Rules framework for CO2 capture and storage on ships

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RINA today

5.324
colleagues

200
offices

70
countries

Our People

More than **90 nationalities**

80%+
educated to degree level

42
average age

Who we are

Marine

Certification

Real Estate & Infrastructures

Energy & Mobility

Industry

Energy transition & Decarbonization

IMO Strategy

Regulatory Framework

2018
Initial IMO Strategy on GHG emission reduction

2020-2021
Impact assessment on States of the approved short-term measures

June 2021
MEPC 76: adoption short-terms measures (EEXI, SEEMP, CII)

Mid 2021
Revision of the EU Emissions Trading System (ETS) to include shipping

2023
Review of IMO Strategy

2026
Review of EEXI requirements

2030
Reduction of CO2 per transport work by at least 40% from 2008 baseline

2050
Reduction of CO2 per transport work by 70%
Reduction of GHG by 50% from 2008 baseline

Mandatory Requirements

1/4/2022
Anticipation of EEDI Ph.3 for some type of ships

End 2022
EEXI, SEEMP and CII entry into force.
Attained EEXI ≤ Required EEXI = (1-Y/100) × EEDI reference line value

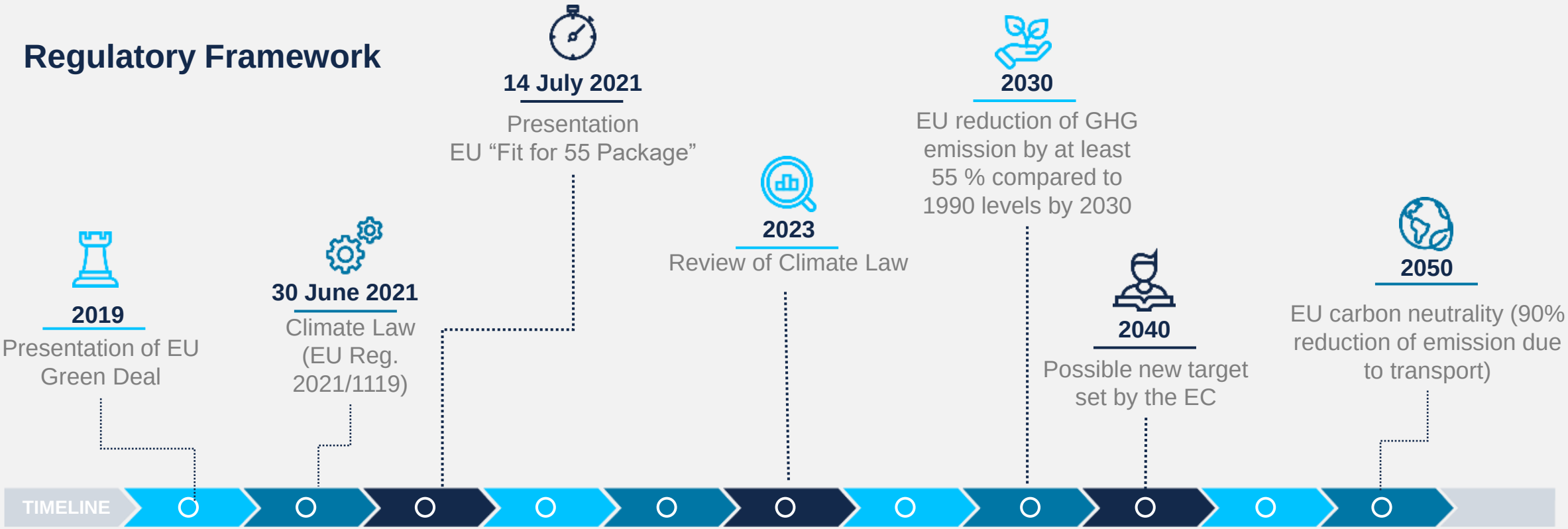
2023
1 Jan. 2023
SEEMP for ships of ≥5000 GT to include CII

