CONOSHIP
INTERNATIONAL

ONBOARD CO2 CAPTURING:
TURNING EMISSION TO FEEDSTOCK FOR SYNTHETIC FUELS

BY GUUS VAN DER BLES

Schiffbautechnische Gesellschaft e.V.

Introduction Conoship International

- Design office since 1952 in the Netherlands
- Services: Design & Engineering, Research & Consultancy, CI-Projects newbuilding
- All types of vessels
- More than 2000 vessels built of our designs
- Long tradition in Special Vessels customized for clients

RESEARCH & CONSULTANCY

- Focus R&D on eCONOmy & eCOlogy
  - **Reduction of** fuel & **emissions**
  - Propulsion on wind & LNG / H2
- => ‘eCONOlogical’ innovations
- Examples projects:
  - Feasibility studies new fuel concepts & **CO2 capturing**
  - Design requirements studies
  - Emission reduction strategy studies

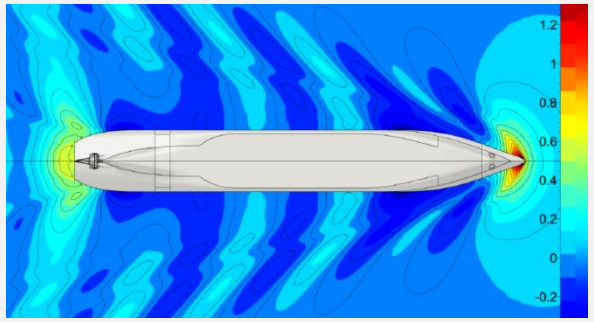
  Conoship initiated eConowind-unit

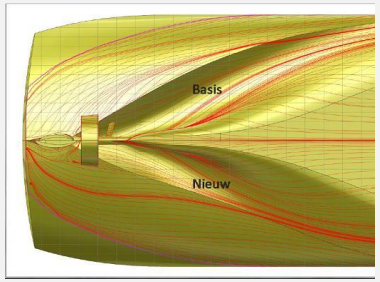
CONOSHIP: SUSTAINABLE SHIP DESIGN

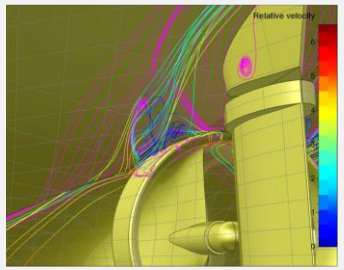
Design Rationale Conoship:

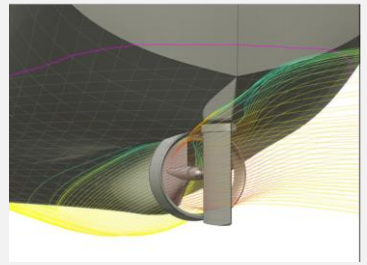
Adapt towards emission free shipping !

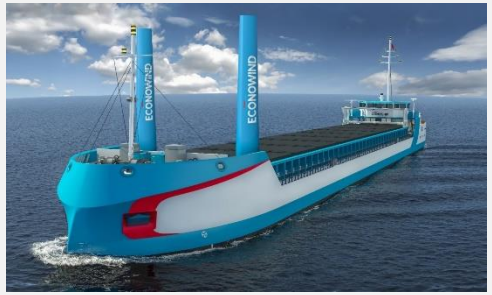
1. Slender hull => lowest resistance
2. Optimize largest possible propulsor
3. Apply largest possible auxiliary Wind Propulsors (consider ship operations)
4. Consider future ‘energy transition’ in ship design : electrification & batteries + methanol / LNG -> syn-fuels / H2 -> 900 bar / LiquidH2 / CH4 / CH3OH











DEVELOPMENT ENERGY EFFICIENT DESIGNS

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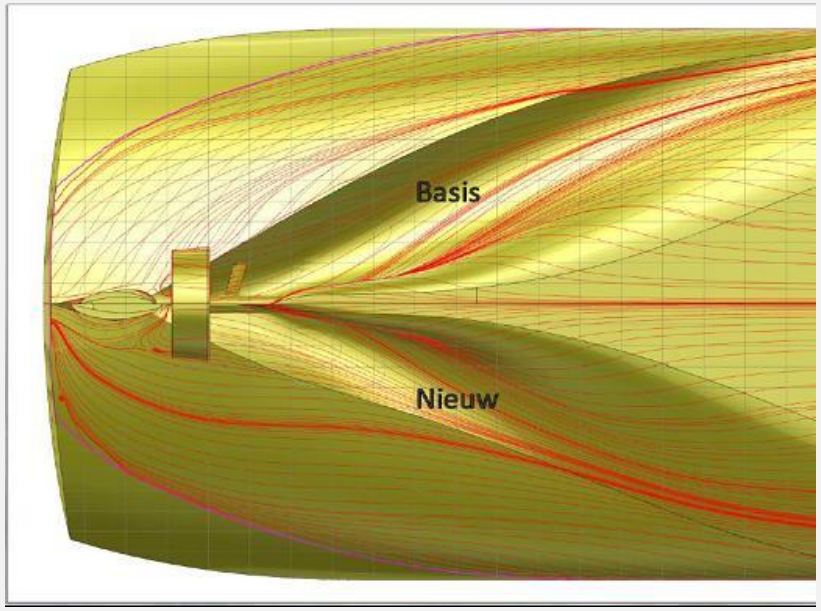
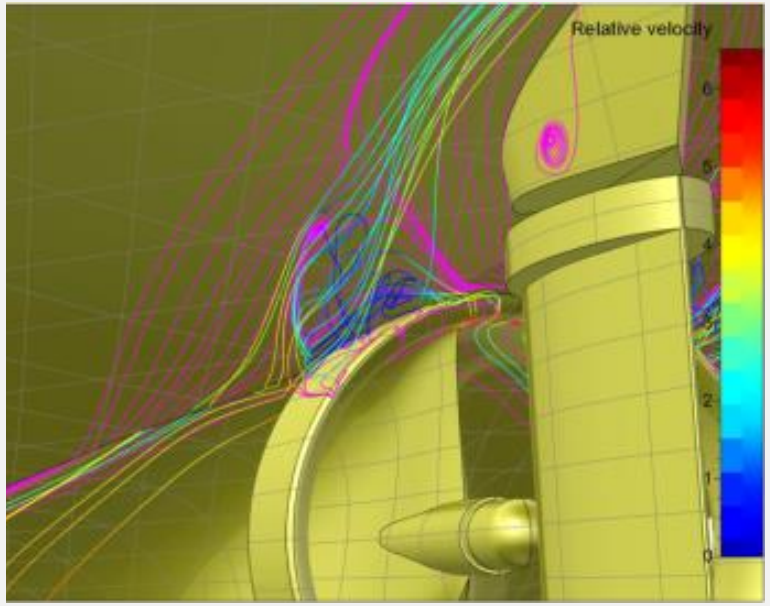
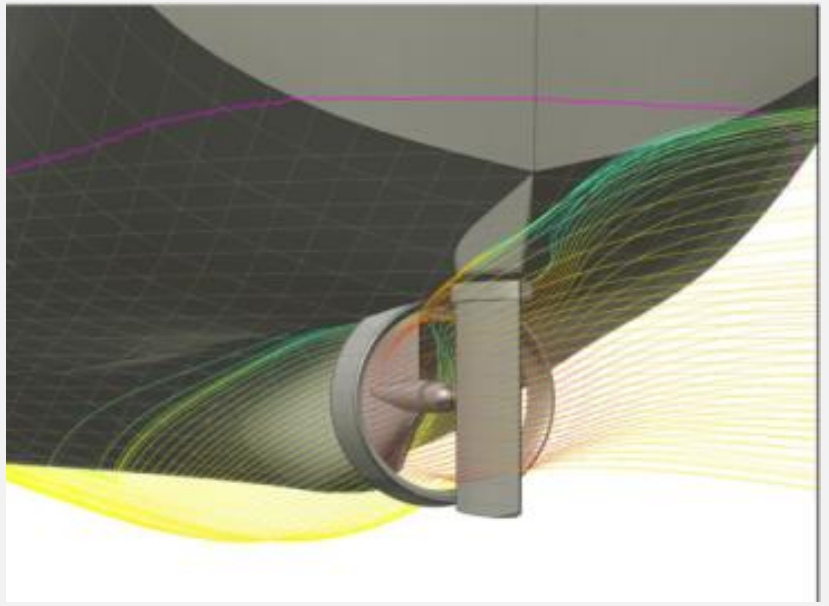
CFD Optimisation of aft-ship form & tunnel-& nozzle-& propellor design







