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**Capture  
the future:  
evolution and  
technologies for  
decarbonization.**

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*The Ecospray journey towards  
2050 goals: development of the  
carbon capture technologies for  
the shipping industry.*

***Second Decarbonization Seminar***

21<sup>st</sup> SEPTEMBER 2023  
INTERCONTINENTAL HOTEL  
ATHENAEUM ATHENS  
Syngrou Avenue 89-93  
11745, Athens

**ECOSPRAY**  
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# **Carbon capture technologies: overview and status.**

Maurizio Archetti

*President*

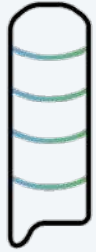
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market leader  
in **EGCS for  
Marine engines**



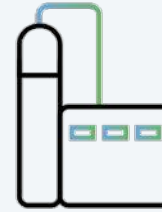
a global company  
that is part of **Carnival  
Corporation**



**5% R&D**  
investment  
to turnover



**2 labs** for in-house  
validation of test  
protocols, a **3<sup>rd</sup> lab**  
for fuel cell tests



**800+**  
systems installed  
worldwide

**Ecospray** started in 2005 as an engineering company.

For 15 years we have made marine and industrial processes more sustainable with the cleaning and treatment of polluting emissions.

Today we offer a wide range of **technological solutions**, driven by the target of creating **clean energy for a zero-emission Planet** for every industry.

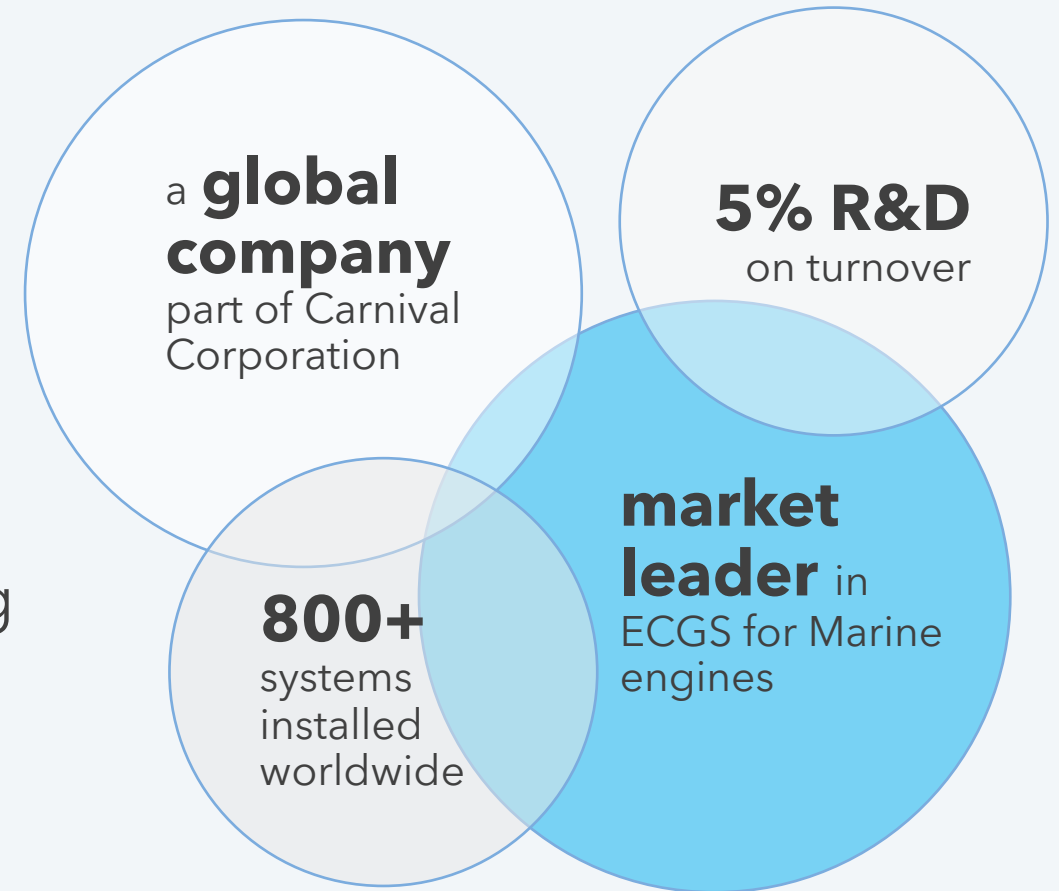
# Ecospray





# What we do

- Research & Development
- Design & Engineering
- Production
- Installation supervision & commissioning
- After sales support
- User training & management