2025
EEDI Phase 3 for all ship types

2026
Mandatory application of CII requirements

EU Green Deal and Climate Law

Regulatory Framework

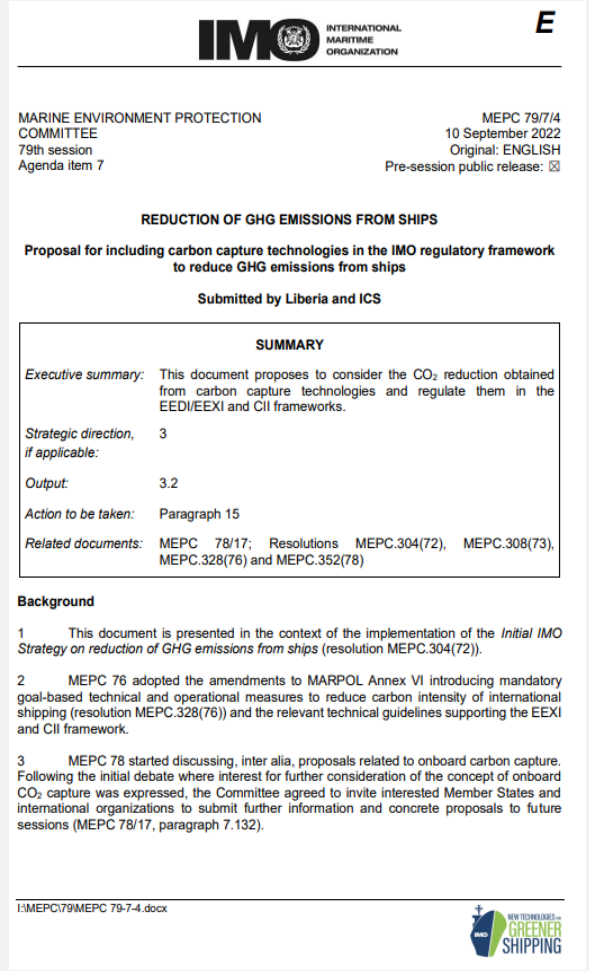


CO_2 IMO Rules Framework

	Storage	Cargo Transport	Capture	Emissions	Port Disposal
IMO	SOLAS Chapter II-1	IGC Code MSC.370(93) § 17.21 and § 17.22	SOLAS Chapter II-1	MEPC 80th CII/EEXI/EEDI 3-7 July 2023	MEPC 80th

Carbon Capture and Storage (CCS) IMO regulatory objectives:

- to identify CCS technologies with proper Technology Level Readiness (TLR) for ships
- to recognize the CCS for the calculation of attained EEDI/EEXI subtracting the quantity of CO_2 captured per hour of operation taking into account the CO_2 storage capacity
- to recognize the CCS for the calculation of attained CII through the reduction of the total mass of CO_2 emitted using a CO_2 receipt note (similar to a BDN)
- to find acceptable CO_2 disposal methodologies
- to find acceptable criteria for the verification and recording of CO_2 disposal



IMO INTERNATIONAL MARITIME ORGANIZATION

E

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_2 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)

Background

1 This document is presented in the context of the implementation of the *Initial IMO Strategy on reduction of GHG emissions from ships* (resolution MEPC.304(72)).

2 MEPC 76 adopted the amendments to MARPOL Annex VI introducing mandatory goal-based technical and operational measures to reduce carbon intensity of international shipping (resolution MEPC.328(76)) and the relevant technical guidelines supporting the EEXI and CII framework.

3 MEPC 78 started discussing, inter alia, proposals related to onboard carbon capture. Following the initial debate where interest for further consideration of the concept of onboard CO_2 capture was expressed, the Committee agreed to invite interested Member States and international organizations to submit further information and concrete proposals to future sessions (MEPC 78/17, paragraph 7.132).

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CO_2 IACS Rules Framework

	Storage	Cargo Transport	Capture	Emissions	Port Disposal
IACS	Machinery Class Rules	CO_2 / LPG Carriers Standards and Class Rules	Machinery Class Rules	MEPC 80th CII/EEXI/EEDI 3-7 July 2023	MEPC 80th

Carbon Capture and Storage (CCS) IACS regulatory objectives:

- to identify CCS technologies with proper Technology Level Readiness (TLR) for ships
- to perform risk assessment for each technology including compression or liquefaction systems for CO2 as well handling of leakages and discharge operations
- to evaluate gaps in the current IACS requirements and possible new requirements related to the safety aspects
- to issue suitable recommendations, unified requirements or unified intepretations

Why CCS may play a role in shipping?

