

# Knutsen NYK Carbon Carriers AS

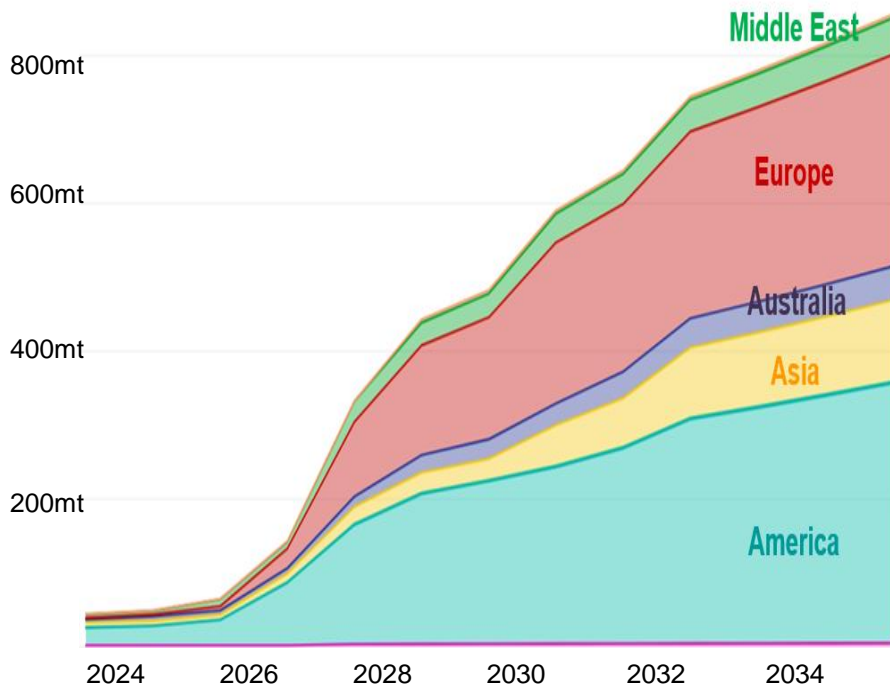
*“A LCO<sub>2</sub> shipping provider with a wholistic CCS value chain approach”*



