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From saving the oceans.
To safeguarding the planet.

ERMA FIRST CARBON FIT

Onboard Carbon Capture & Storage (OCCS)

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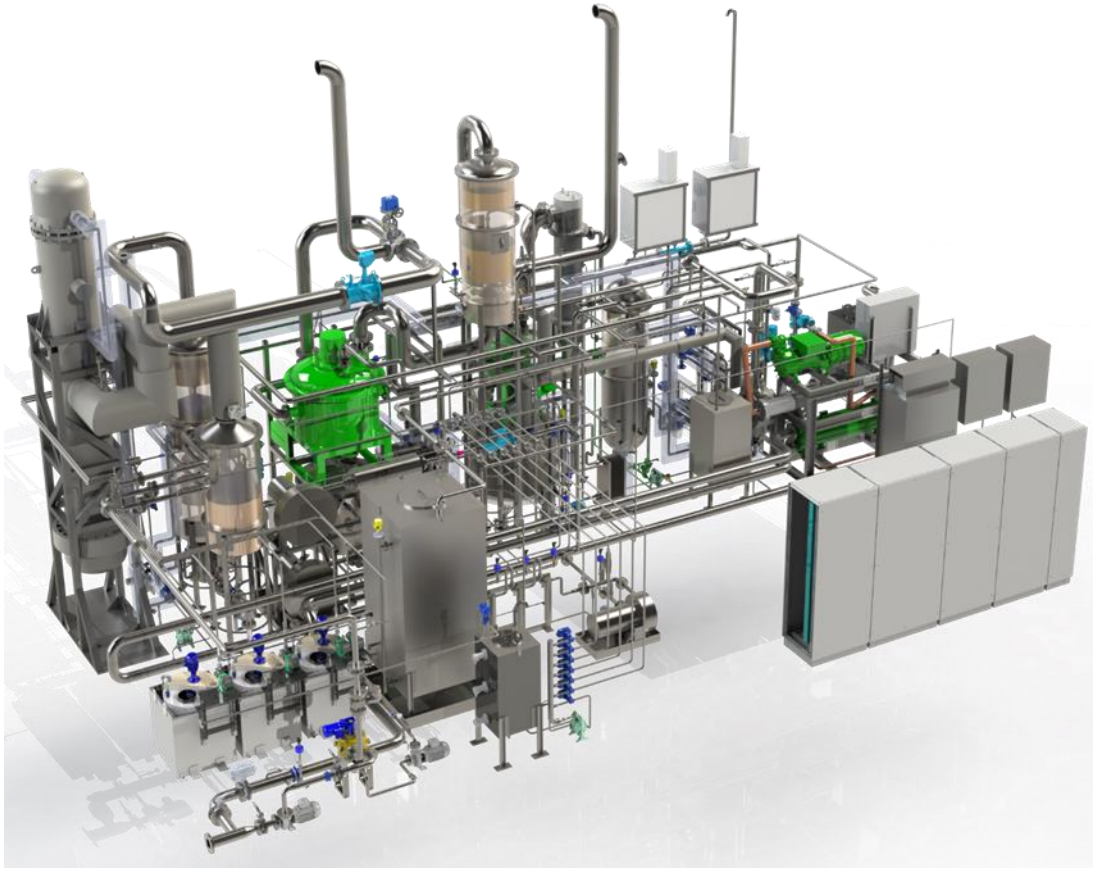
CARBON FIT:
ONBOARD CARBON CAPTURE AND STORAGE



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ERMA FIRST CARBON FIT Amine

Onboard Carbon Capture & Storage (OCCS)

