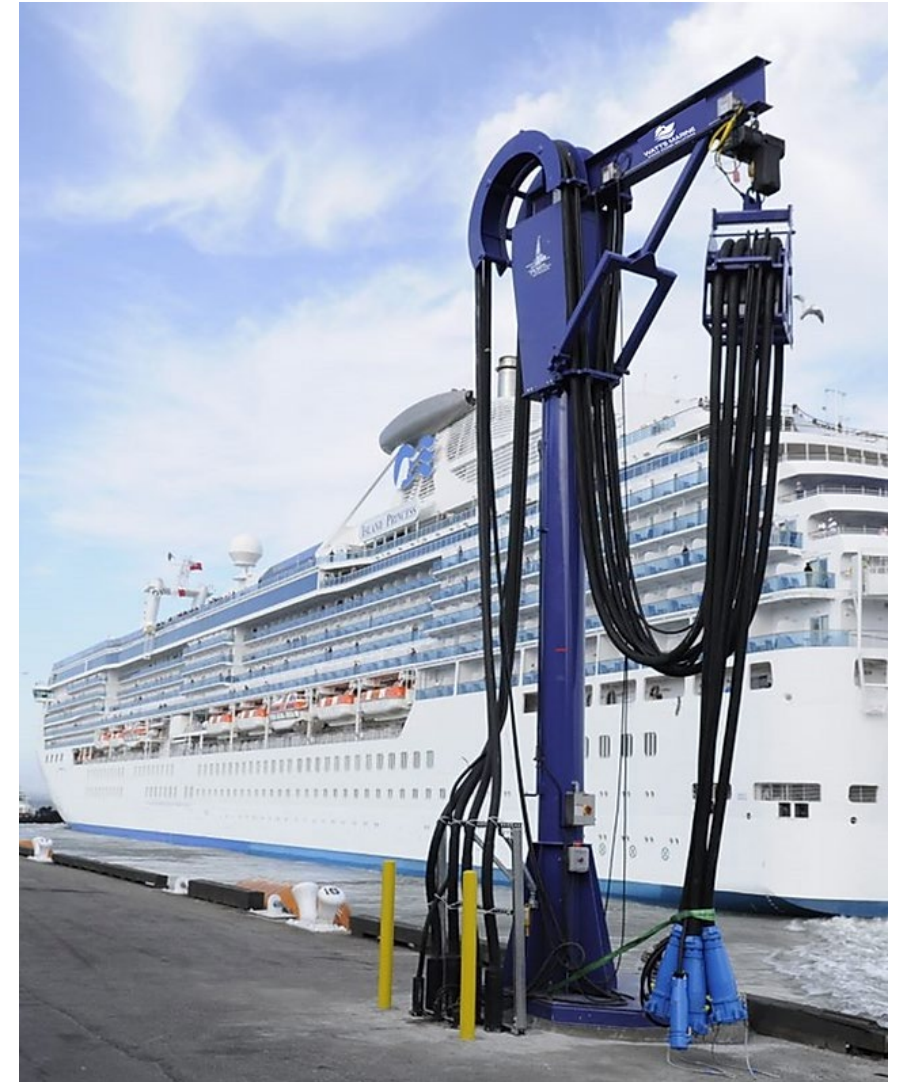
Reward factor *for wind assisted propulsion - WIND (f_{wind})*	$\dfrac{P_{Wind}}{P_{Prop}}$
0,99	0,05
0,97	0,1
0,95	>0,15