15<sup>th</sup> November 2023

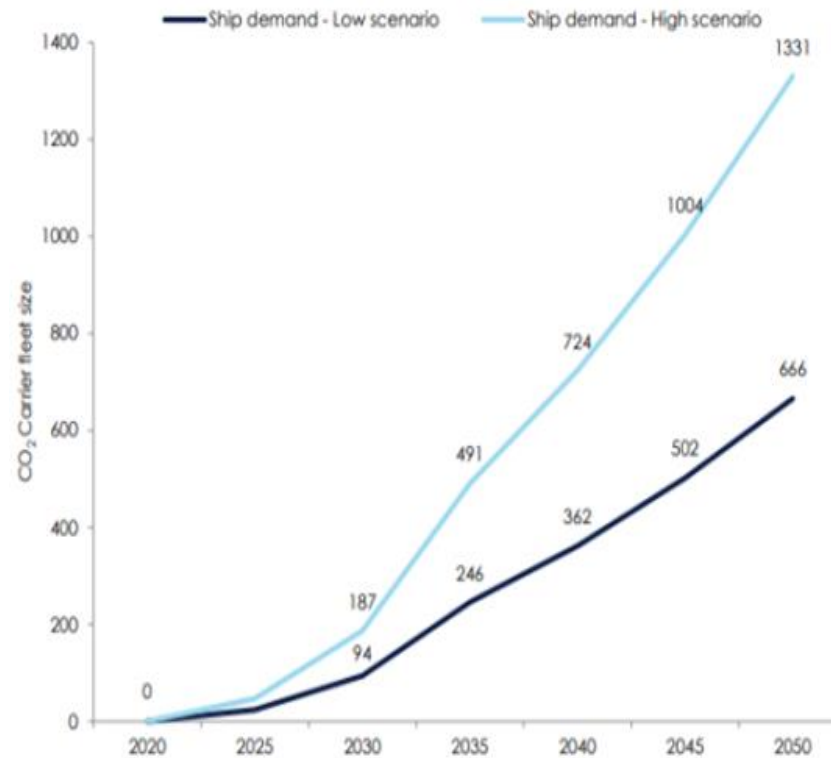
# Unprecedented market growth

### Capture demand





Source: Rystad Energy

### LCO2 Carrier demand

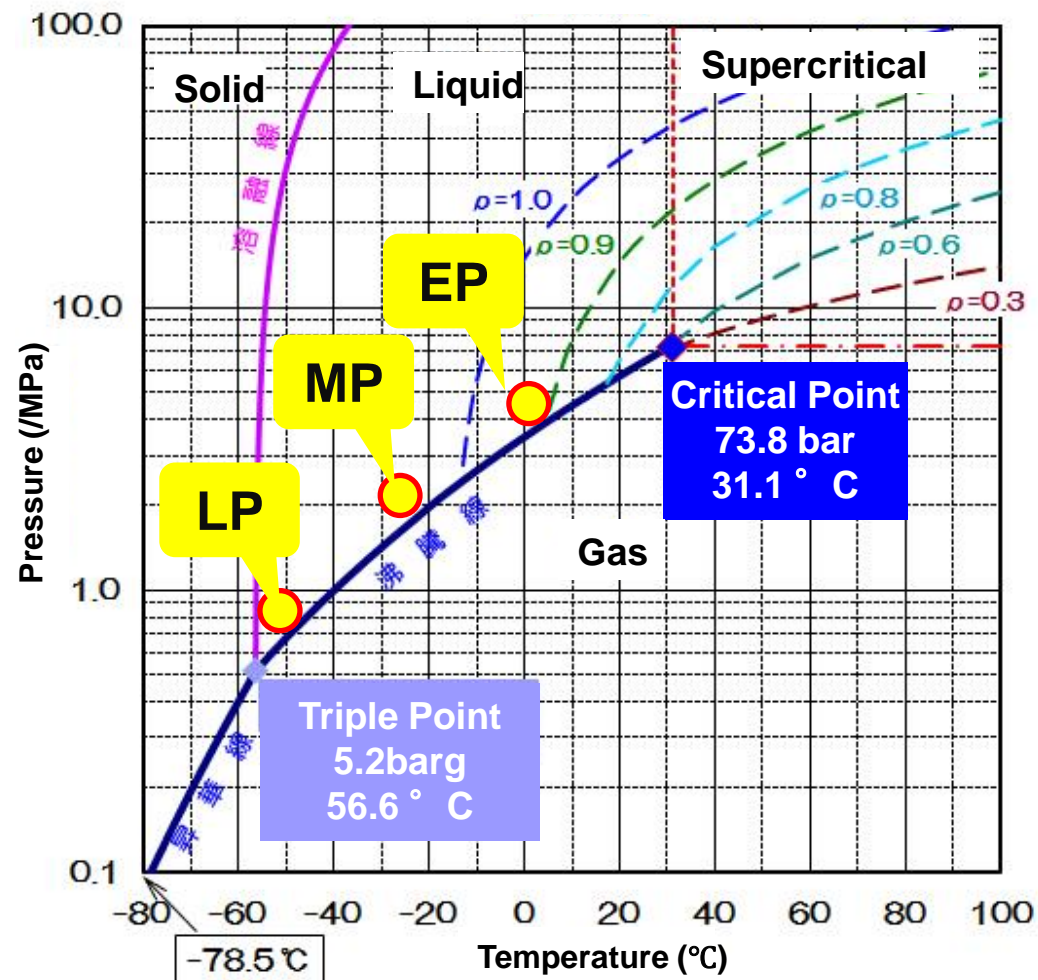


Source: Clarkson

# Three ways of handling LCO2

Mode	Temperature	Pressure	Tank Type
<b>LP</b> (Low Pressure)	abt -55° C	abt 7-9 barG	<b>Type-C Tanks</b>  IMO type C tank
	<b>MP</b> (Mid Pressure)	abt -35° C	
<b>EP</b> (Elevated Pressure)	abt 0-10° C	abt 34-45 barG	<b>CTC</b> (Cargo Tank Cylinder) 