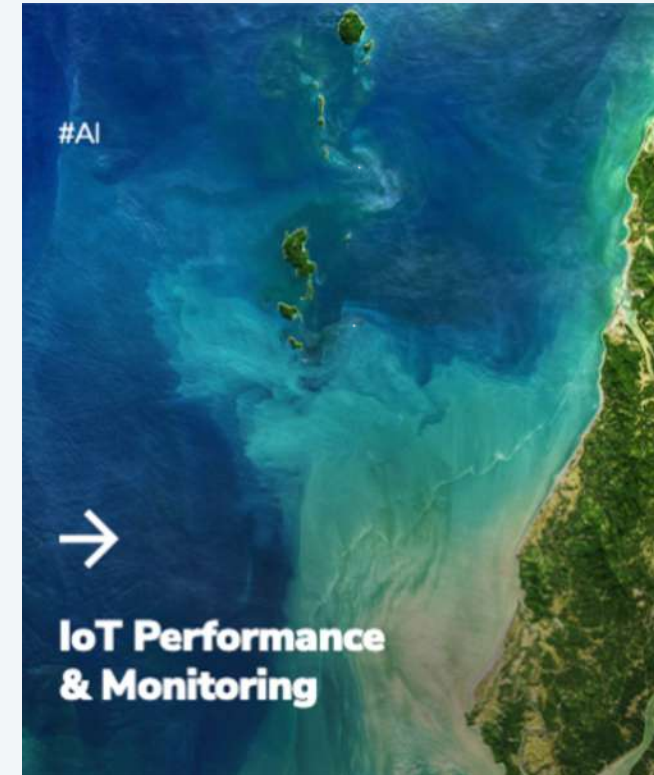
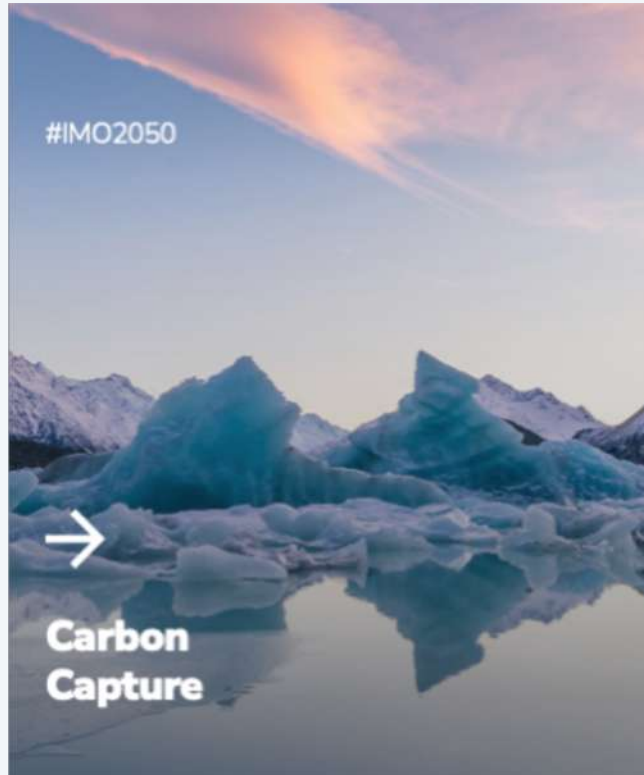
Starting from **R&D** and thanks to our 360° approach, we follow our clients along the **entire value chain**.

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# with you for a Zero Emission 2050