DECARBONISATION

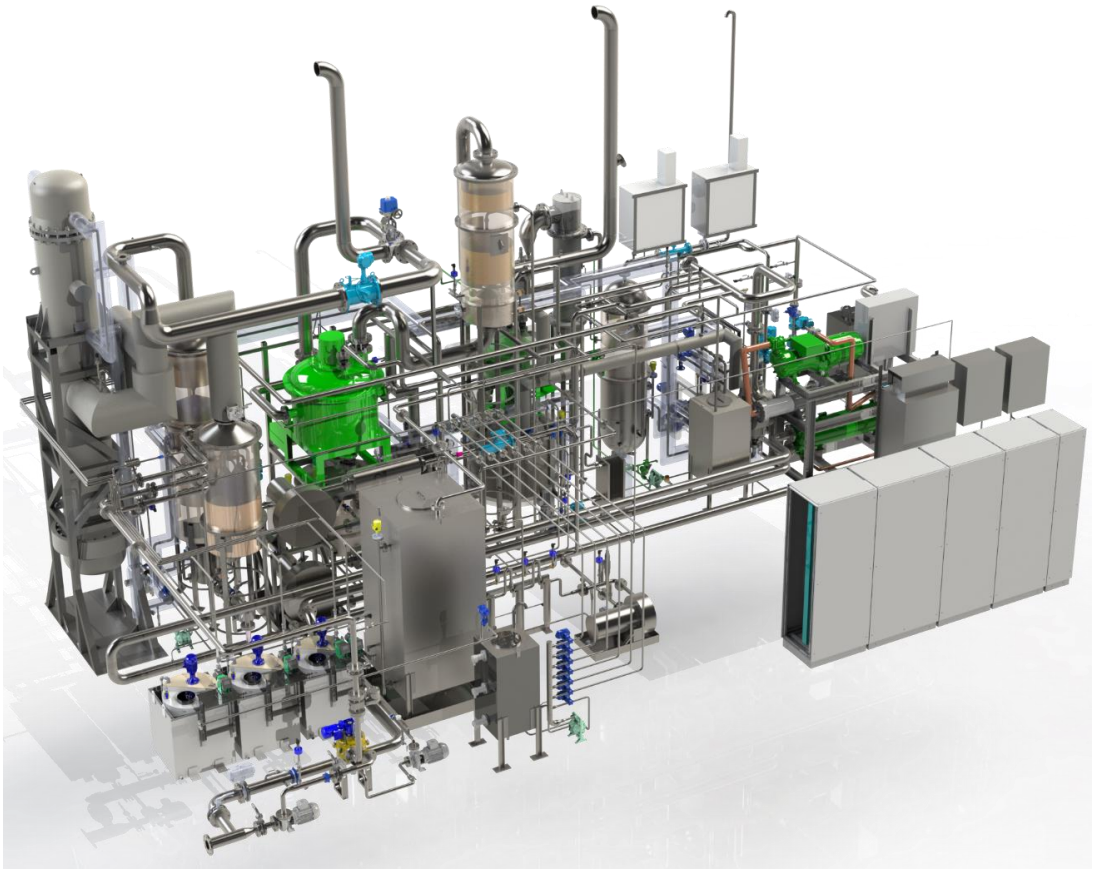
DESIGNED FOR MARINE AND LAND APPLICATIONS.

CARBON CAPTURE Amine Absorption

This system relies on the proven amine absorption technology.

The amine solvent absorbs CO_2 from the flue gas in a specially designed absorber. The solvent is then regenerated through the application of heat, releasing the CO_2, which is subsequently liquefied and stored under cryogenic conditions onboard.

The regenerated amine solvent is then reused, creating a cyclical, efficient process for capturing and storing CO_2.



- Proven solution
- Recyclable process
- Eco-friendly

LR & DNV
Approval in Principle
(AiP)

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ABSORPTION AS A POST COMBUSTION CO_2 CAPTURE METHOD

- Absorption is the most widely spread technological approach for CO_2 capture
- Advantages of chemical absorption include:

➢ Reliance on established technologies

➢ Capacity to be retrofitted to existing power plants/industrial plants with minimal modifications

➢ Carbon Capture processes based on chemical absorption (with conventional amine solvents) is also currently at a Technology Readiness Level (TRL) of 6-8

Types of absorption applied are:

