

# La Carbon Capture nell'evoluzione del quadro normativo sulle emissioni

*27<sup>th</sup> November 2023*

The background of the slide is a night-time aerial view of a city skyline, likely Singapore, with numerous skyscrapers illuminated. Overlaid on this image are numerous vertical and diagonal lines of various colors (blue, purple, red) that connect different points, creating a digital network or data flow effect.

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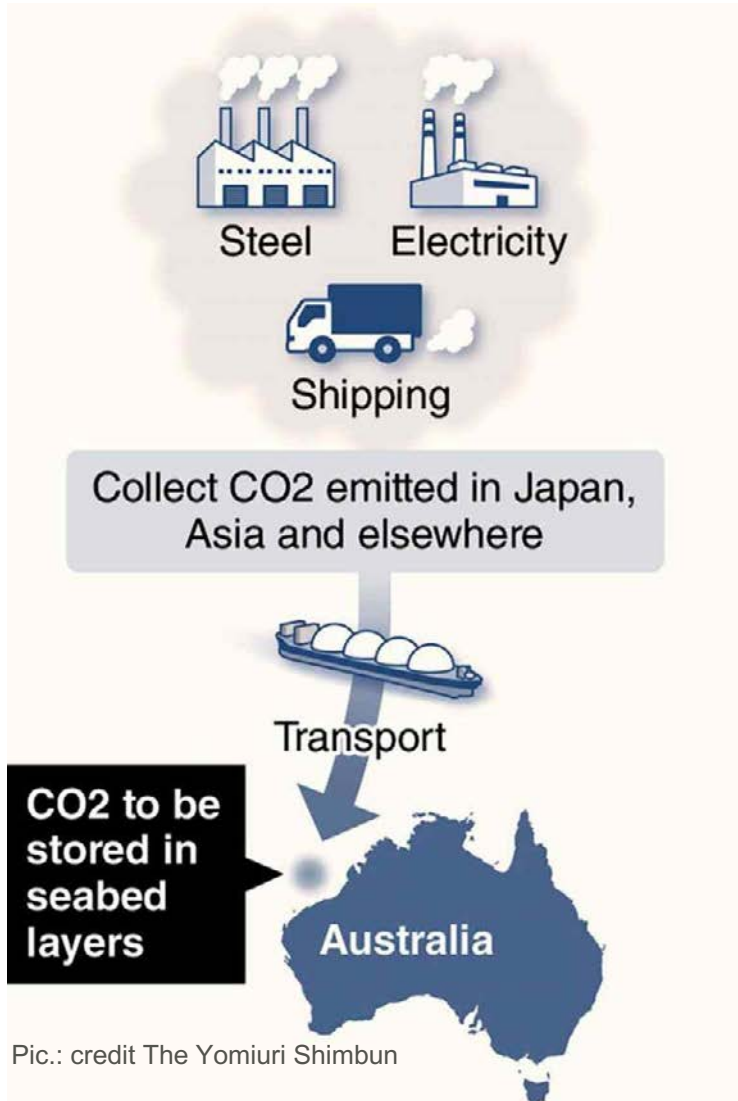
# SUMMARY



- **Introduction**
- **IMO – submissions of documents on CCS**
- **EU (MRV, ETS & FEUM) regulations & CCS**

