



Langh Tech



ONBOARD CARBON CAPTURE

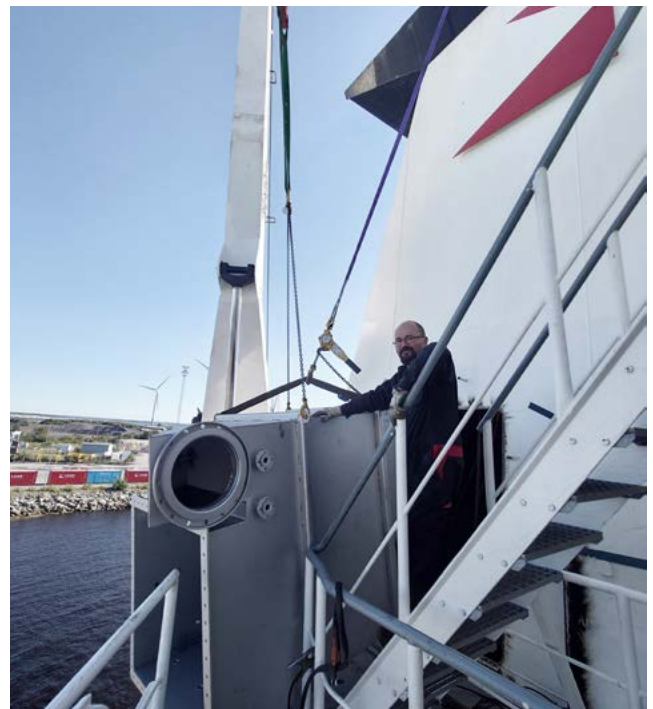


INNOVATION AT OUR CORE

Environment first

Langh Tech's mission is to find more efficient and sustainable solutions for the maritime industry. In addition to Onboard Carbon Capture (OCC), our portfolio includes green tech systems such as SO_x scrubbers and BWMS.

Our expertise dates back several decades with knowledge attained through the other Langh Companies, with shipping company Langh Ship being at our foundation, giving us a shipowners perspective for everything we do.

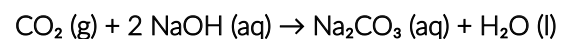


OCC with a unique approach

Langh Tech's onboard carbon capture (OCC) system utilizes a unique circular approach. Unlike many other technologies, our system does not apply absorption-desorption cycle, resulting in significantly lower increase in energy requirements than amine-based systems.

In short, Langh Tech's OCC system utilizes a post-combustion technique, where the ship's exhaust gases containing CO₂ are directed into a capture unit. Thanks to counter-currently flowing aqueous NaOH solution and maximized surface area, CO₂ dissolves into a liquid phase.

As a result of several consecutive reactions, CO₂ is chemically bound into a thermodynamically stable product of sodium carbonate accordingly:



With Langh Tech's post-combustion capture, there is no need for solvent regeneration or CO₂ compression. The formed sodium carbonate can be stored as a solution onboard and utilized in various land-based industries, contributing to circular economy.



Sustainability over the whole life cycle: Reagent production and product utilization

The sodium carbonate generated during the carbon capture process has a wide range of applications, spanning industrial and consumer chemical uses. These include its utilization in global industries such as detergent and glass manufacturing, as well as in water softening processes. Our carbon capture and utilization (CCU) strategy not only effectively captures CO₂ but also generates a valuable product with significant market demand, thereby fostering a circular economy by transforming waste into a resource.