Annual production of Green energy	**8,300 TWh**	
Energy for production of green ammonia	38.2	GJ/MT NH3
Green Ammonia for shipping	661	Million MT
Green Energy for ammonia for shipping	**7,015**	**TWh**
Power-to-methanol conversion efficiency	48.2%	
Energy content of Methanol	23.0	GJ/MT
Green Methanol for shipping	618	Million MT
Green Energy for methanol for shipping	**8,191**	**TWh**

Not enough green energy for green fuels

CCS Challenges in Shipping

- Marinization of CCS equipment for their use onboard ships
- Familiarization of shipping stakeholders with the CCS technologies
- Suitable technical requirements for safe storage and handling of liquefied CO_2
- OPEX/CAPEX analysis on the basis of alternative fuel prices, CO_2 market and taxes
- Availability of CO_2 disposal facility at called ports
- Standard specification of CO_2 quality from CCS
- Amount of tankers for the transport of liquefied CO_2

How does RINA tackle the CCS Challenges?

- Support to CCS equipment manufacturer and integrators for the compliance with maritime regulations
- Risk Assessment to arise awareness of safety hazards related to CCS
- Development of class rules for the validation of the CCS systems on ships
- Financial monitoring of prices and of tax regulations and economical feasibility study
- Support to Ports for the development of their CO_2 infrastructure (pipeline and storage)
- Support technical committee for the development of standards for CO_2 quality
- Development of new designs for LCO_2 carriers together with owners and yards (AiP)

Storage in LCO_2 Carriers - AiP

Security level: RINA/CL/SENSITIVE

RINA

CERTIFICATE OF APPROVAL IN PRINCIPLE

LCO2/LPG Type C Bi-lobe Tank
AIP-MAC47121XG

This is to declare that the Approval in Principle (AiP) of the following Project:

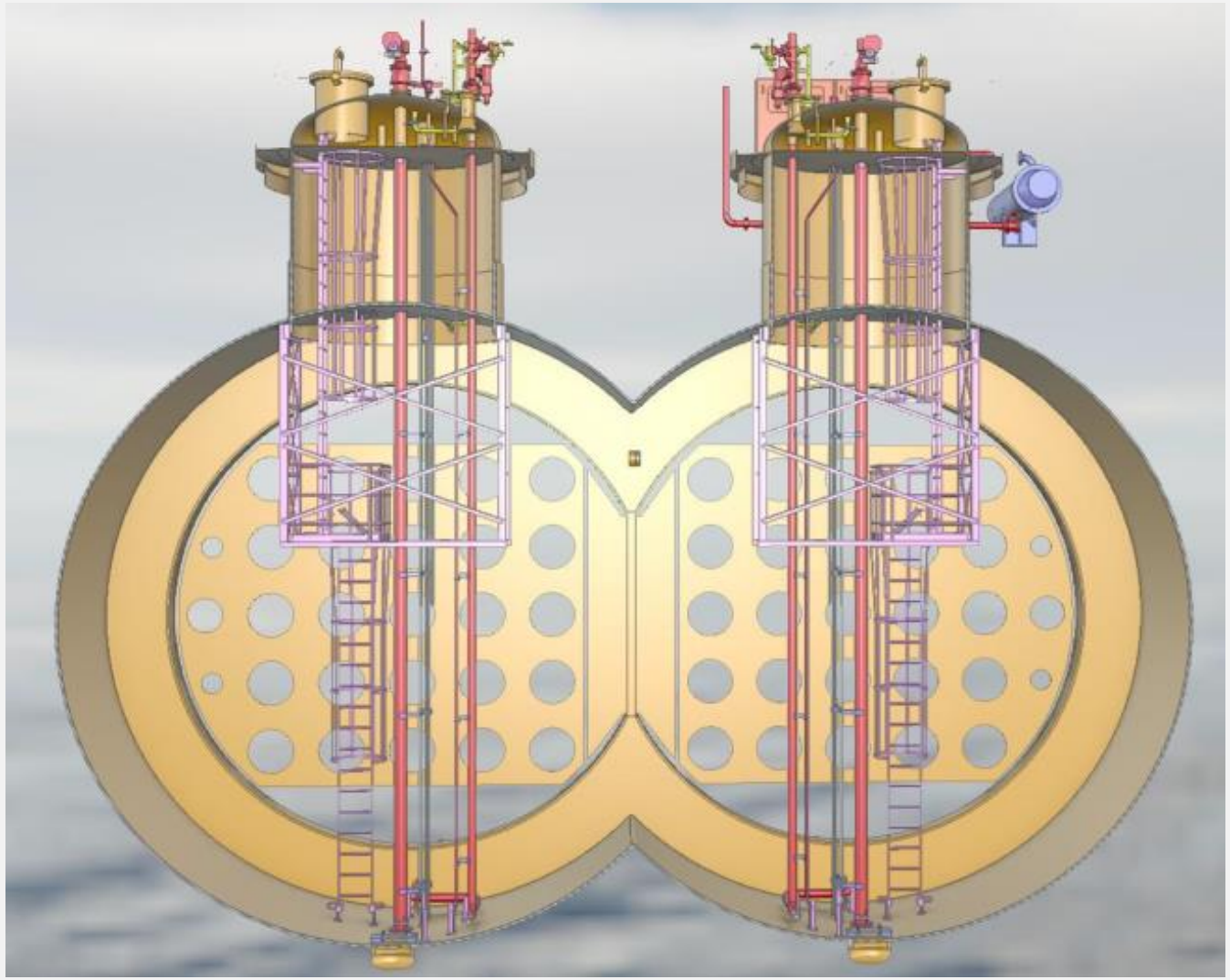
Project:	Type C Bi-lobe Tank for LCO2/LPG
Applicant:	HB Hunte Engineering GmbH Werftweg 15 26135 Oldenburg Germany
Manufacturer:	Class Approved maker for Pressure Vessel construction acc. to IGC Code: to be defined
Description:	IMO TYPE C Bi-Lobe Tank for Liquid Carbon Dioxide & Liquefied Petroleum Gas
Properties:	Max. Design Pressure P_0 = 19,00[bar] Min. Design Pressure P_{ed} = 0,30 [bar] external Pressure Test Pressure = 28,50 [bar] Min/Max Temp. T_{min} = -35,0 [°C] T_{max} = +45 [°C] Transport Media: CO_2 & LPG Cargo Density = 1100 [kg/m³] Tank Capacity = approx. 4000 [m³] Weight of tank steel structure = 698 [t]