# INTRODUCTION

## The chain: Emission, Capture, Transport, Storage

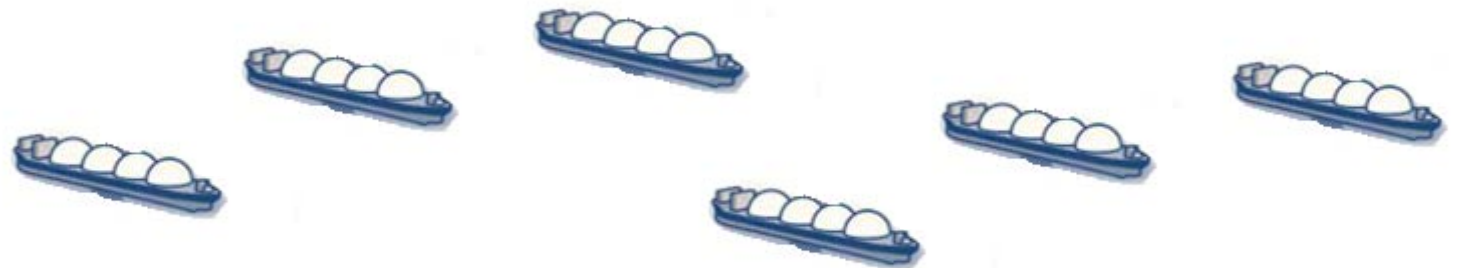


Pic.: credit The Yomiuri Shimbun

Carbon capture is a continuous process of CO<sub>2</sub> emission separation of from exhaust gases emission of industrial plants and transport means

Captured CO<sub>2</sub> is stored, and in almost all cases is to be shipped to the final storage location. A marine transportation system includes port temporary storage on land and loading-unloading facilities.

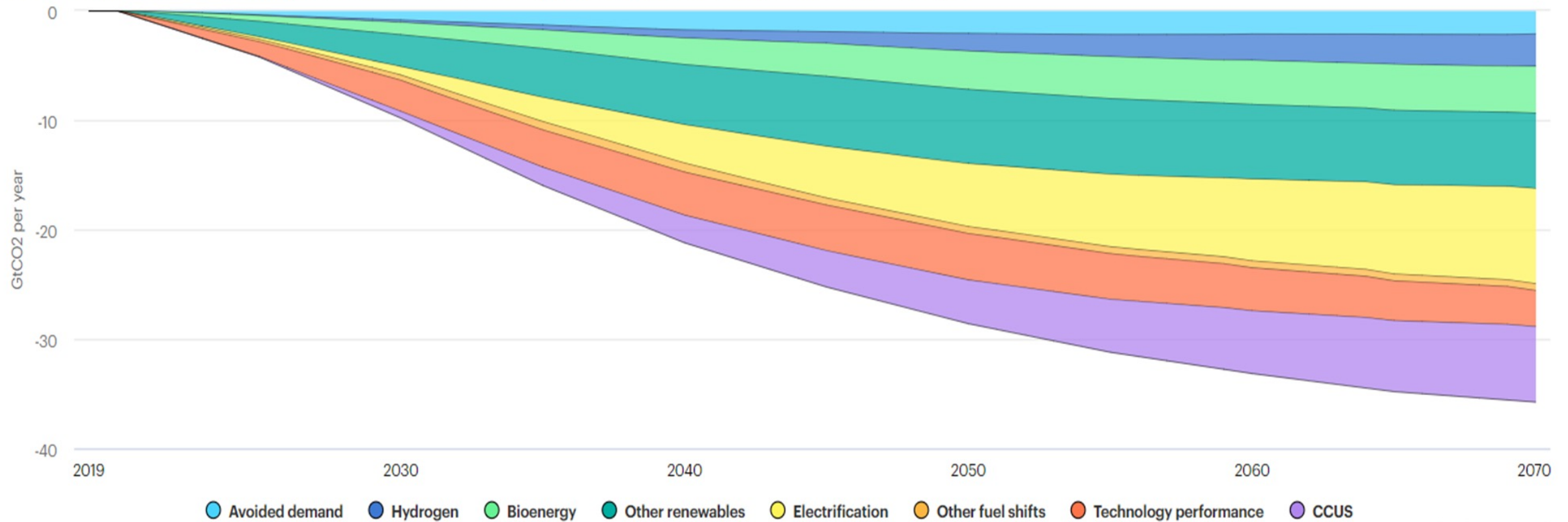
Quantity of captured CO<sub>2</sub>, transport distance, and technical restrictions are parameter that will determine the capacity, the speed, and the number of ships the market will require



# INTRODUCTION - Scenario according to IEA (International Energy Agency)



CO2 emissions reductions in the energy sector in the Sustainable Development Scenario relative to the Stated Policies Scenario



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Cumulative emissions reductions, 2020-2070