... get ready for **decarbonization**



# Clean Fuels: bio-LNG expanding network

## The technology package includes:

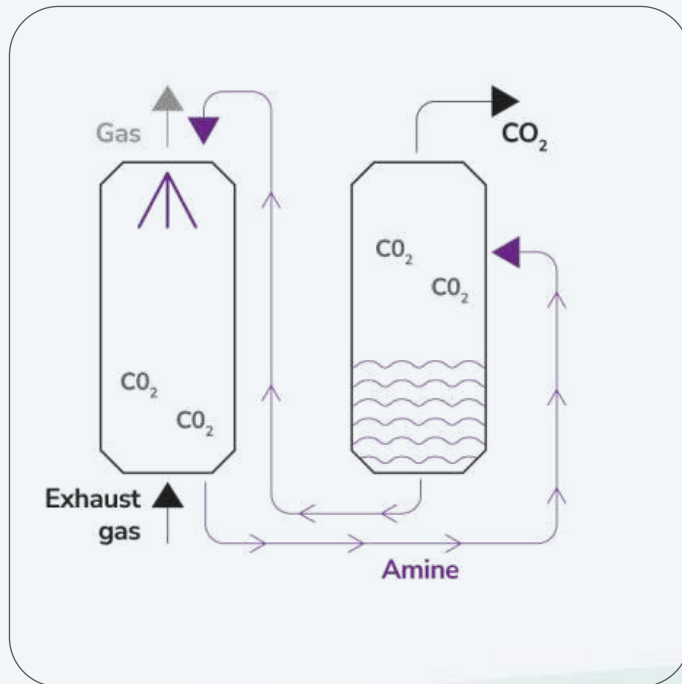
- **Biogas upgrading** (biogas → biomethane)
- **Liquefaction** (biomethane → bio-LNG)
- **Biogenic LCO<sub>2</sub>** production (industrial or food-grade)



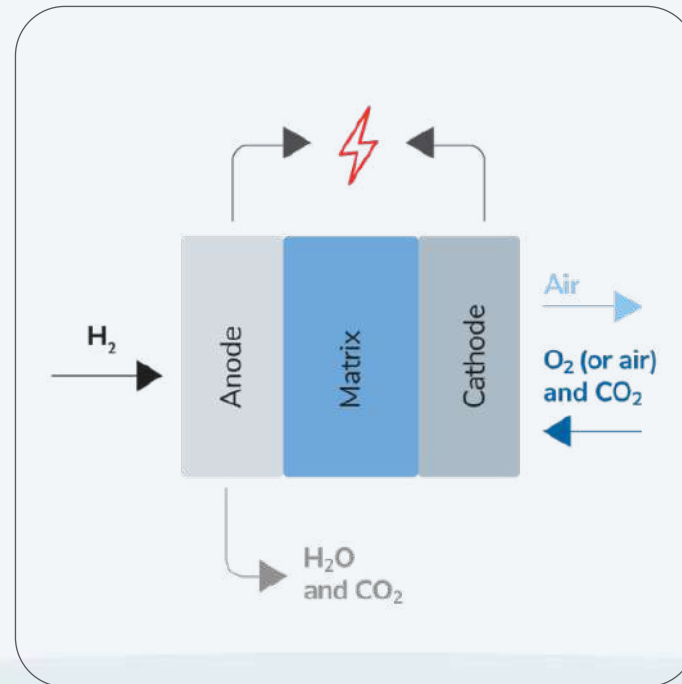
- 1 bio-LNG facility completed in 2022 (Germany) – 3 TPD
- 3 bio-LNG facilities under installation (2 Germany, 1 Italy)
- 4 bio-LCO<sub>2</sub> projects in progress (Germany)
- 13 facilities to be completed within mid 2024
- Tot. combined bio-LNG capacity ~100 TPD

# Carbon Capture technologies

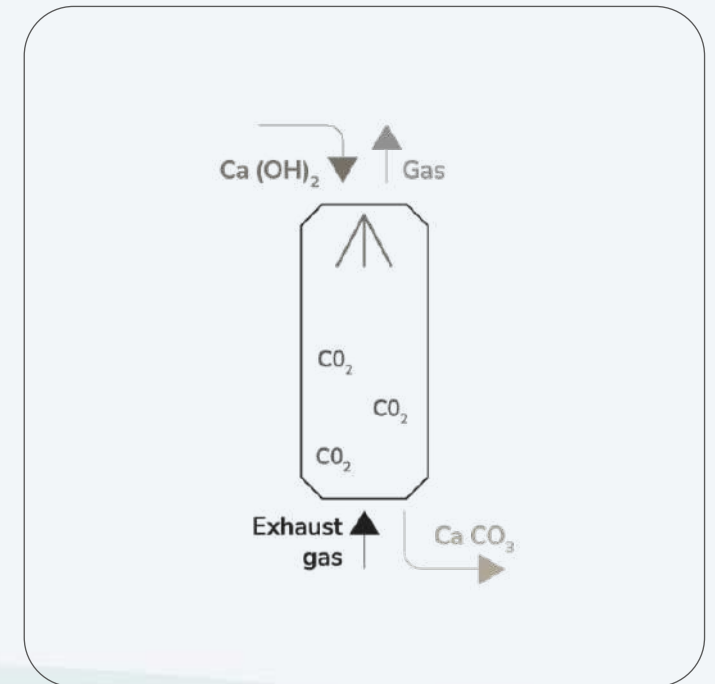
## Amines



## MCFC



## Ca(OH)<sub>2</sub>







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# Regulatory overview: what after MEPC 80?