Has been carried out in compliance with the process described in the "RINA Guide for Approval in Principle Processes" (Edition 1-Jan-2014), on the basis of the below listed technical criteria.

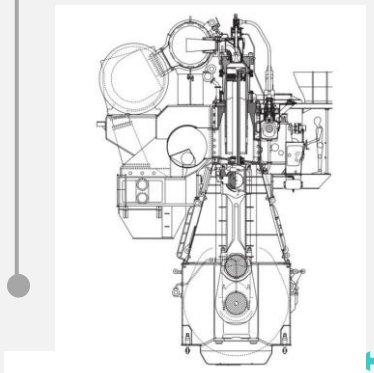
RINA RULES FOR THE CLASSIFICATION OF SHIPS 2021:	Part C; Chapter 1; Section 3 Part D; Chapter 1; Section 2 Part E; Chapter 9; Section 4
IMO Resolution MSC.370(93), IGC CODE, as amended:	Regulations for Cargo Containment

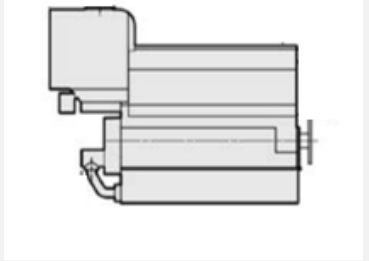
Issued in **HAMBURG** *on May 05, 2021.*