Source: <https://www.iea.org/reports/ccus-in-clean-energy-transitions/ccus-in-the-transition-to-net-zero-emissions>



# IMO – Submission on CCS MEPC 79/7/4

Proposal for including carbon capture technologies in the IMO regulatory framework to reduce GHG emissions from ships:

- RINA Decarbonization Committees provided the first draft (including Ecospray contribution)
- Sponsored by Liberia and ICS
- Submitted to MEPC 79 as MEPC 79/7/4
- CCS in EEDI/EEXI, CII and CO<sub>2</sub> Receipt Note

## MEPC 79 OUTCOME:

The Committee invited Member States to submit other documents on this subject to MEPC 80 2023)

MARINE ENVIRONMENT PROTECTION  
COMMITTEE  
79th session  
Agenda item 7

MEPC 79/7/4  
10 September 2022  
Original: ENGLISH  
Pre-session public release: ☒

### REDUCTION OF GHG EMISSIONS FROM SHIPS

Proposal for including carbon capture technologies in the IMO regulatory framework  
to reduce GHG emissions from ships

Submitted by Liberia and ICS

#### SUMMARY

*Executive summary:* This document proposes to consider the CO<sub>2</sub> reduction obtained from carbon capture technologies and regulate them in the EEDI/EEXI and CII frameworks.

*Strategic direction,  
if applicable:* 3

*Output:* 3.2

*Action to be taken:* Paragraph 15

*Related documents:* MEPC 78/17; Resolutions MEPC.304(72), MEPC.308(73), MEPC.328(76) and MEPC.352(78)

# Other submissions on CCS

## MEPC 79

MEPC 79/7/6 Rep. of China

**IMO** INTERNATIONAL MARITIME ORGANIZATION

MARINE ENVIRONMENT PROTECTION COMMITTEE  
79th session  
Agenda item 7

MEPC 79/7/6  
30 September 2022  
Original: ENGLISH  
Pre-session public release:

**REDUCTION OF GHG EMISSIONS FROM SHIPS**

**Proposed amendments to EEDI calculation Guidelines to incorporate Carbon Capture system for Ship Exhaust gas (CCSE)**

Submitted by China

SUMMARY	
<b>Executive summary:</b>	The document proposes amendments to the EEDI calculation Guidelines to incorporate the positive emission reduction effects by the installation of a Carbon Capture system for Ship Exhaust gas (CCSE).
<b>Strategic direction, if applicable:</b>	3
<b>Output:</b>	3.2
<b>Action to be taken:</b>	Paragraph 10
<b>Related documents:</b>	Resolution MEPC.304(72); resolution MEPC.308(73); resolution MEPC.322(74); resolution MEPC.332(76); MEPC 76/7/17; and MEPC 78/17

MEPC 79/7/7 Rep. of China

**IMO** INTERNATIONAL MARITIME ORGANIZATION

MARINE ENVIRONMENT PROTECTION COMMITTEE  
79th session  
Agenda item 7

MEPC 79/7/7  
30 September 2022  
Original: ENGLISH  
Pre-session public release:

**REDUCTION OF GHG EMISSIONS FROM SHIPS**

**Proposed amendments to EEDI Survey and Certification Guidelines to incorporate a Carbon Capture system for Ship Exhaust gas (CCSE)**

Submitted by China

SUMMARY	
<b>Executive summary:</b>	This document proposes amendments to the corresponding EEDI Survey and Certification Guidelines, taking into account the updated EEDI calculation Guidelines as proposed in document MEPC 79/7/6, which incorporates the positive emission reduction effects by the installation of a Carbon Capture system for Ship Exhaust gas (CCSE).
<b>Strategic direction, if applicable:</b>	3
<b>Output:</b>	3.2
<b>Action to be taken:</b>	Paragraph 3
<b>Related documents:</b>	Resolution MEPC.254(67); resolution MEPC.261(68); resolution MEPC.304(72); resolution MEPC.309(73); MEPC.1/Circ.855/Rev.2; MEPC 76/7/17 and MEPC 78/17