Energy Efficient Designs

Adler ‘Rum Hart’ - Wyk auf Fohr

750 kW: 250 Paxx @ 18 kn at max draught 1,50 m

750 kW: 3500 ton cargo @ 10 kn / Fuel **3.0 ton/day**,

CONOSHIP INTERNATIONAL

LNG: 2005 SEAGOING LNG FEEDER TANKER

MODULAR WIND ASSISTED SHIP PROPULSION

MARITIME INNOVATION AWARD NOMINEE 2019

eConowind unit with 2 VentiFoils:

Optimal thrust force in compact unit

For equivalent thrust force, a sail area of abt.

2 x 165 m2 should be applied !

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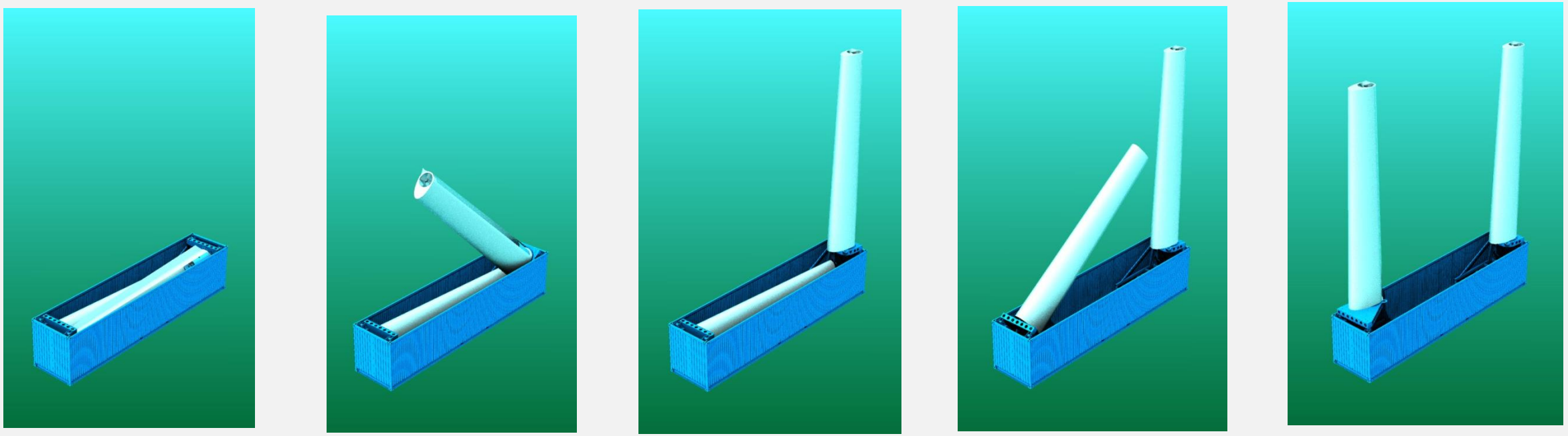
AUTONOMOUS FOLDABLE VENTIFOILS IN 40’ CONTAINER



Check wind is OK => VentiFoils unfolding out of eConowind-unit automatically +

Turning to optimal wind angle , start ventilator + adjust to windspeed => THRUST !

eConowind technology tested at sea: wind saves!

Maiden voyage nov 2018

Emden – Plymouth – Finland.

Fuel savings reported:

Up to 8% with 1 eConowind- unit in first technology tests at sea

Fuelcosts saving estimate:

€ 70,000 - € 100.000 / year

=>2 eConowind-units POP 4~6 year

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SAVING CLIMATE & AIR QUALITY!

GOOD HEALTH:

~20% reduction on NOx & Sooth/PM

~No SOx by legislation

CLIMATE ACTION:

~20% reduction on CO2 emissions =>

~ 380 ton CO2/year/ ship

~ 200.000 ton/year for relevant short sea fleet (~500 ships)

SAVING CLIMATE: FOSSIL CO2 EMISSION TO 0 !

CLIMATE ACTION:

- IMO: 2050 < 50% CO2 emission

Strategies for seagoing ships:

- Transition to H2 : how to bunker?
  - 900 bar ? Liquid – 253 C ?
  - H2 carriers: LOHC / NaBH / SiO2?
  - H2 syn-fuel: CH4, NH3, CH3OH

  Practical application 10 ~20 years ?
- Capturing CO2 from exhaust:
  - Existing engines / ships
  - Proven on land => to marinize !