RINA Services S.p.A.
Giuseppe Russo ; Patrizio Di Francesco



Steam Methane Reforming Concept





Comb boiler

Steam

Fuel Reforming

$CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$

LNG tank

LNG

Steam condenser

30°C

CO_2 separation

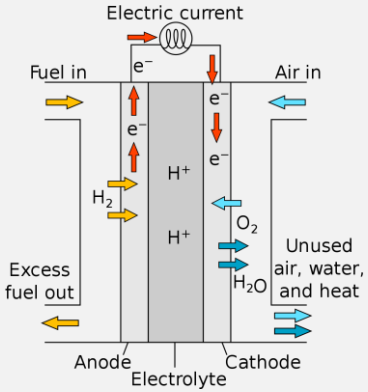
- 60°C

CO_2

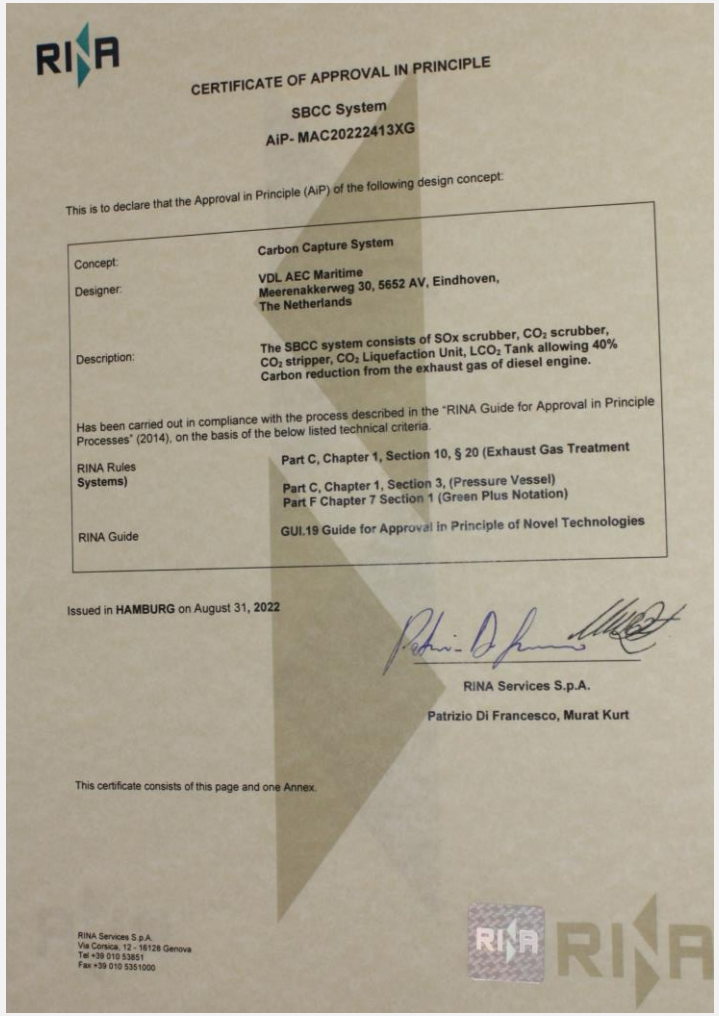
Hydrogen

CO_2 tank

Hydrogen



CO_2 Post Combustion Capture Concept- AiP



RINA

CERTIFICATE OF APPROVAL IN PRINCIPLE

SBCC System

AiP- MAC20222413XG

This is to declare that the Approval in Principle (AiP) of the following design concept:

Concept:	Carbon Capture System
Designer:	VDL AEC Maritime Meerenakkerweg 30, 5652 AV, Eindhoven, The Netherlands
Description:	The SBCC system consists of SOx scrubber, CO_2 scrubber, CO_2 stripper, CO_2 Liquefaction Unit, LCO_2 Tank allowing 40% Carbon reduction from the exhaust gas of diesel engine.

Has been carried out in compliance with the process described in the "RINA Guide for Approval in Principle Processes" (2014), on the basis of the below listed technical criteria.

RINA Rules Systems)	Part C, Chapter 1, Section 10, § 20 (Exhaust Gas Treatment Part C, Chapter 1, Section 3, (Pressure Vessel) Part F Chapter 7 Section 1 (Green Plus Notation)
RINA Guide	GUI.19 Guide for Approval in Principle of Novel Technologies

Issued in HAMBURG on August 31, 2022

RINA Services S.p.A.

Patrizio Di Francesco, Murat Kurt

This certificate consists of this page and one Annex.