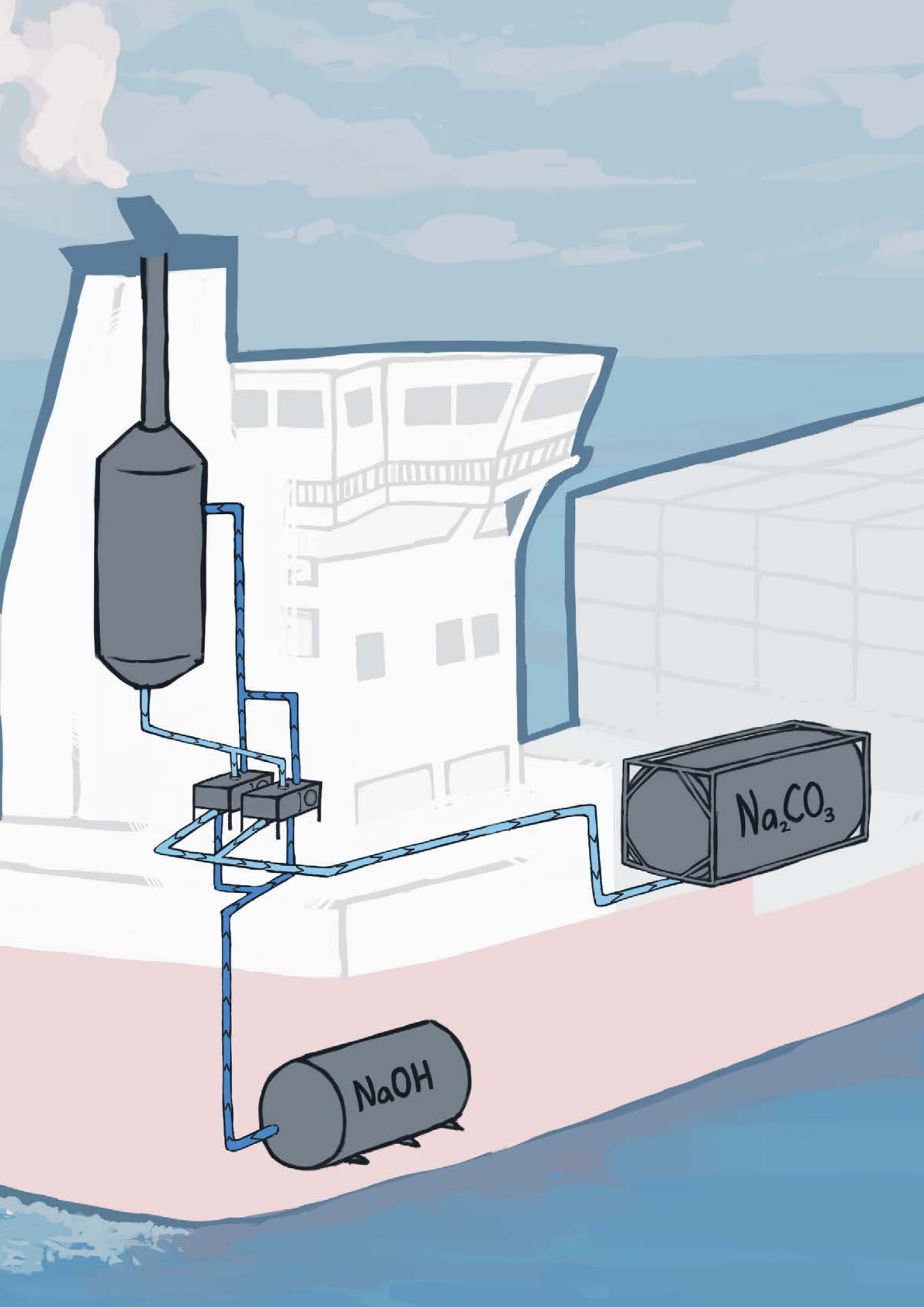
Currently, the sodium carbonate industry predominantly relies on extracting ores from the Earth's crust. By adopting a low-carbon alternative from the shipping industry, our approach can simultaneously contribute to the decarbonization of related industries, further amplifying its environmental benefits.

In addition to product utilization, Langh Tech's OCC system prioritizes sustainability in the production of reagents. Specifically, the capture reagent, sodium hydroxide, can be produced via the electrolysis of sodium chloride using renewable energy sources. This ensures a substantial reduction in emissions and maximizes the overall environmental benefits throughout the product's life cycle.