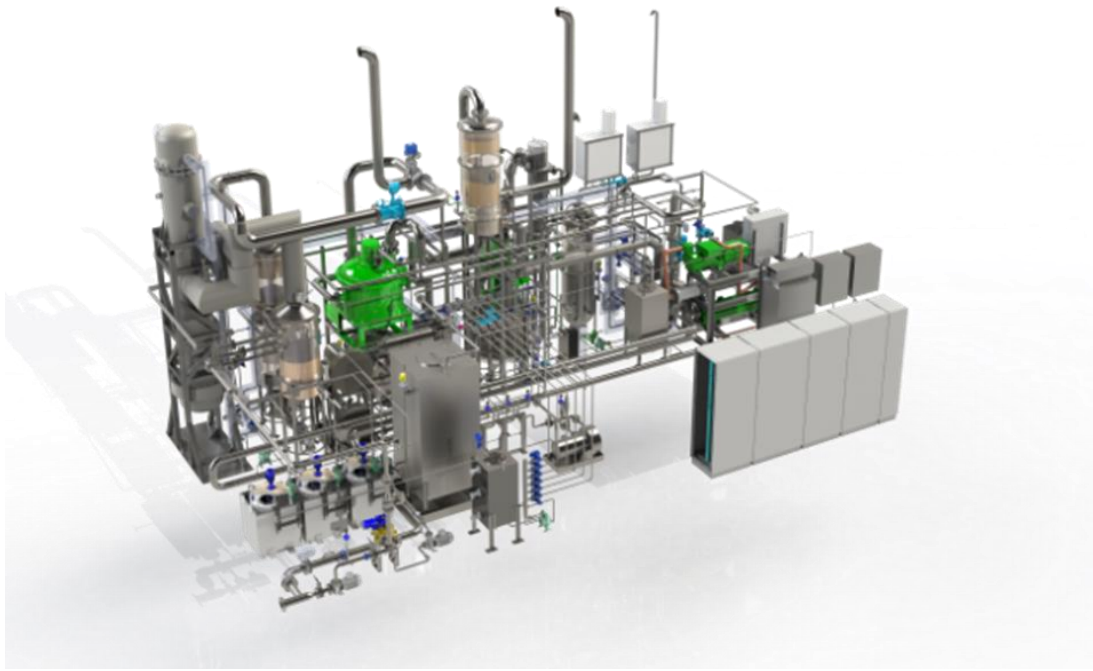
➢ Chemical adsorption

➢ Use of amine-based solvents

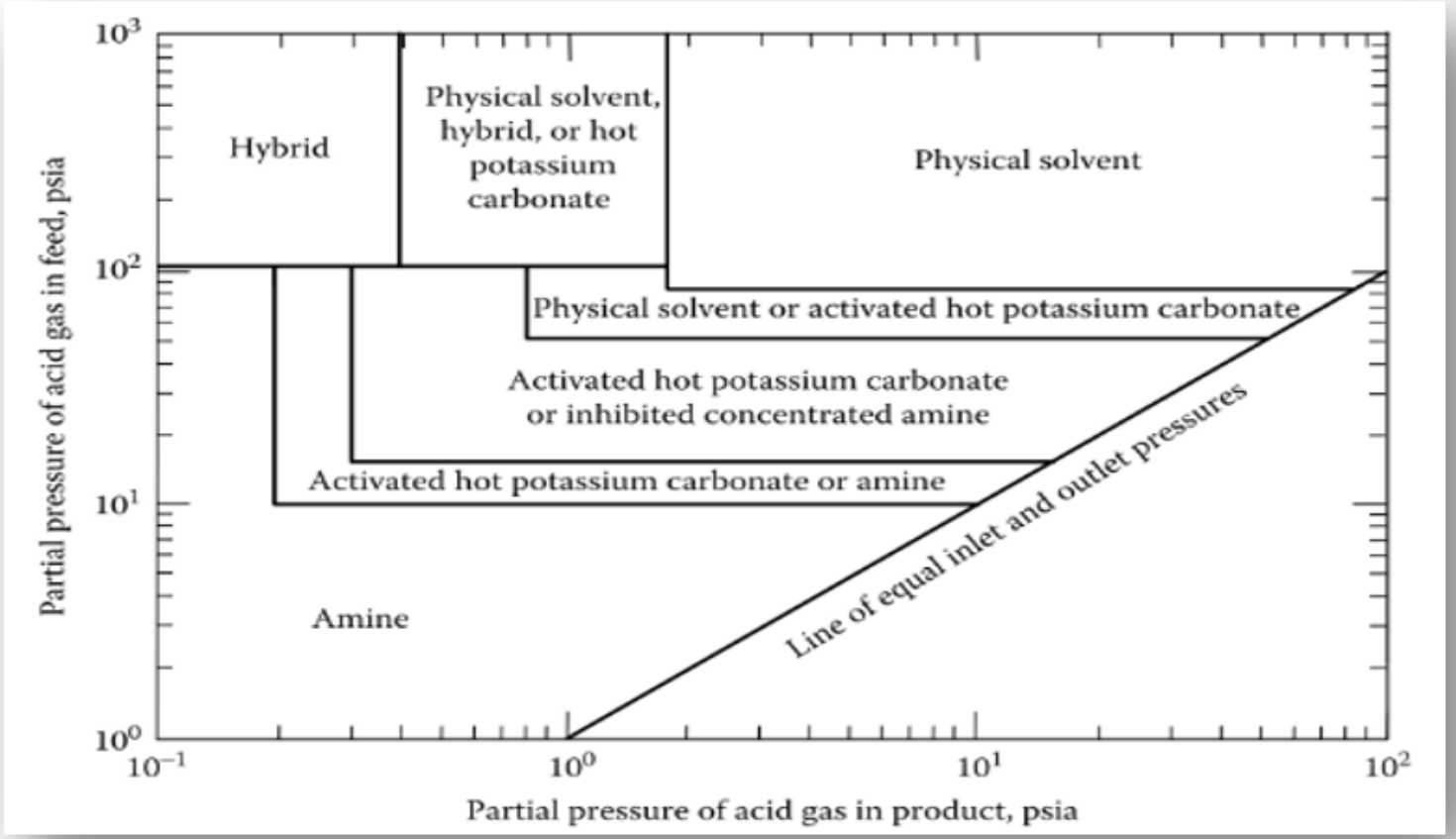
➢ Use of inorganic solvents (Caustic Soda, Potassium Carbonate, etc.)

➢ Ammonia-based processes (Chilled Ammonia Process)