MEPC 79/7/7 Norway

**IMO** INTERNATIONAL MARITIME ORGANIZATION

MARINE ENVIRONMENT PROTECTION COMMITTEE  
79th session  
Agenda item 7

MEPC 79/7/16  
7 October 2022  
Original: ENGLISH  
Pre-session public release:

**REDUCTION OF GHG EMISSIONS FROM SHIPS**

**Carbon capture and storage on board ships**

Submitted by Norway

SUMMARY	
<b>Executive summary:</b>	The document considers how carbon capture and storage can reduce GHG emissions from shipping, and what needs to be addressed by the Organization to enable the use of carbon capture technology on ships and ensure responsible handling and storage of the captured carbon dioxide. Finally, it proposes a process for how the Organization can work on this issue.
<b>Strategic direction, if applicable:</b>	3
<b>Output:</b>	3.2
<b>Action to be taken:</b>	Paragraph 38
<b>Related documents:</b>	MEPC 76/7/17, Resolution LP.1(1), Resolution LP.3(4), Resolution LP.5(14) and LC 34/15 annex 8

MEPC 79/7/22 Rep. of Korea

**IMO** INTERNATIONAL MARITIME ORGANIZATION

MARINE ENVIRONMENT PROTECTION COMMITTEE  
79th session  
Agenda item 7

MEPC 79/7/22  
7 October 2022  
Original: ENGLISH  
Pre-session public release:

**REDUCTION OF GHG EMISSIONS FROM SHIPS**

**Proposal to include onboard CO<sub>2</sub> capture system in the IMO GHG regulatory framework**

Submitted by Republic of Korea

SUMMARY	
<b>Executive summary:</b>	This document proposes to include the CO <sub>2</sub> reduction of onboard CO <sub>2</sub> capture system in the IMO GHG regulatory framework including EEDI, EEXI and CII to remove regulatory barriers to innovative technology and to provide a level playing-field and cost-effective opportunity for decarbonization of shipping industry.
<b>Strategic direction, if applicable:</b>	3
<b>Output:</b>	3.2
<b>Action to be taken:</b>	Paragraph 23
<b>Related documents:</b>	Resolutions MEPC.304(72), MEPC.328(76), MEPC.332(76), MEPC.350(78), MEPC.352(78), MEPC.355(78); MEPC 76/7/17, MEPC 76/7/44, MEPC 78/17, MEPC.1/Circ.896 and ISWG-GHG 11/2/3

Other proposals on CCS:

- Sponsored by China, Norway, Korea
- CCS in EEDI/EEXI, CII, verification, working group

# Informal Group on CCS

## MEPC 80/7/7



**Proposal to establish  
a WG on CCS: not yet  
passed**



**Informal group (China, Japan, Liberia, Norway, Republic of Korea, who submitted proposal at MEPC 79 + ASEF) prepared a joint submission for MEPC 80**

- **The concept:** CCS as technology able to facilitate the transition period and contribute to the climate target achievement
- CCS to be assessed and subject to agreement included within the regulatory framework
- MEPC 80/7/7 The use of onboard carbon capture systems within IMO's regulatory framework

### Proposed terms of reference

- undertake a regulatory scoping exercise for the use of onboard CO<sub>2</sub> capture;
- develop a work plan to accommodate onboard CO<sub>2</sub> capture within the IMO's regulatory framework; and
- submit a written report to MEPC 81.

# All submissions on CCS

## MEPC 80



### MEPC 80/7 (RINA) MEPC 80/INF.14

- analysis of **technical and economic** aspects of onboard carbon capture (OCC) technology applied to different ship types and sizes (container, bulk and tanker), main carbon-based fuels and full and partial application as part of a retrofit or newbuild;

### MEPC 80/7/7 (China et al.)

- **dedicated work stream on onboard CO<sub>2</sub> capture** and that, as the first step, a structured review of the current IMO regulatory framework should be undertaken as part of the development of a work plan to accommodate onboard CO<sub>2</sub> capture within IMO's regulatory framework