*) 2021 guidance on treatment of innovative energy efficiency technologies for calculation and verification of the attained EEDI and EEXI
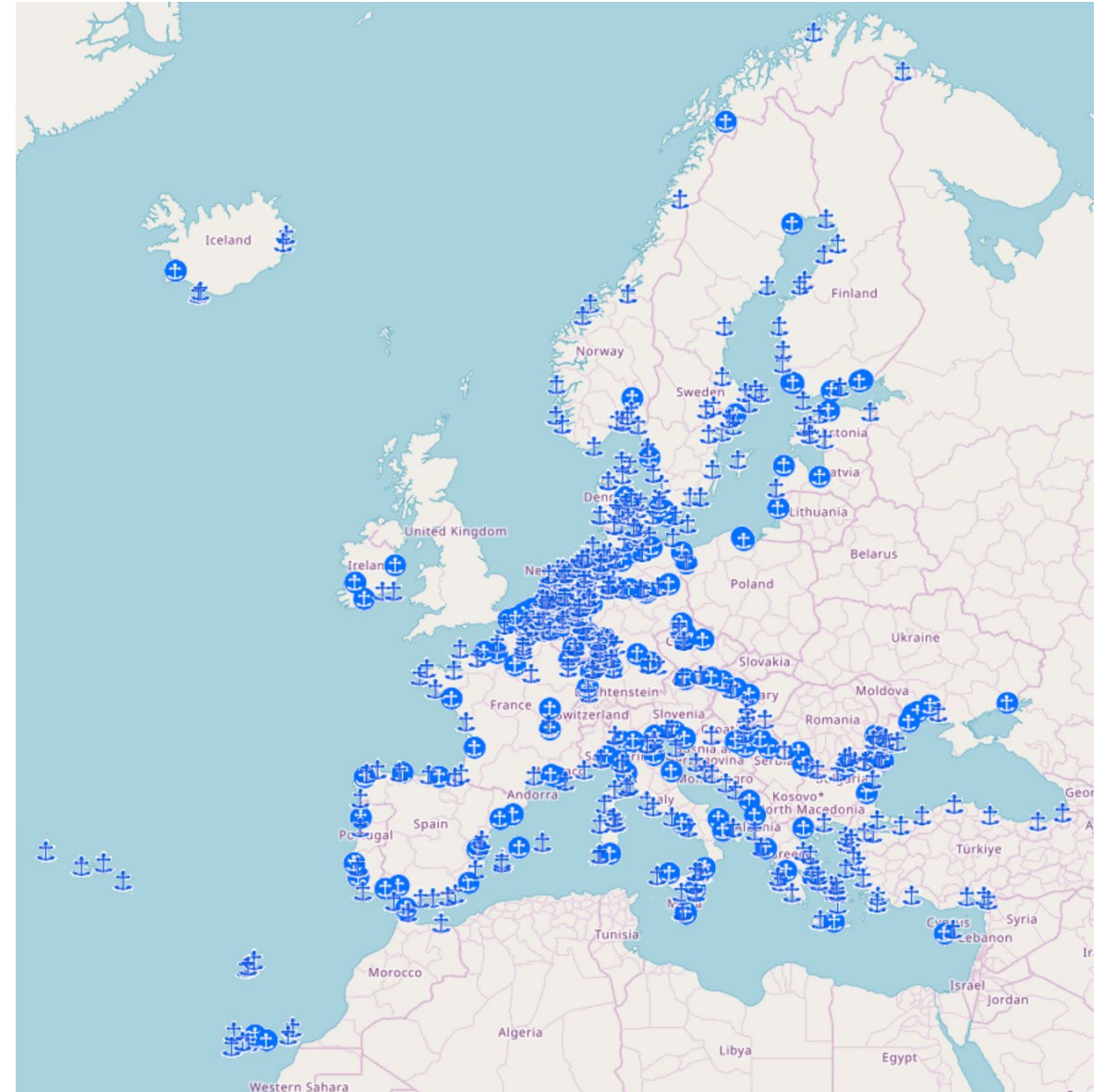
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Shore power

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Shore power requirements

- From 1 January 2030 - **container and passenger ships** not using zero-emission technologies must **connect to shore power while at berth in TEN-T ports** for more than 2 hours

- From 1 January 2035 - **container and passenger ships** in all ports where shore power is available

- Numerous exemption clauses in case of no-fault lack of connectivity or electricity

- Penalty determined as **1.50 € / kWh** multiplied by the **established total electrical power demand of the ship at berth** in kW and by the **total number of rounded-up hours spent at berth in non-compliance**

- **Penalty example**
  - 5000 kW x 100 hours x 1.5 €/kWh = **750 000 €**

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TEN-T ports

- [Trans-European Transport Network (TEN-T) (europa.eu)](#)

- [TENtec Interactive Map Viewer (europa.eu)](#)

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Thank you

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