Alberto Di Cecio

*General Manager*

*Second Decarbonization Seminar*

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## Overview

### IMO and EU regulatory framework for GHG emissions reduction from international shipping

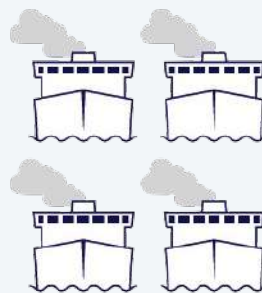
Approved in June 2023, enforced from 2025 for emissions reported in 2024

Candidate mid-term GHG reduction measure, as per 2023 IMO revised strategy (resolution MEPC 377(80))

#### EU Emissions Trading System

#### Global market-based measure

- **Addresses:** Ship/fleet GHG emissions
- **Applicable measures:** All GHG reduction measures



Fleet emissions

#### FuelEU Maritime

#### Global GHG fuel standard

- **Addresses:** Fuel well-to-wake GHG intensity
- **Applicable measures:** Alternative fuels, shore power, wind

- IMO - adopted
- IMO - proposed
- EU - proposed (Fit for 55)
- Operational requirement
- Design requirement
- GHG price

Approved in July 2023, enforced from 2025

Candidate mid-term GHG reduction measure, as per 2023 IMO revised strategy (resolution MEPC 377(80))

#### Carbon Intensity Indicator

- **Addresses:** Actual carbon intensity
- **Applicable measures:** All measures except logistics

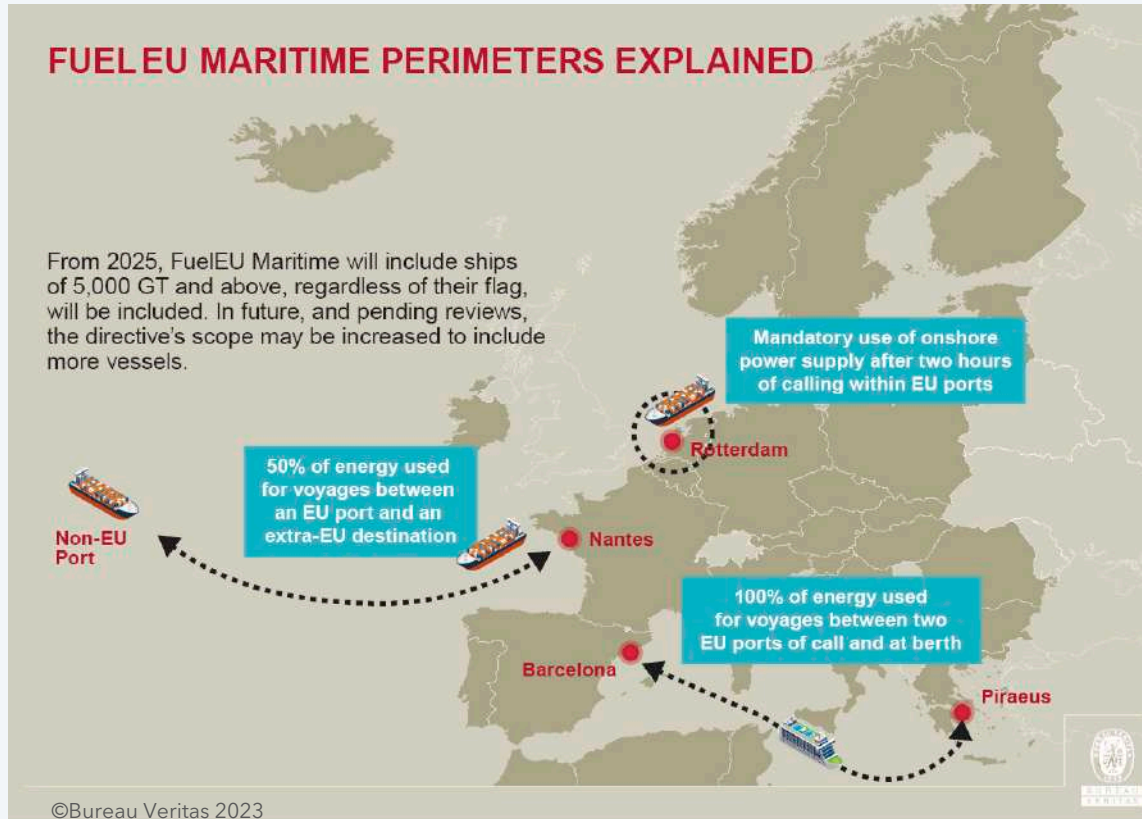
#### Ship Energy Efficiency Management Plan