### MEPC 80/7/10 (IBIA)

- identification of requirements for **preparation of marine diesel engine exhaust gases for shipboard carbon capture (SBCC)** technologies

### MEPC 80/INF.31 (Korea)

- preliminary **assessment of zero and negative emissions depending on the origin of carbon** in fuel and the fate of CO<sub>2</sub>

### MEPC 80/INF.32 (India)

- initiation of **policy action to limit GHG emissions from engine exhausts through carbon capture, storage, utilization/sequestration (CCUS)**

## MEPC 80 OUTCOME:

Following consideration, the Committee agreed to instruct ISWG-GHG 16, **if time permitted**, to consider the proposals related to onboard CO<sub>2</sub> capture, using document MEPC 80/7/7 (China et al.) as a basis and taking into account documents MEPC 80/7 (RINA), MEPC 80/7/10 (IBIA), MEPC 80/INF.14 (RINA), MEPC 80/INF.31 (Republic of Korea), MEPC 80/INF.32 (India), MEPC 79/7/4 (Liberia and ICS), MEPC 79/7/6 (China), MEPC 79/7/7 (China), MEPC 79/7/16 (Norway), MEPC 79/7/22 (Republic of Korea) and MEPC 79/INF.27 (Republic of Korea), **and advise the Committee on a way forward**



# Work in progress on CCS

## Submission to MEPC 80



### How to incorporate onboard carbon capture in the Organization's regulatory framework

- Chapter 4 of MARPOL Annex VI
- London Protocol on geological storage of CO<sub>2</sub>
- The legal classification of CO<sub>2</sub> / status of the captured CO<sub>2</sub> which is temporarily stored onboard (waste, a pollutant/harmful substance or a cargo)
- Classification and possible implications on transboundary movement of carbon dioxide
- Ownership of CO<sub>2</sub> delivered to a CO<sub>2</sub>-terminal for onward transport and storage
- Certification of the onboard CCS system itself in respect of e.g. CO<sub>2</sub> capture rate and monitoring of key parameters during operation
- Comparison with EGCS
- Attained EEDI/EEXI (i.e. subtracting the quantity of CO<sub>2</sub> captured per hour of operation taking into account the CO<sub>2</sub> storage capacity)
- Attained CII through the reduction of the total mass of CO<sub>2</sub> emitted on the basis of the CO<sub>2</sub> emission in the air

# CCS & IMO

## Current status



- Currently, **onboard CO<sub>2</sub> capture is not incorporated** in the IMO's regulatory framework of short terms measures (EEDI, EEXI, SEEMP, CII) even if several proposals have been submitted to MEPC 79 and 80
- Likely, before next MEPC 81, **ISWG-GHG 16 will not consider the proposals** related to onboard CO<sub>2</sub> capture due to time constraints
- **LCA guidelines**, approved at MEPC 80, but still in discussion in the Correspondence Group on the Further Development of the LCA , **is taking into account carbon capture, both for fuel production and onboard capture**

# CCS and LCA Guidelines



$$GHG_{TtW} = \frac{1}{LCV} \left( \left( 1 - \frac{1}{100} (C_{slip\_ship} + C_{fug}) \right) \times (C_{fCO_2} \times GWP_{CO_2} + C_{fCH_4} \times GWP_{CH_4} + C_{fN_2O} \times GWP_{N_2O}) + \left( \frac{1}{100} (C_{slip\_ship} + C_{fug}) \times C_{sfx} \times GWP_{fuelx} \right) - S_{Fc} \times e_c - S_{Fccu} \times e_{ccu} - e_{OCCS} \right)$$

Note: terms  $S_{Fccu}$ ,  $e_{ccu}$  and  $e_{OCCS}$  are pending further methodological guidance to be developed by the Organization.  
For more details refer to footnotes 11 to 13.