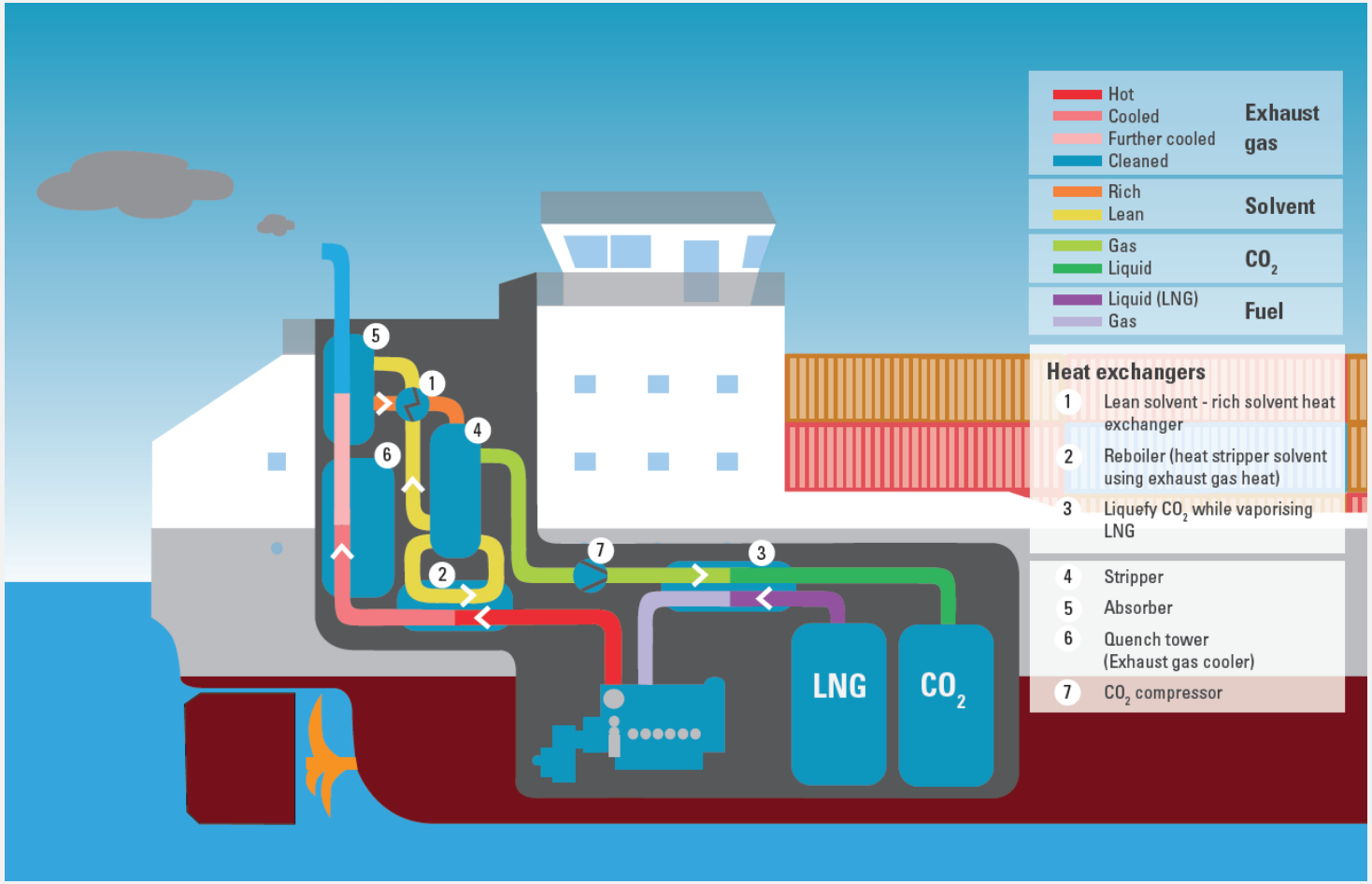
SUSTAINABLE DEVELOPMENT GOALS

LAND BASED CARBON CAPTURE

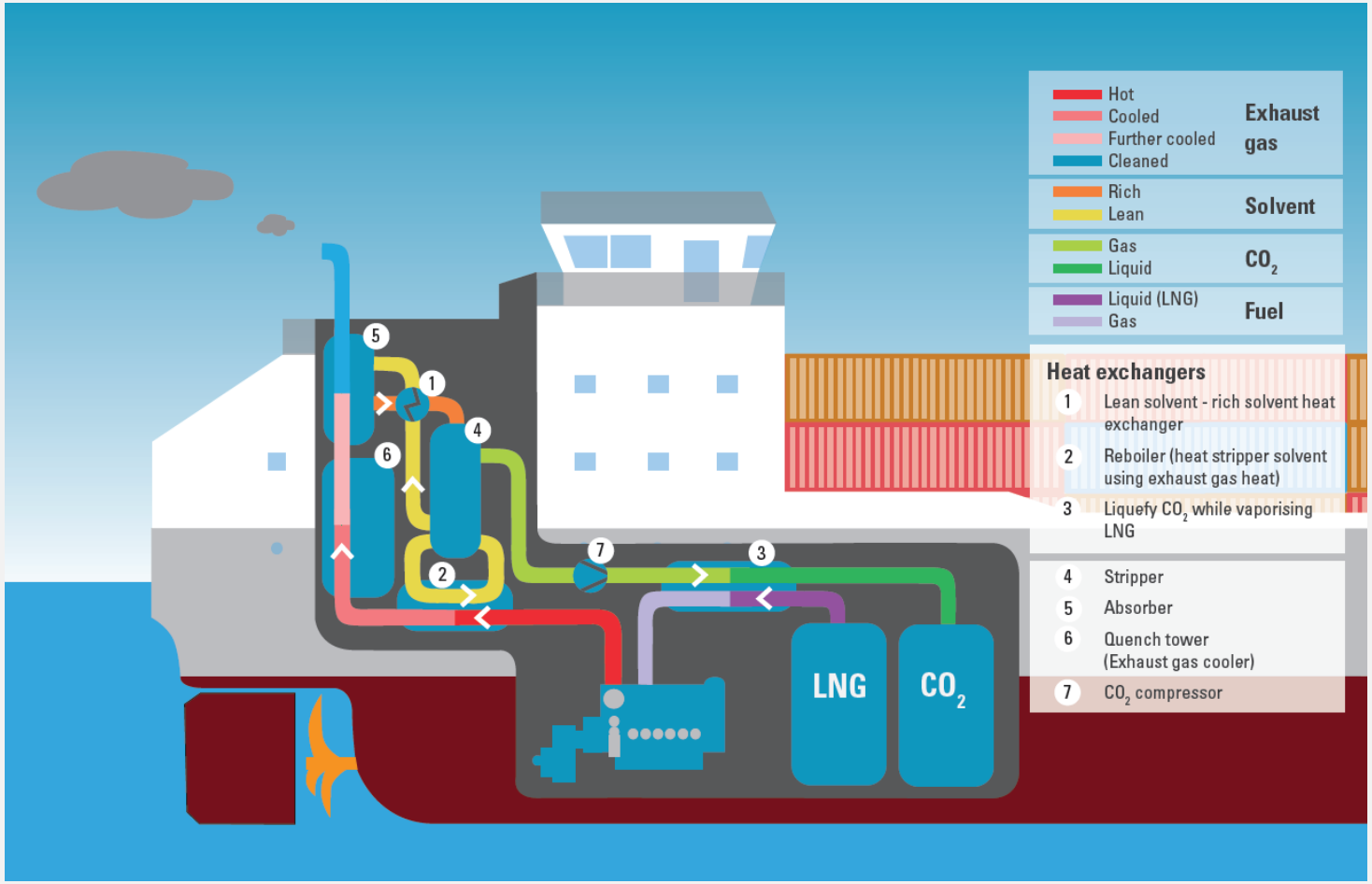
13 CLIMATE ACTION

Coal-fired Power Plant in Canada capturing 1 million ton CO2 per year since 2014

SHIPBASED CARBON CAPTURE



CHALLENGES: CAPTURING & STORING CO2 ON BOARD