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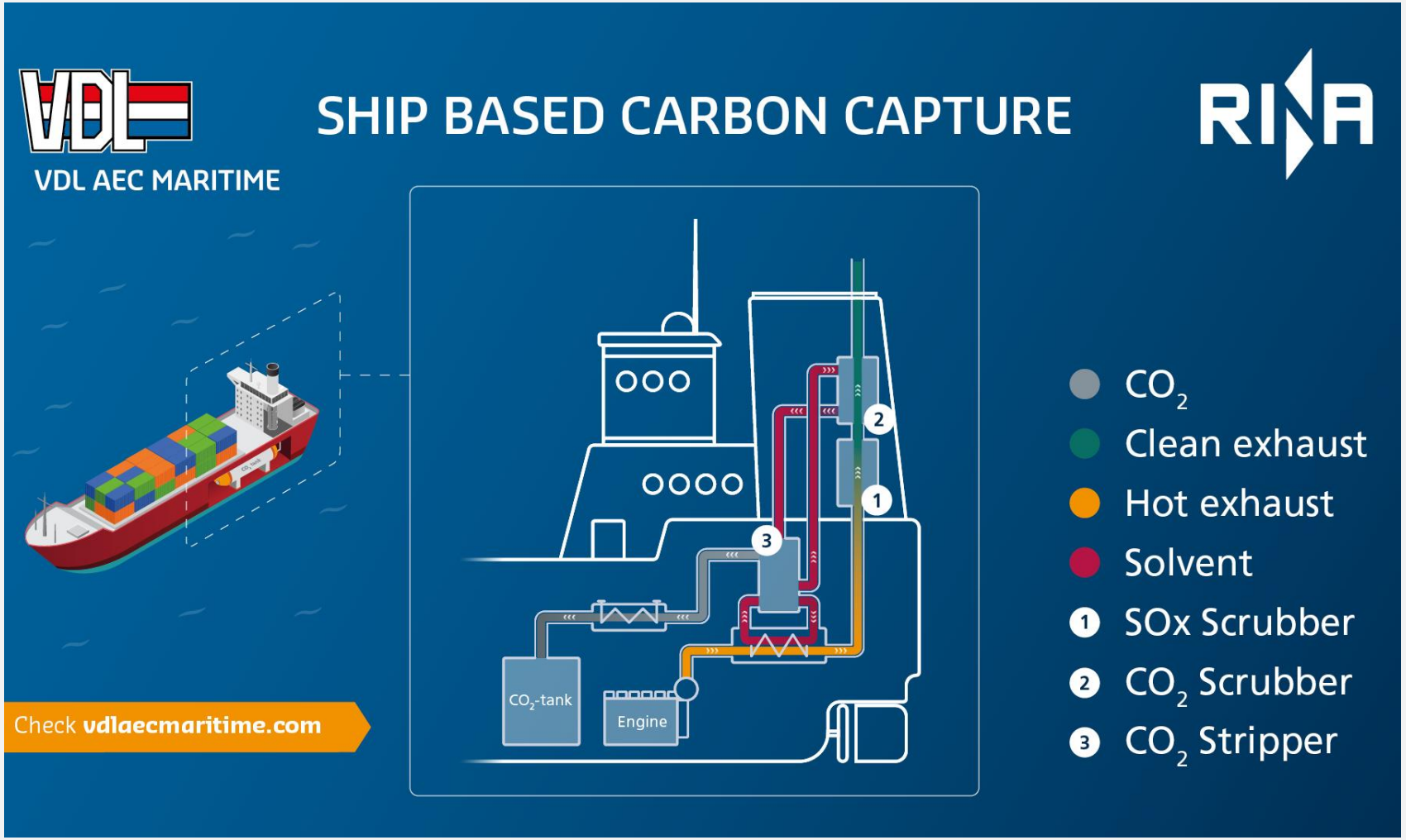
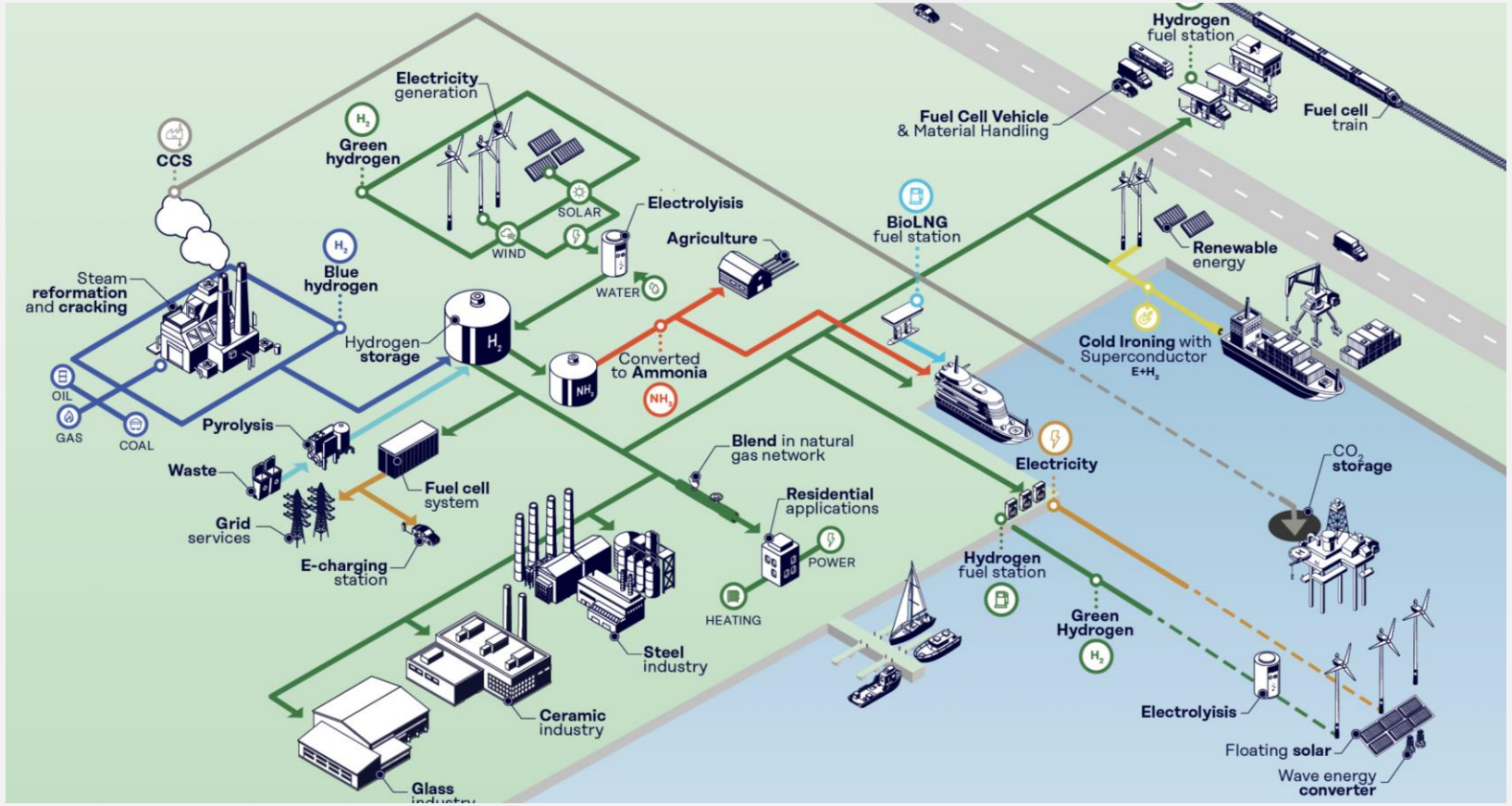