Emission credit due  
to biomass growth

Emission credit from the used captured  
CO<sub>2</sub> to produce synthetic fuels

Emission credit due to CC  
on board and storage



# CCS and LCA Guidelines

$$GHG_{TtW} = \frac{1}{LCV} \left( \left( 1 - \frac{1}{100} (C_{slip\_ship} + C_{fug}) \right) \times (C_{fCO_2} \times GWP_{CO_2} + C_{fCH_4} \times GWP_{CH_4} + C_{fN_2O} \times GWP_{N_2O}) + \left( \frac{1}{100} (C_{slip\_ship} + C_{fug}) \times C_{sfx} \times GWP_{fuelx} \right) - S_{Fc} \times e_c - S_{Fccu} \times e_{ccu} - e_{OCCS} \right)$$

*Note: terms  $S_{Fccu}$ ,  $e_{ccu}$  and  $e_{OCCS}$  are pending further methodological guidance to be developed by the Organization. For more details refer to footnotes 11 to 13.*



Term	Units	Explanation	Note	CG status
$e_{OCCS}$	gCO <sub>2eq</sub> /g fuel	Emission credit from carbon capture and storage ( $e_{OCCS}$ ), where capture of CO <sub>2</sub> occurs onboard. This should properly account for the emissions avoided through the capture and sequestration of emitted CO <sub>2</sub> , if CCS occurs on-board. From the above-mentioned emission credit, all the emissions resulting from the process of capturing ( $e_{cc}$ ), and transporting ( $e_t$ ) the CO <sub>2</sub> up to the final storage (including the emissions related to the injection, etc.) need to be deducted. This element should be calculated with the following formula: $e_{OCCS} = c_{SC} - e_{cc} - e_t - e_{st} - e_x$	Pending further methodological guidance to be developed by the Organization, the value of $e_{OCCS}$ should be set to zero.	No default emission factors are provided for the use of onboard CCS ( $e_{OCCS}$ ), the amount of captured carbon per unit of fuel mass should be specifically certified. The parameters related to emission credits from the used captured CO <sub>2</sub> as carbon stock to produce synthetic fuels ( $e_{ccu}$ ) requires further development. The need for considering the long-term storage, when a specific credit for the CCS pathways is generated, is valid for both on-board and on-land pathways. Specific guidelines are needed for the $e_{st}$ term. Associated with the long-term storage of CO <sub>2</sub> there are potential leakages to be considered.  <b>Working on methodological position, measurement methods, shop tests on carbon capture system , onboard measurements on carbon capture system, numerical calculation on carbon capture, type approval of the system, system degradation.</b>
$c_{SC}$	gCO <sub>2</sub> /g fuel	Credit equivalent to the CO <sub>2</sub> captured and stored (long-term: 100 years)		
$e_{cc}$	gCO <sub>2eq</sub> /g fuel	Any emission associated with the process of capturing, compress and temporarily store on-board the CO <sub>2</sub>		
$e_t$	gCO <sub>2eq</sub> /g fuel	Emissions associated with transport to long-term storage site		
$e_{st}$	gCO <sub>2eq</sub> /g fuel	Any emission associated with the process of storing (long-term: 100 years) the captured CO <sub>2</sub> (including fugitive emissions that may happen during long-term storage and/or the injection of CO <sub>2</sub> into the storage)		
$e_x$	gCO <sub>2eq</sub> /g fuel	Any additional emission related to the CCS		

# CCS

## EU Fit for 55



**EU ETS:** captured emissions shall be multiplied by zero

**Fuel EU Maritime:** no benefit for onboard carbon capture

- emissions verified as **captured and transported for permanent storage** to a facility for which a permit is in force in accordance with Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide.
- emissions of greenhouse gases which are considered to have been captured and utilised in such a way that they have become **permanently chemically bound in a product** so that they do not enter the atmosphere under normal use, including any normal activity taking place after the end of the life of the product.”

Table B.6

Application of carbon capture and storage technologies referred to in Part C, point 1.4, of Annex II to Regulation (EU) 2015/757

Description of the technology in use	Supporting evidence for compliance with the requirements spelled out in Article 12(3a) or Article 12(3b) of Directive 2003/87/EC	Emissions source to which capture and storage and/or carbon capture and utilisation is applied



For more info:



**Thank you for  
your attention**

**Our experience. Your growth.**