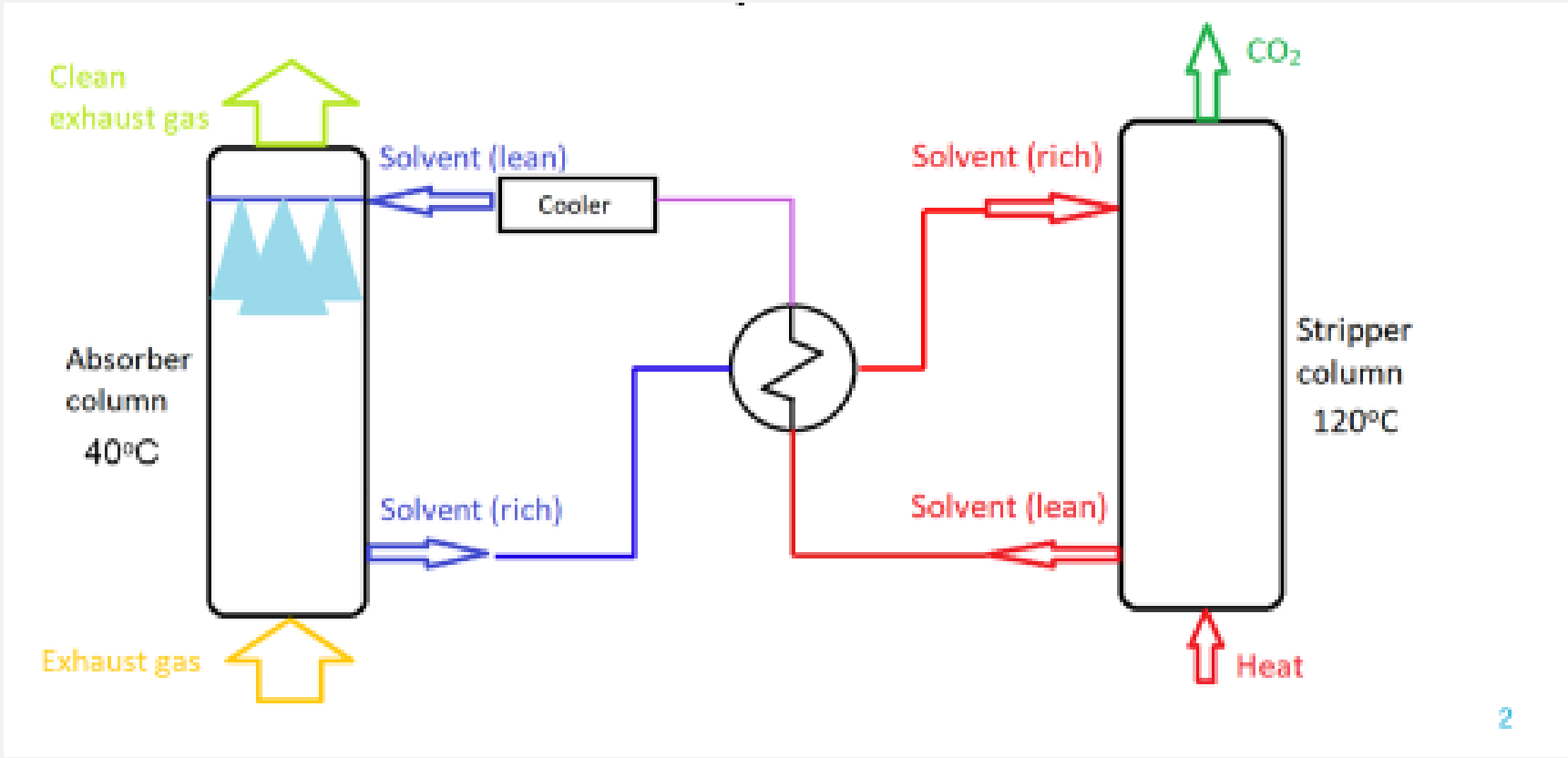
Capturing CO2:

- proven technology
- land-based plants:
- size/weight/roll&pitch-effects?

Storing CO2 on board:

- Liquid: -20 C @ 20 bar or -50C @ 8 bar in tank(/-containers)
- Energy for compression + cooling? => cool with LNG !