Langh Tech OCC benefits

- ▶ Circular economy from the start
- ▶ Decarbonization effect expanding several industries
- ▶ Utilisation of captured CO₂ instead of permanent storage
 - ▶ Smoother and quicker process than storage
 - ▶ No need to wait for infrastructure and political decisionmaking
- ▶ Flexibility where to offload the CO₂







NaOH to capture CO₂

- ▶ NaOH reacts with CO₂
- ▶ The reaction between NaOH and CO₂ produces sodium carbonate (Na₂CO₃) and sodium bicarbonate
 - Na₂CO₃ formation occurs significantly faster and is preferred
- ▶ NaOH is mainly produced by electrolysis of NaCl
- ▶ NaOH solution circulated in the capture unit where a part of the flue gas is directed.
- ▶ The produced Na₂CO₃ solution can be pumped into storage units

Onshore options

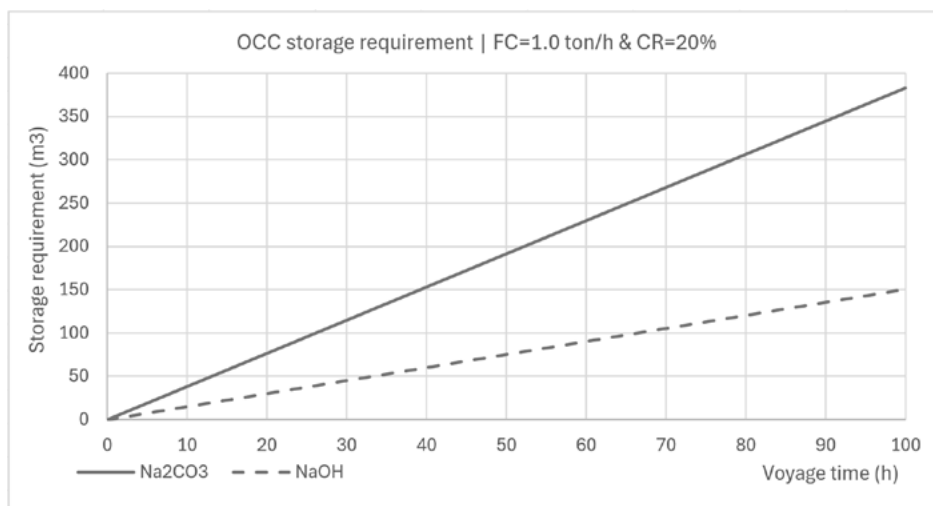
DIRECT USE

- ▶ Na₂CO₃ has an international market
- ▶ Several industrial and consumer applications
 - Glass manufacturing
 - Detergents
 - pH regulation
 - Water softening
 - Exhaust gas cleaning