CO_2 Sequestration and Well Stimulation

Guide for Installation on Deck of Equipment for Well Stimulation and
CO_2 Sequestration Activities
Effective from 1 November 2021

for Offshore Support Vessels performing well stimulation and injection activities for the sequestration of CO_2 into depleted gas fields on temporary basis.



Services Map for CO_2

Supporting the entire value chain from CapEx to OpEx as System Integrator

Technology | **Analysis** | **Funding** | **Project Development**

- Technology Scouting & Technology Observatory
- TRL evaluation e Technology Selection
- Market & Sector Analysis for Utilization
- Patent analysis
- Research & Development (EU)
- Technology Qualification & Approval In Principle
- Conceptual, Feasibility Studies & FEED for decarbonization
- Innovation assessment
- Technical-Financial-Operational Feasibility
- Investment (CapEx/OpEx) and Business Plan optimization
- Cost-benefit analysis
- Testing for CO2
- Green Finance
  - Business planning & modeling
  - Relevant costs and cost efficiency
  - impact on the competitiveness and on sustainable growth
- Sector coupling scenario analysis
- Circular Economy analysis for CO2 (Capture & Utilization)
- Map of industrial processes for Carbon Capture and Utilization plan
- Engineering Consulting services and Asset Repurposing for CO2

Thank you

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