CO2 temperature-pressure diagram

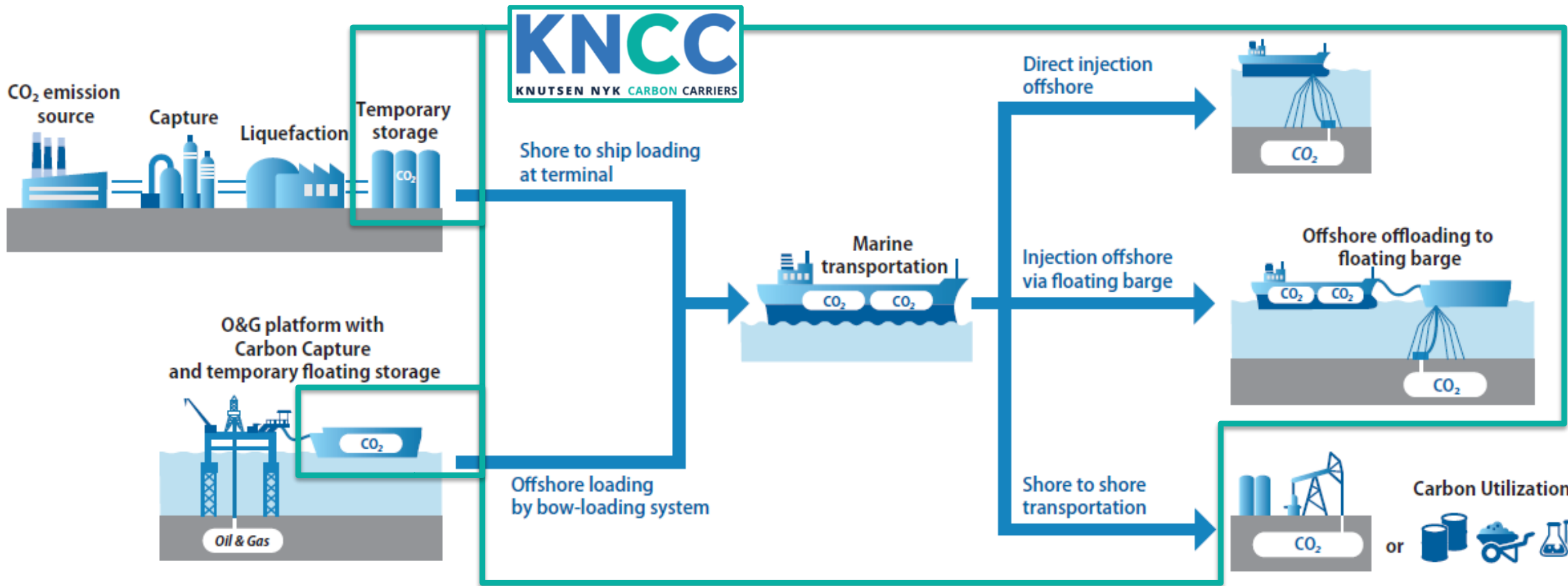


# Strong and long term owners of KNCC



- Global logistics enterprise with terminals and vessels for most forms of maritime transport
- Extensive experience in cryogenic transport (LNG/LPG/etc)
- Ambitious green transition objectives
- Pioneered shuttle tanker market
- Unique track record of operational performance and know-how of complicated offshore operations
- Gas and LCO<sub>2</sub> transport technology development and marine engineering

# Scope of Business

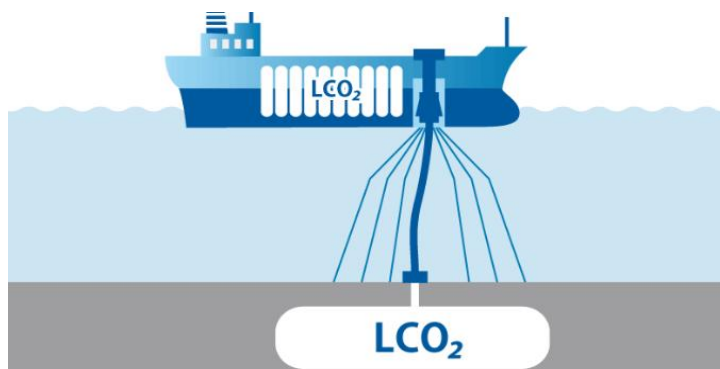


# KNCC's market approach

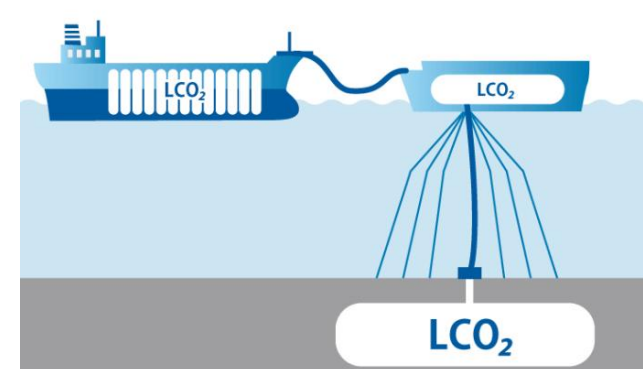
<u>Optionality</u>	<u>Scalability</u>	<u>Low Cost</u>
<ul style="list-style-type: none"> <li>• EP – TtT/DiO</li> <li>• MP – TtT</li> <li>• LP – TtT</li> </ul>	<ul style="list-style-type: none"> <li>• 40 000 + cbm</li> <li>• 20 000 cbm</li> <li>• 12 000 cbm</li> </ul>	<ul style="list-style-type: none"> <li>• CAPEX</li> <li>• OPEX</li> <li>• Emission</li> </ul>