How does carbon capture work

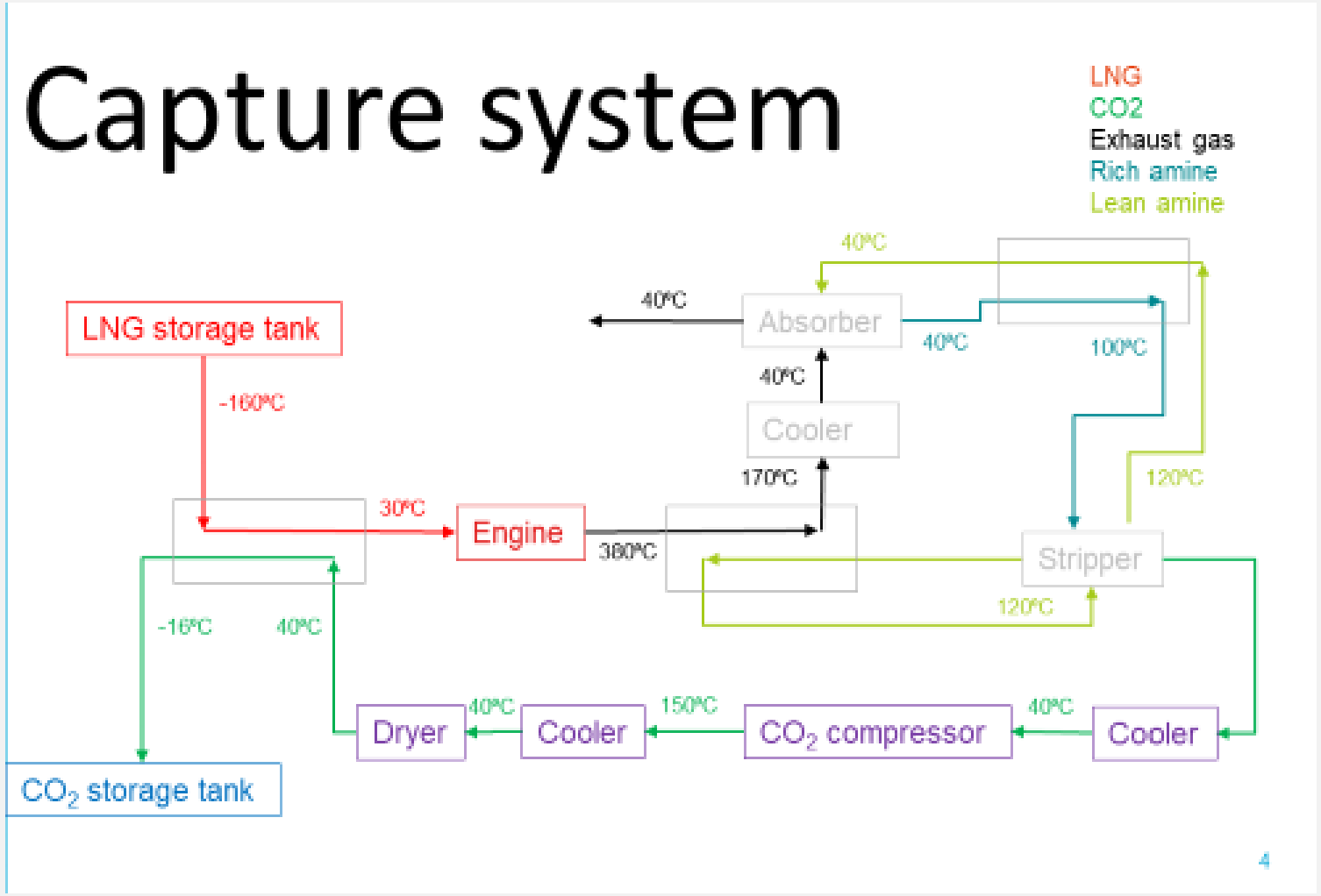


EXISTING PLANT IN TWENTE NETHERLANDS

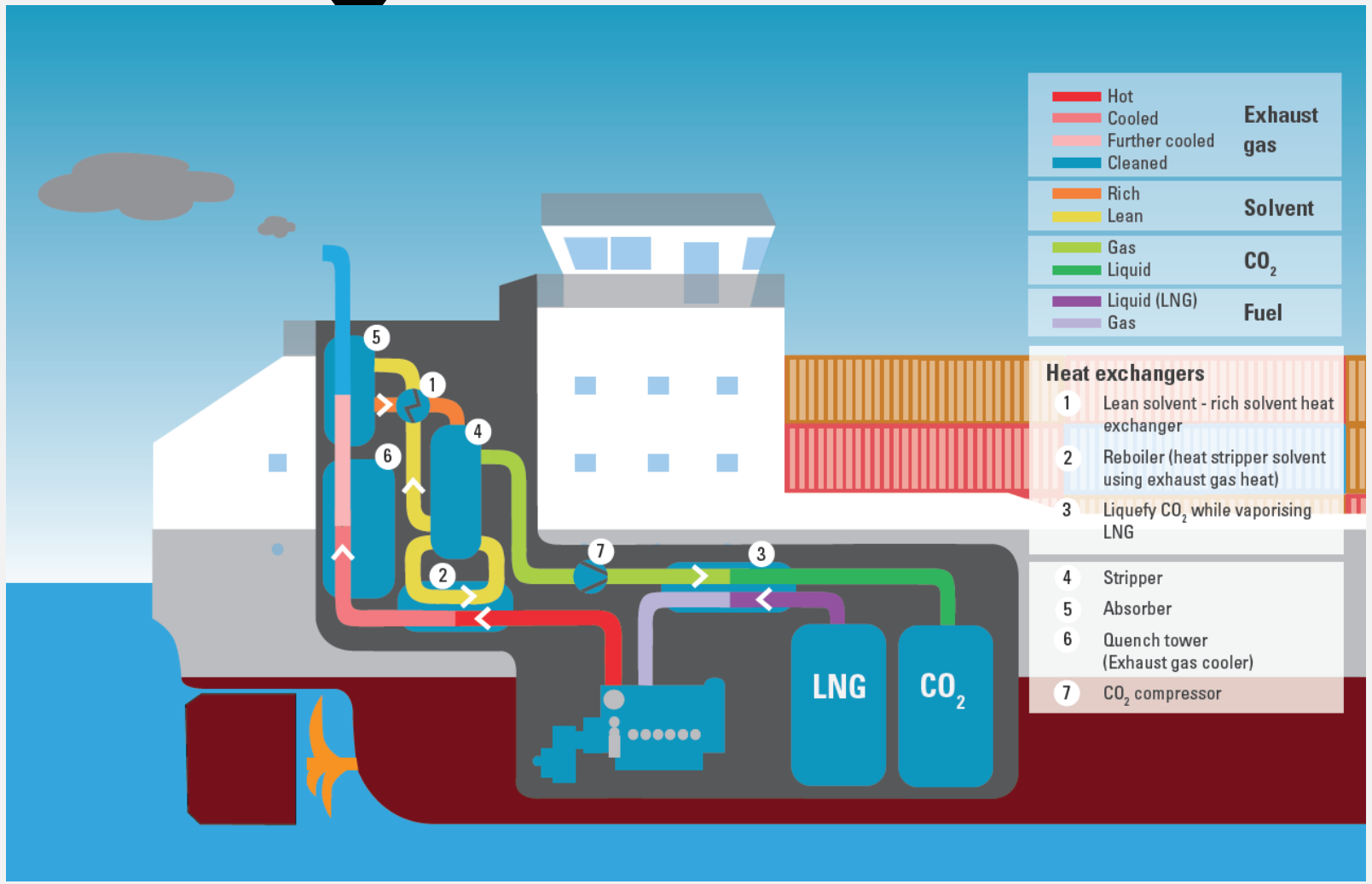
CO2 CAPTURE ON LNG VESSEL

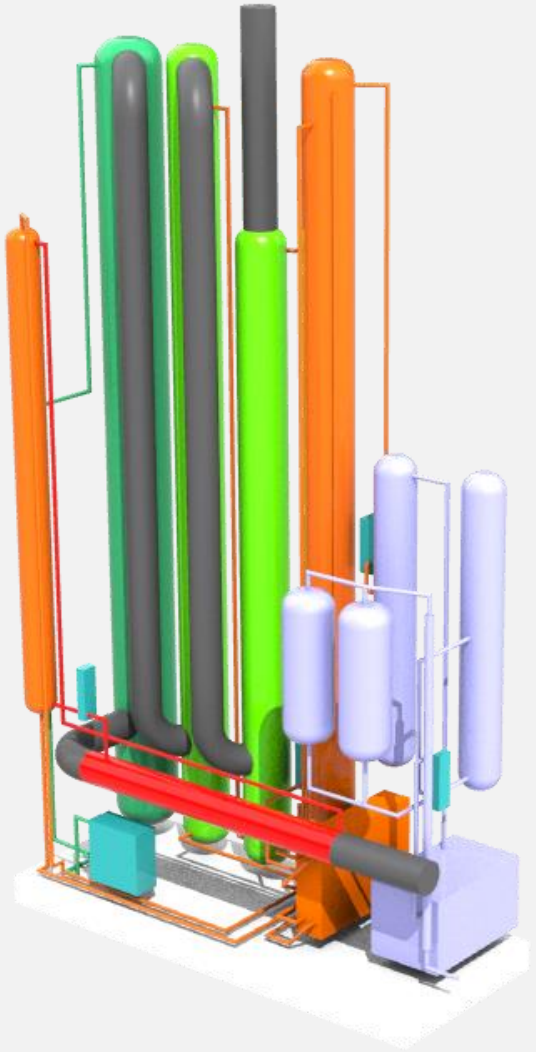
Combining carbon capture with LNG:

- Exhaust gases from LNG contain little contaminants (SO_x, NO_x, particulate matter) => less complicated capture
- CO_2 needs cooling to be stored: LNG is a cold source
  - 163 C -> -20 C @ 20 bar
    or -50 C @ 8 bar