- **Addresses:** Continuous improvement
- **Applicable measures:** All measures except logistics

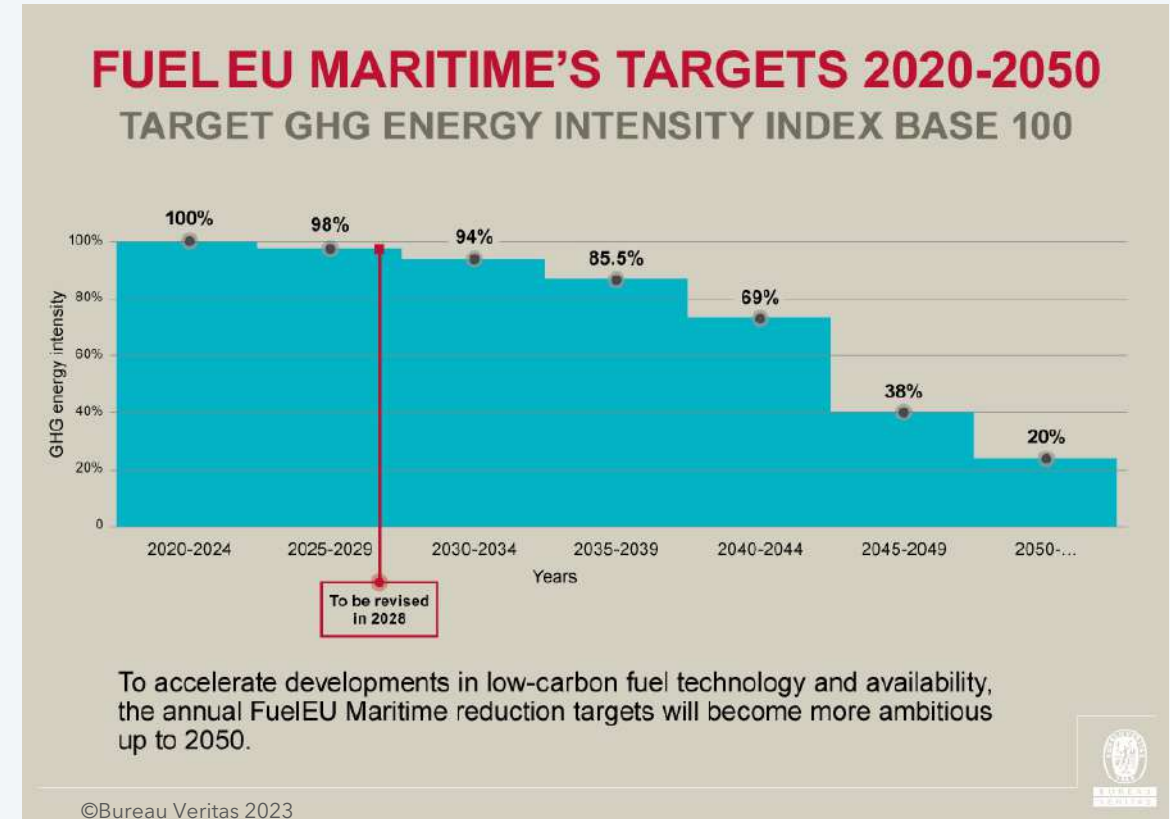
#### EEDI/EECI

- **Addresses:** Ideal carbon intensity
- **Applicable measures:** New ships: Hull, machinery, LNG, speed; Existing ships: Speed, basic hull improvements