REGENERATION

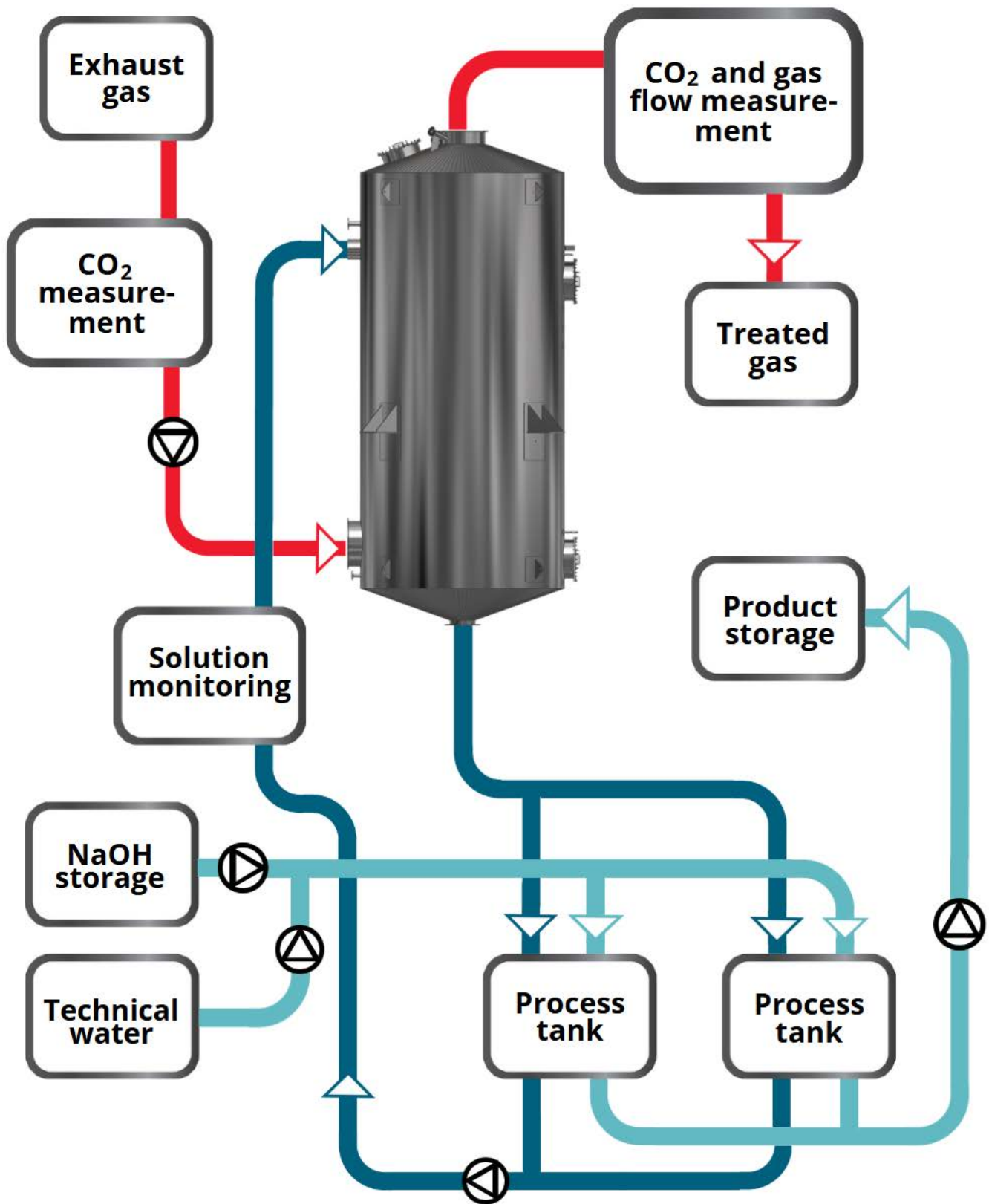
- ▶ Na₂CO₃ can be regenerated back to CO₂ and NaOH
- ▶ The first reaction occurs at temperatures above 650 °C
- ▶ Regeneration possible to be done onshore if preferred