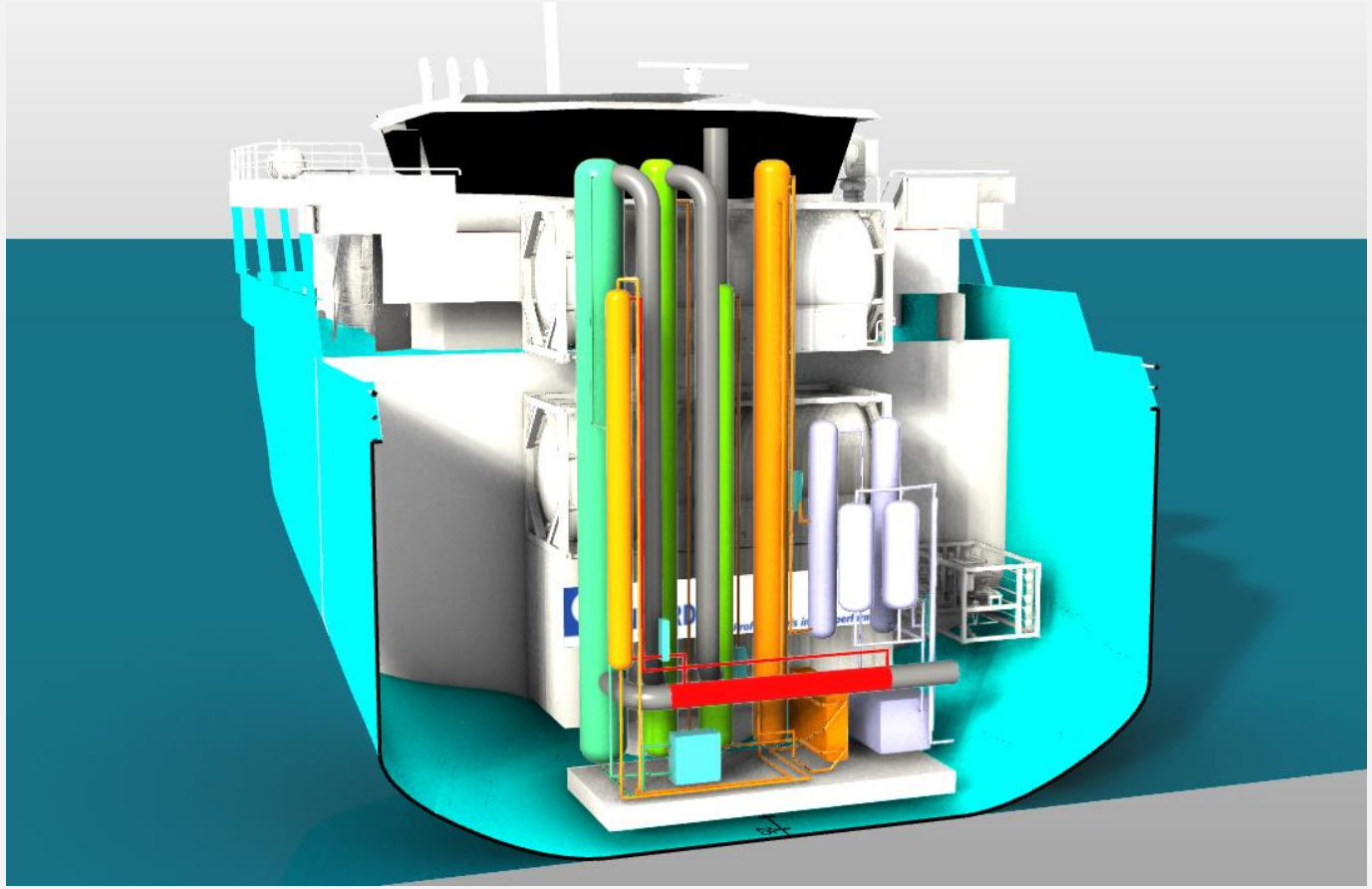


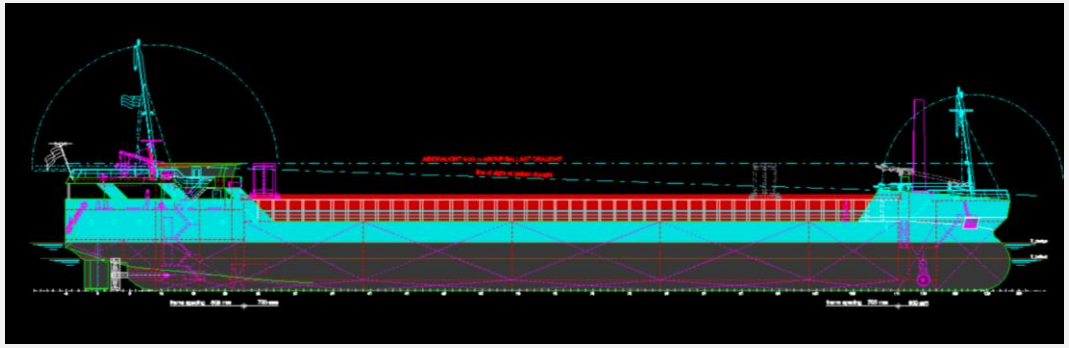
CAPTURING INSTALLATION IN SHIP



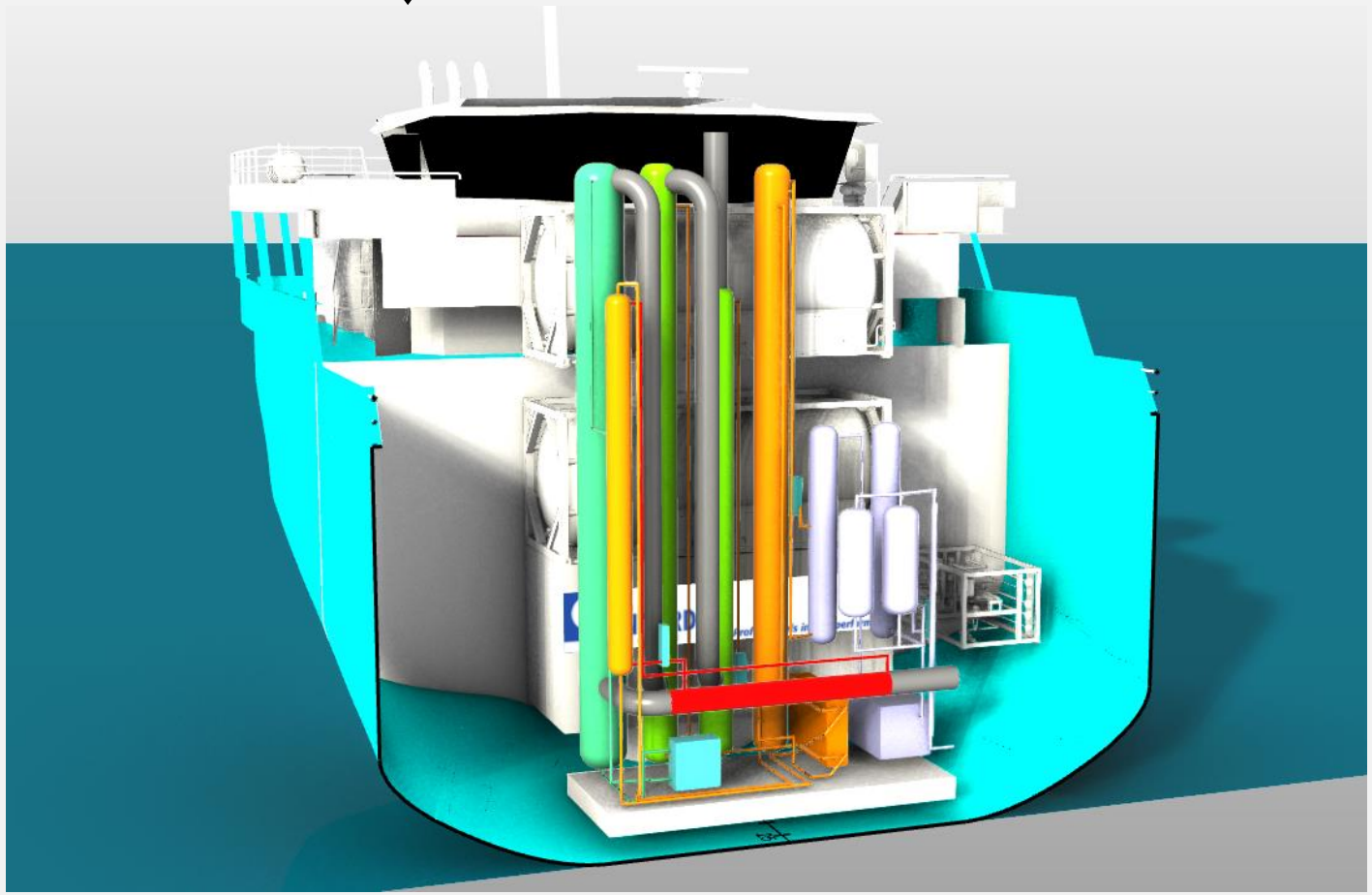


2019~2021 Feasibility studies on-board application



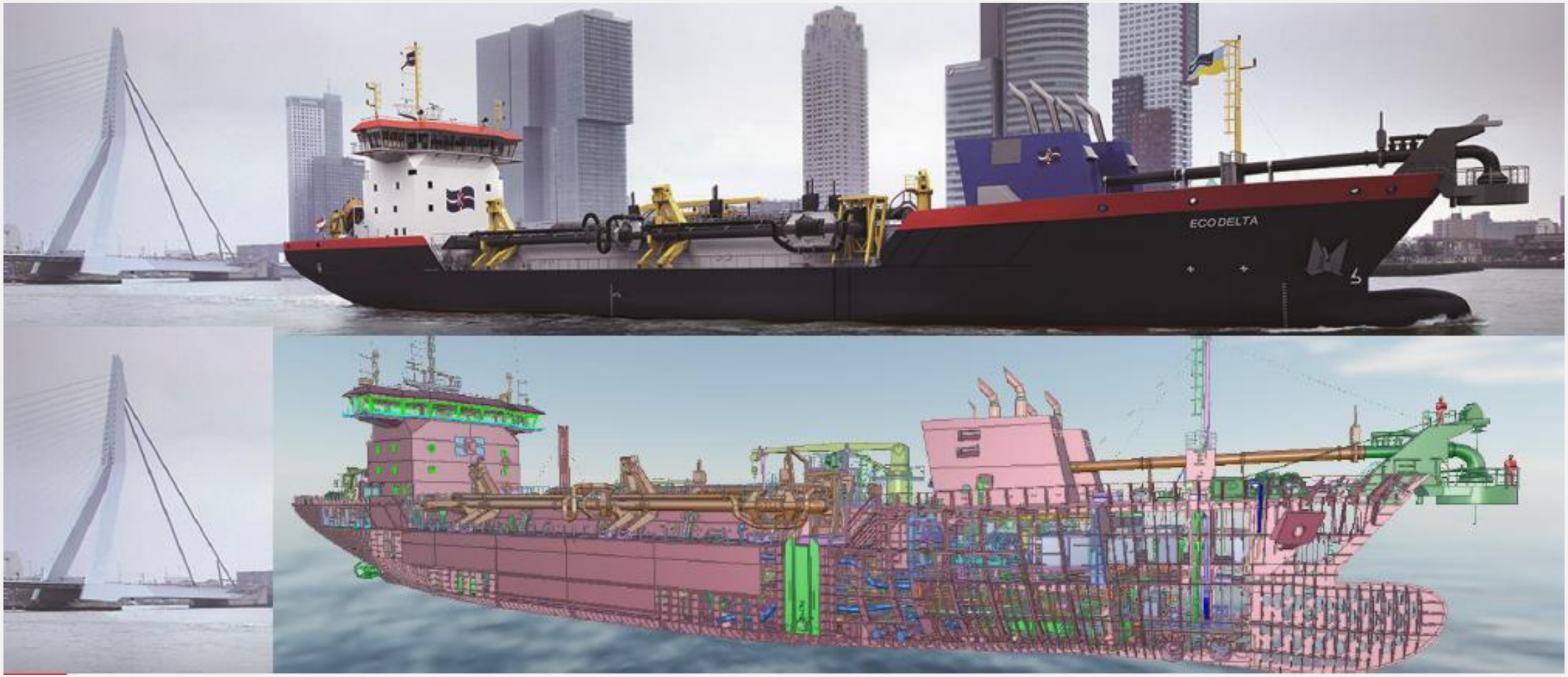


INTEGRATION IN EXISTING / NEW SHIPS



20 ft containers : LNG / CO2 / Gas-engines +
Capture installation footprint 10 m height
15 days CO2 7bar @ -50C capture rate 75%

2019: TSHD ECODELTA 5500 M3 ON LNG



CONOSHIP DESIGNED LNG-DREDGER -> H2 READY !