➢ Physical absorption



ABSORPTION AS A POST COMBUSTION CO_2 CAPTURE METHOD



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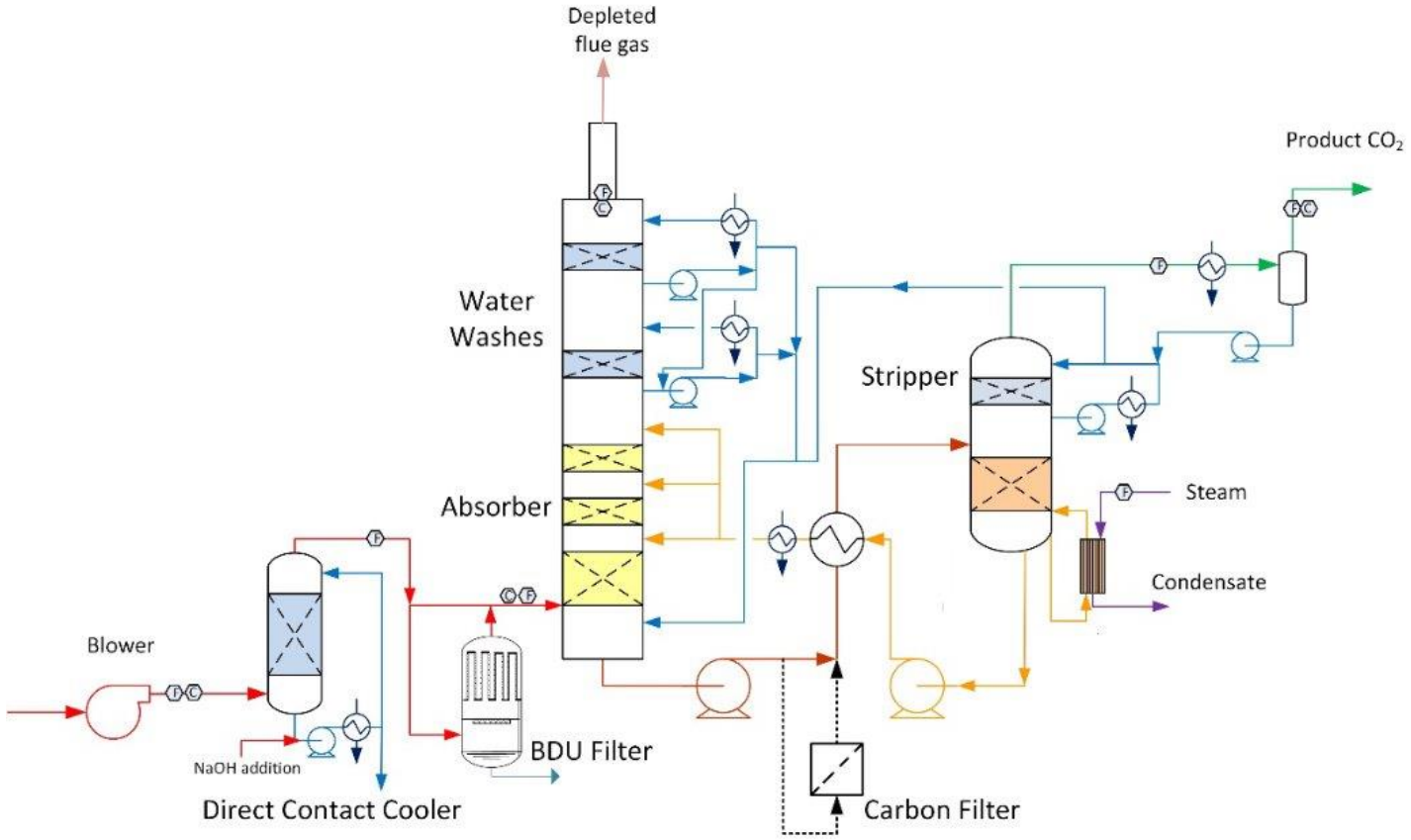
ABSORPTION WITH AMINE-BASED SOLVENTS

- Cyclic absorption and desorption (stripping) of CO_2 usually by temperature swing
- High CO_2 absorption capacities between 90-95% have been reported in the literature and have been demonstrated during various plant campaigns
- The high absorption rate come with a cost which is the high energy, usually in the form of supplied heat, that is required for the stripping of the stripping of the CO_2 and regeneration of the amine solvent
- Various types of amines or amine blends as well as process modifications have been employed in order to minimize the energy penalty associated with the amine regeneration
- The use of Monoethanolamine (MEA) is considered the baseline standard for post combustion carbon capture