Product and reagent storage



FC = Fuel consumption CR = Capture rate

PROCESS DIAGRAM



EXAMPLE DATA

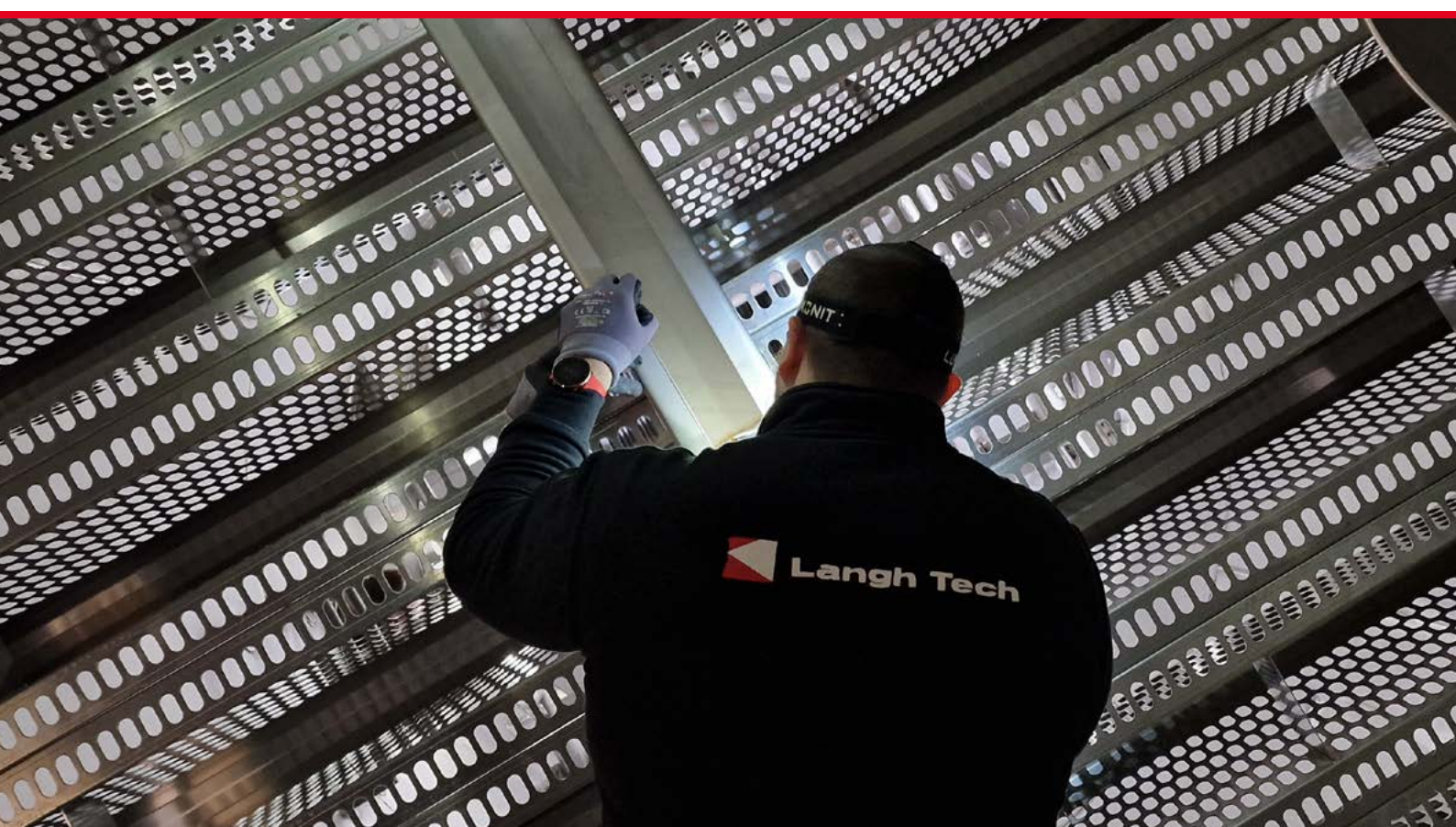
Numbers are approximative

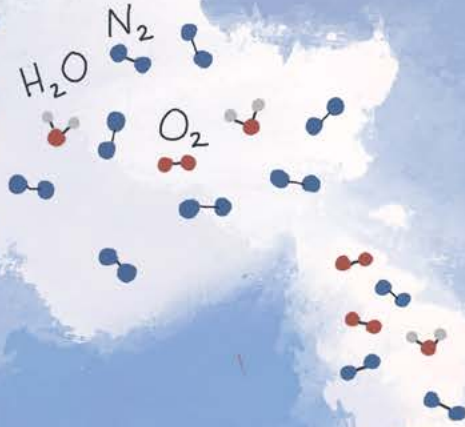
RORO vessel (5500 lane meters)

Fuel consumption	4 ton/h
Capture rate	10 %
CO ₂ captured	1.24 ton/h
Diameter	4400 mm
Voyage time	15 h
Total CO ₂	19 ton
NaOH volume	50 m ³
Na ₂ CO ₃ volume	120 m ³
Energy consumption	240 kW

Container vessel (500 TEU)

Fuel consumption	0.7 ton/h
Capture rate	20 %
CO ₂ captured	0.43 ton/h
Diameter	2600 mm
Voyage time	200 h
Total CO ₂	87 ton
NaOH volume	220 m ³
Na ₂ CO ₃ volume	560 m ³
Energy consumption	90 kW





Captured your interest?



Langh Tech

Langh Tech Oy Ab
Alaskartano
Vanhamakarlantie 29
FI-21500 Piikkiö
Finland

www.langhtech.com