## FuelEU Maritime - 1



- Applicable to vessels of 5,000+ GT
- 100% of energy for intra-EU voyages, 50% for extra-EU
- 50% for transshipment (within 300 Nm/65% of traffic)

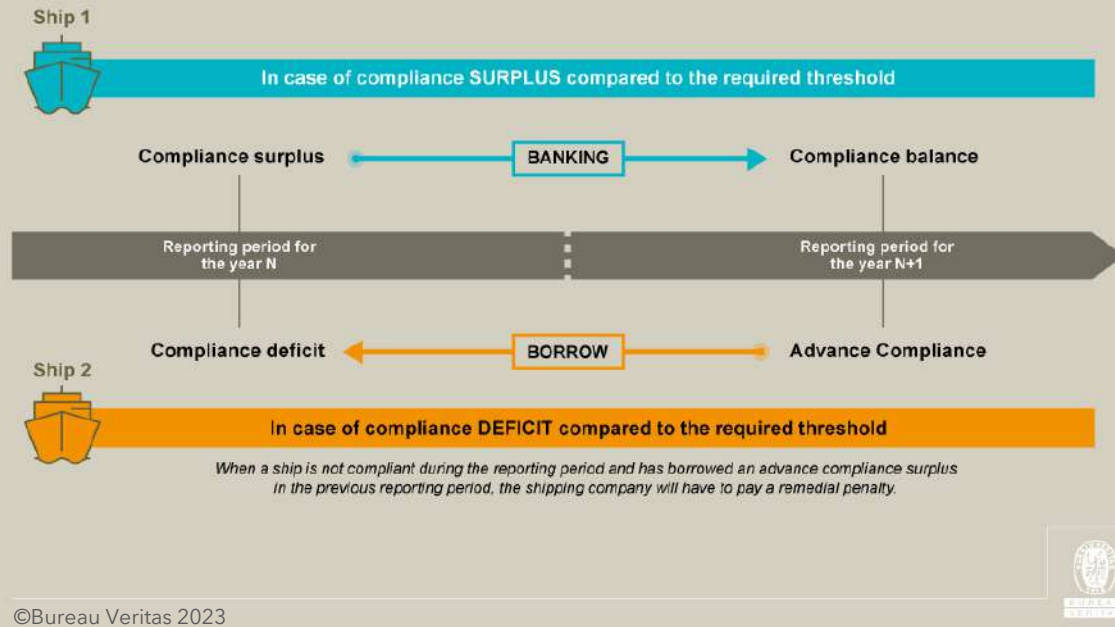


- Increasing annual reduction targets
- Renewable fuels incentivized between 2025 and 2034
- Mandatory use of OPS for container and passenger vessels



## FuelEU Maritime - 2

### FLEXIBILITIES TO COMPLY WITH FUEL EU MARITIME BANKING



- Compliance achievable through banking, borrowing and pooling (flexibility allowed)
- Standardized emissions monitoring plan to be submitted by August 2024
- Allowed pooling for ships verified by the same body

### FLEXIBILITIES TO COMPLY WITH FUEL EU MARITIME POOLING

Two or more ships may pool their compliance balance to achieve compliance per individual ship, even if they are controlled by more than one company.

#### PERMITTED

- Total pooled compliance is positive.
- The ship which has a compliance deficit is compliant after the allocation of the pooled compliance.
- The ship which had a compliance surplus does not have a compliance deficit after the allocation of the pooled compliance.



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- The ship which had a compliance surplus does not have a compliance deficit after the allocation of the pooled compliance.