PROCESS FLOW DIAGRAM OF AN AMINE BASED CCS



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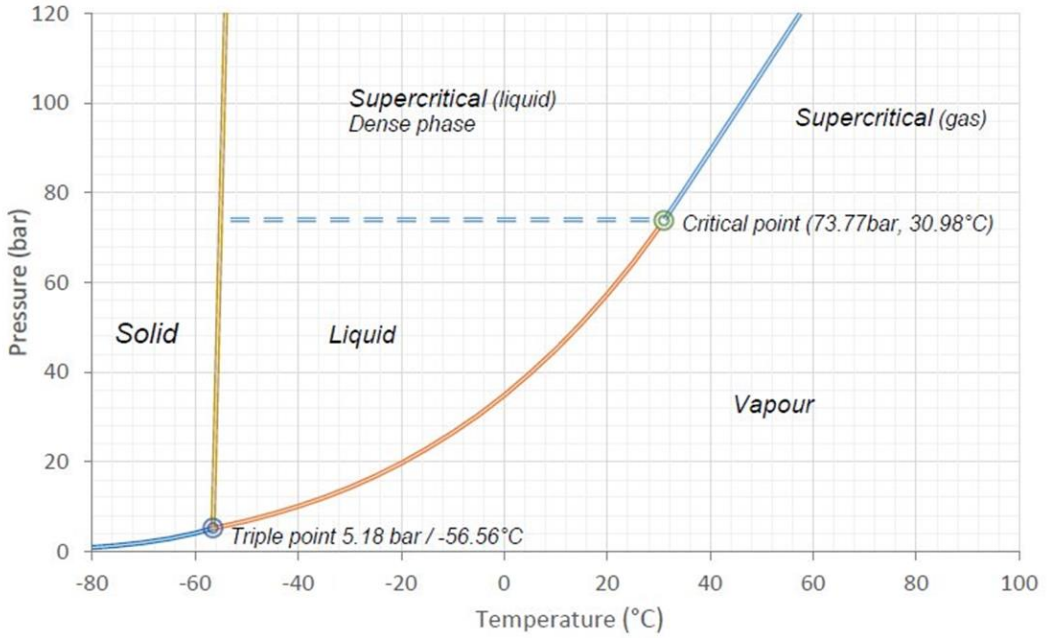
CO_2 STORAGE OPTIONS

Practical options for CO_2 storage include:

- ✓Compression in gas form, or
- ✓Liquefaction

Out of the above, two options **liquefaction** seems to be the most practically feasible, because at typical liquefaction conditions CO_2 density is significantly higher (similar to water) thus minimizing storage space requirements

Another option could be compression to the supercritical liquid state where CO_2 also possesses a relatively high density



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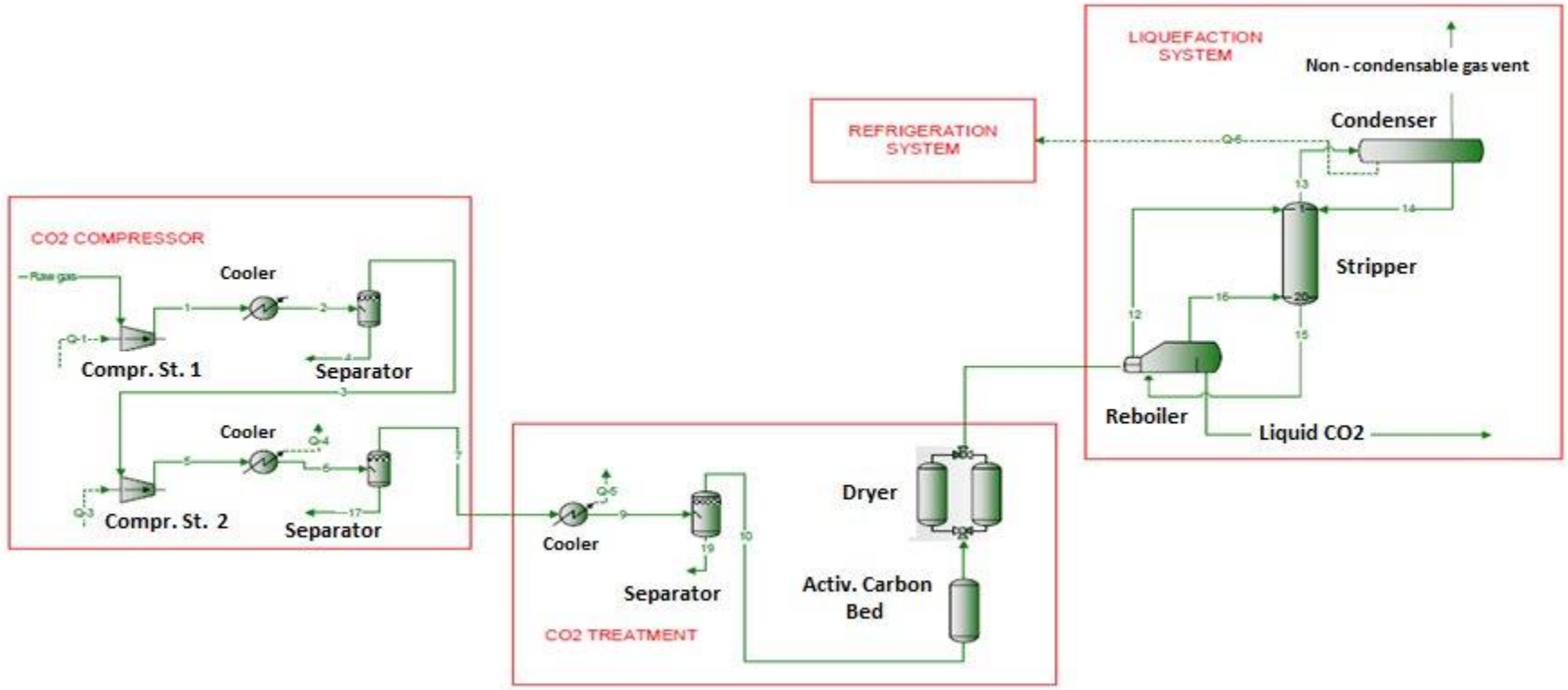
CO_2 LIQUEFACTION