TtT: Terminal to Terminal



DiO: Direct Injection Offshore



FSIU: Floating Storage Injection Unit

# Comparison of EP/MP/LP

	EP	MP	LP
Technical readiness	Yellow	Green	Yellow
Scalability	Green	Red	Green
CO2 density	Red	Yellow	Green
Dry ice risk	Green	Yellow	Red
DIO	Green	Yellow	Yellow
Tolerance to leakage	Green	Yellow	Orange
Vessel Capex	Yellow	Yellow	Orange

- Technology driven
- Commercially viable business model
- Cargo specification

→ **Selection of mode requires wholistic value chain approach**

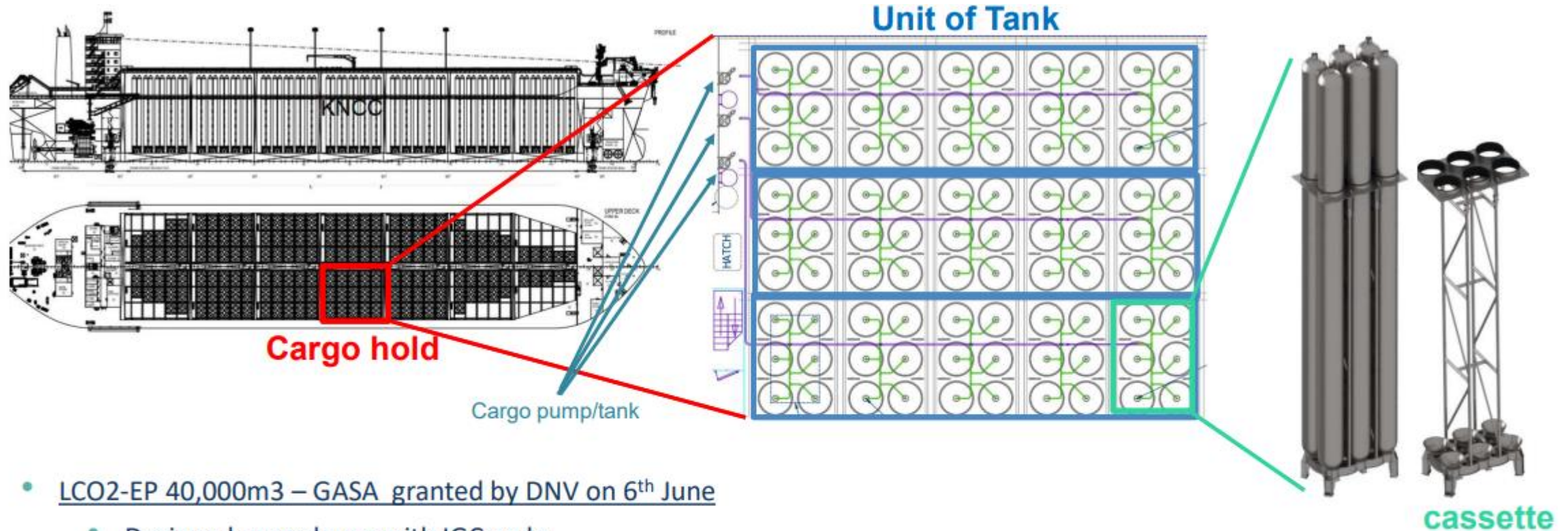
## 40k LCO2-EP with STL



- ✓ 40,000 cbm
- ✓ LCO2-EP (Elevated Pressure at Ambient temperature)
- ✓ DPS (Dynamic Positioning System)
- ✓ DIO (Direct Injection Offshore)
- ✓ STL (Submerged Turret off Loading system)



# DNV GASA for the 40K LCO<sub>2</sub> – EP



- LCO<sub>2</sub>-EP 40,000m<sup>3</sup> – GASA granted by DNV on 6<sup>th</sup> June
  - Designed accordance with IGC code
    - 1 cargo hold consists of 3 tanks
    - 1 tank consists of 30 CTCs (Cargo Tank Cylinder)
    - 1 cassette contains vertically stacked 6 CTCs
  - Operational concept
    - All CTCs, 1028pcs, works as 1 system, i.e. uniform loading and unloading of LCO<sub>2</sub>