#### NOT PERMITTED

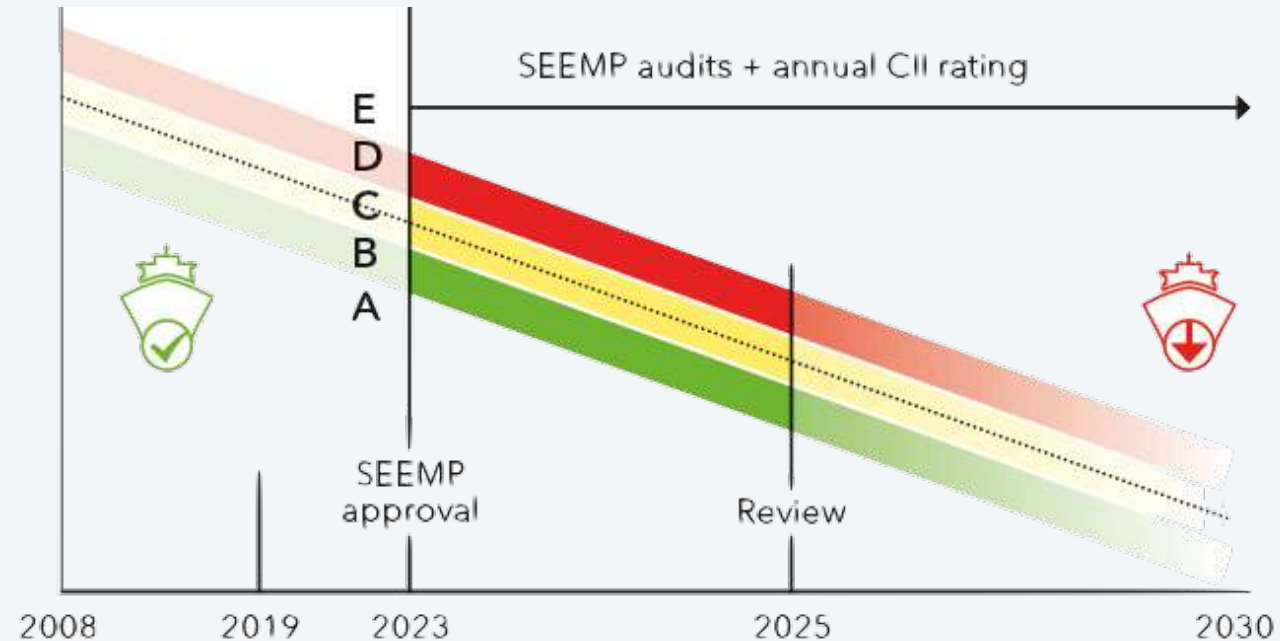
- Total pooled compliance have to be positive (100% for two ships).
- A ship which had a compliance deficit can not have a higher compliance deficit after the allocation of the pooled compliance.



©Bureau Veritas 2023

- Pooling allowed for ships compliant in the year n-1
- The total pooled compliance must be positive
- Pools and compliance allocation are recorded by April 30<sup>th</sup> every year

## CII open topics



©DNV 2022

After MEPC 80 there are currently three main open topics in terms of GHG impact and CII reduction:

- **Biofuels** → partially addressed by the Interim Guidance (MEPC.1/Circ.905) issued by MEPC 80, allowing certified sustainable biofuels with Well-to-Wake GHG emissions reduction of at least 65% to be used to improve a ship's CII rating
- **E-fuels** → MEPC adopted the LCA guidelines resolution MEPC 376(80) which will be used to support any mid-term measures adopted by MEPC at future sessions. The LCA guidelines allow for a Well-to-Wake calculation, including Well-to-Tank and Tank-to-Wake emission factors, of total GHG emissions related to the production and use of marine fuels
- **Carbon capture** → due to differences in opinion over whether the CO<sub>2</sub> capture should be considered a part of the fuel life-cycle analysis framework, or as a separate workstream, all the proposals related to the onboard CCS have been forwarded to ISWG-GHG 16 for further consideration if time permits, prior to review by MEPC 81



## What's next?

### Carbon capture

Even though some useful guidelines became available recently (e.g. ClassNK in April 2023), there are still several open topics about onboard CCS related to:

- design and construction
- arrangement
- equipment
- electrical installation
- safety and protection
- Class notations (CCS-ready?).



### Alternative solutions

Other carbon capture solutions currently under development would not require onboard or shoreside liquefaction/storage, e.g. calcium hydroxide. There are still several unanswered questions from the regulatory point of view, on top of the ones generally applicable to carbon capture technologies. Those questions are mostly related to the measurement of captured CO<sub>2</sub> and to the associated discharge into the oceans.

### Onboard storage

Particular attention will be needed for onboard storage, since for real-scale applications most likely stand-alone tanks will be needed. Some key challenges are:

- volumes (storage in the range of 1,000+ m<sup>3</sup> will be needed)
- onboard arrangement, particularly for avoiding cargo loss and/or specific constraints (e.g. passenger vessels)
- possibility to strip CO<sub>2</sub> (e.g. amines regeneration) shoreside, particularly interesting for regular itineraries.

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**Thank you**  
**[dicecio@ecospray.eu](mailto:dicecio@ecospray.eu)**

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