Typical flow diagram of a CO_2 liquefaction plant (15 to 18 bar, -25 to – 30 ºC)



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PLANT SIZING PROCEDURE

- Vessel details submitted
- Pre-assessment conducted by ERMA FIRST
- Techno - economical feasibility study (typically by DNV) regarding the impact of the plant on the vessel in terms of CII reduction over the years, steam, power and fuel consumption
- Decision on system capacity and sizes of the CO_2 storage tanks

CCS PLANT POWER, STEAM CONSUMPTION & SYSTEM CAPACITIES

Power and steam consumption for **1000 Kg/h** CCS system

- Power consumption: **420 – 450 KW**, 50% for CO2 capture and 50%for compression and liquefaction
- Steam consumption: **1400 Kg / h** at **6 bar**

Available tanks sizes: up to **400 m^3**

Available System Capacities:

- 500 Kg CO_2/h
- 1000 Kg CO_2/h
- 1500 Kg CO_2/h
- 2000 Kg CO_2/h
- 2500 Kg CO_2/h

WHY CARBON FIT

DECARBONISATION

- Extremely low footprint.
  Absorber is more than 10 times smaller compared to conventional towers. The absorber of a CARBON FIT 1000 Kg/h system is approximately 4m high and 2m diameter, while the CO_2 stripping can be achieved in an expansion tank.
- Performance of absorption and stripping unaffected by ship inclination.
- Possibility to install the system in vessels already equipped with EGCS.
- Modular installation.
  Components are loose and can be installed at vessel available spaces.
- Exhaust gas economizer as a standard to reduce steam consumption to an absolute minimum.
- Purity of produced CO_2 up to food grade (>99.9% CO_2).
- Flexible offering including or not CO_2 liquefaction plant.
- Easy integration with vessels with installed EGCS burning HFO and able to operate on vessels which use ULSF.
- Use of non-proprietary amine solution allows easy sourcing at competitive pricing.
- Remote monitoring and data analysis system with AI assistance ensuring high efficiency and remote operation/ trouble shooting support.
- Standard models offering from 165 $kgCO_2$ eq/ hr up to 2,500$kgCO_2$ eq/hr.
- Readily available product.
- CO_2 offloading offering on major ports*.
  **Through affiliated partners. Terms and conditions vary per geographical location.*
- Turnkey solution, including:
  - ✓ Project management
  - ✓ Class approval engineering
  - ✓ Installation materials procurement
  - ✓ Installation supervision worldwide
  - ✓ Commissioning
  - ✓ Service and maintenance contracts

ERMA FIRST CARBON FIT Strong Alkali

Onboard Carbon Capture & Storage (OCCS)