Confidential

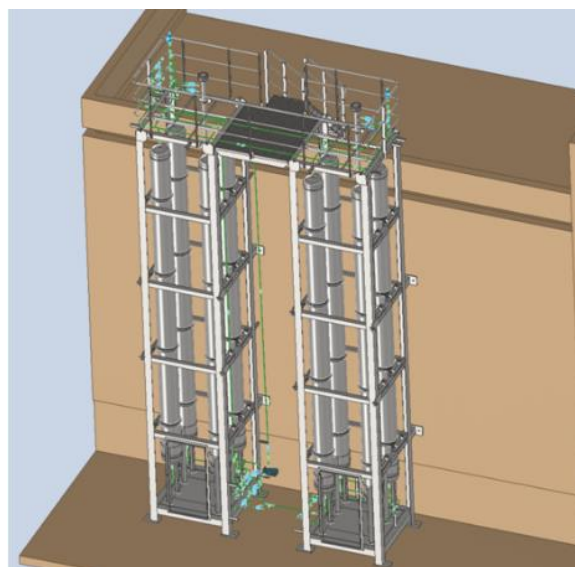
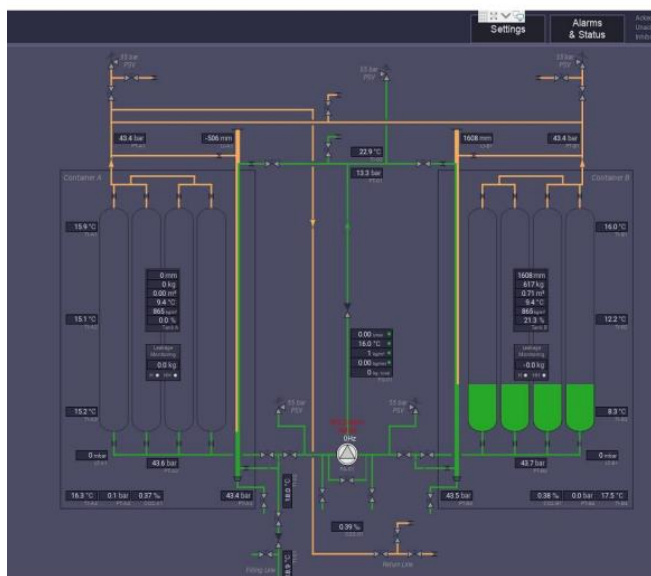


# Onshore storage – completing the value chain



# CO2 test rig – building deep knowledge

- Construction, commissioning and phase i test program is completed
- Phase ii CO2 test rig includes leakage and pressure drop
- The CO2 test rig will be used in the future for training crew



# KNCC is progressing

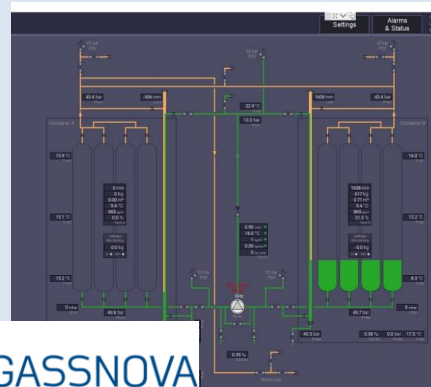
## GASA\* obtained from DNV



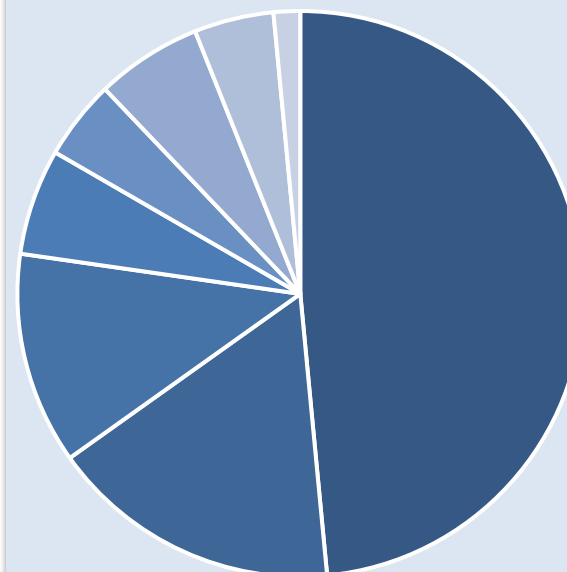
## HAZID complete



## Demonstration of EP technology



## Broad engagement across the CCS VC for dozens of projects



- Oil & Gas
- CO2 Manager
- Power
- Steel
- Engineer/Consultant
- terminal
- Capture

\*GASA: General Approval for Ship Application

**Thank You**

<https://www.kn-cc.com/>

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