DECARBONISATION

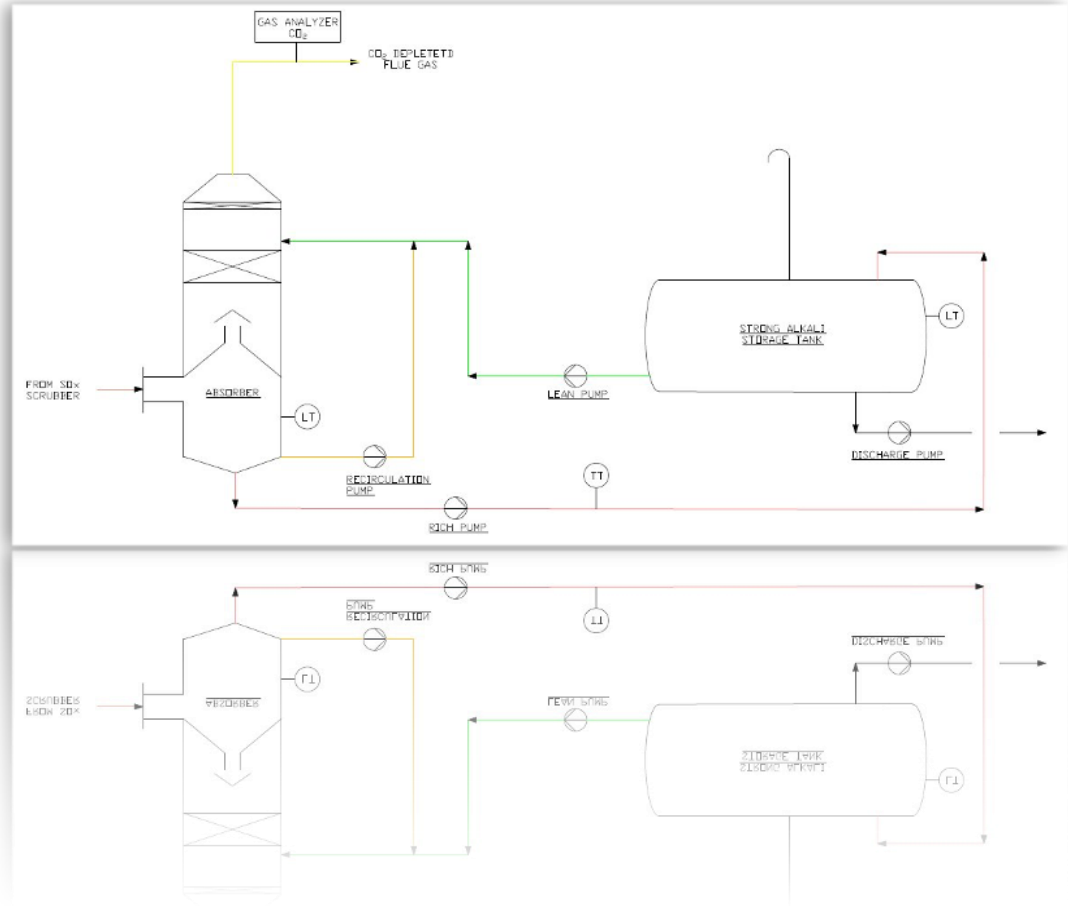
CARBON CAPTURE FOR SHORT SEA SHIPPING.

CARBON CAPTURE Strong Alkali

This system utilizes potassium hydroxide as an inorganic alkali agent to capture CO_2.

The flue gas reacts with the calcium hydroxide solution in a specially designed reactor, creating a calcium carbonate slurry as a byproduct.

This byproduct is then dehydrated and stored onboard until it can be disposed of at authorized facilities.



WHY ERMA FIRST CARBON FIT Strong Alkali

- Simplified method
- No waste production
- Sustainable
- The ultimate solution for short sea shipping trading

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THINK DECARBONISATION …

THINK ENVIRONMENTAL PROTECTION …

THINK ERMA TECH GROUP!

Contact us:

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