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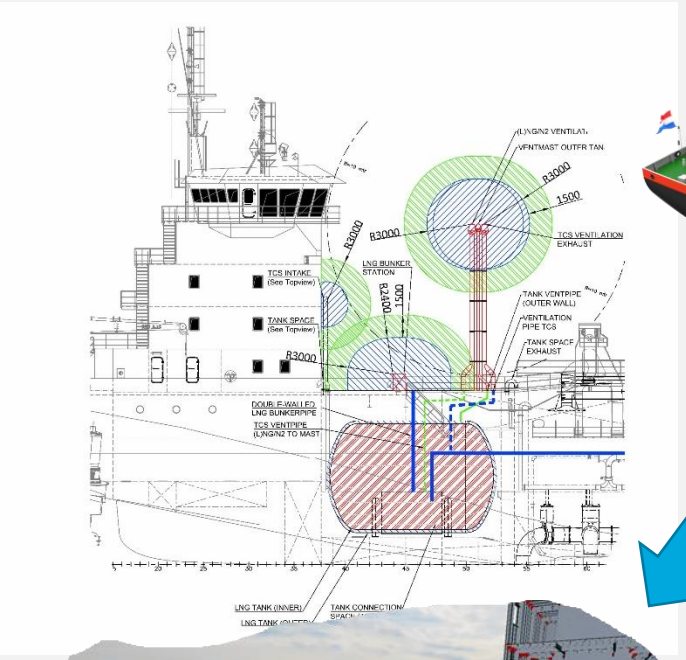

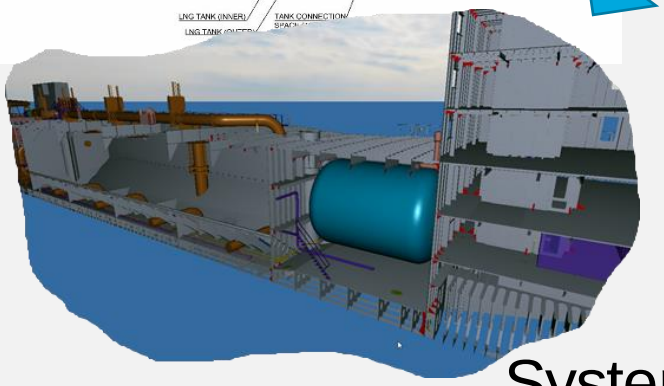

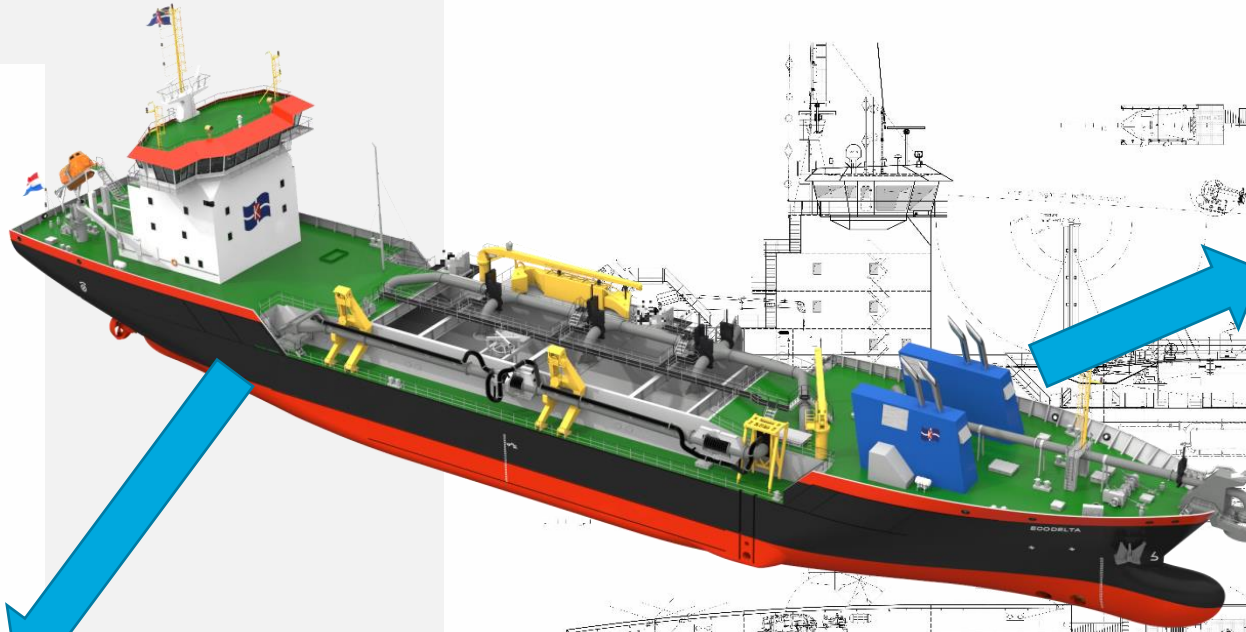

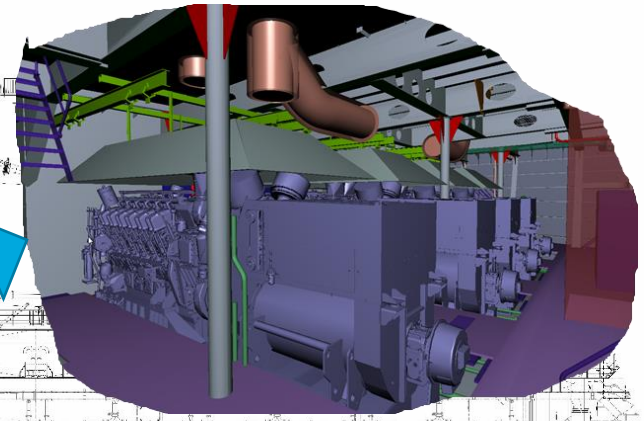

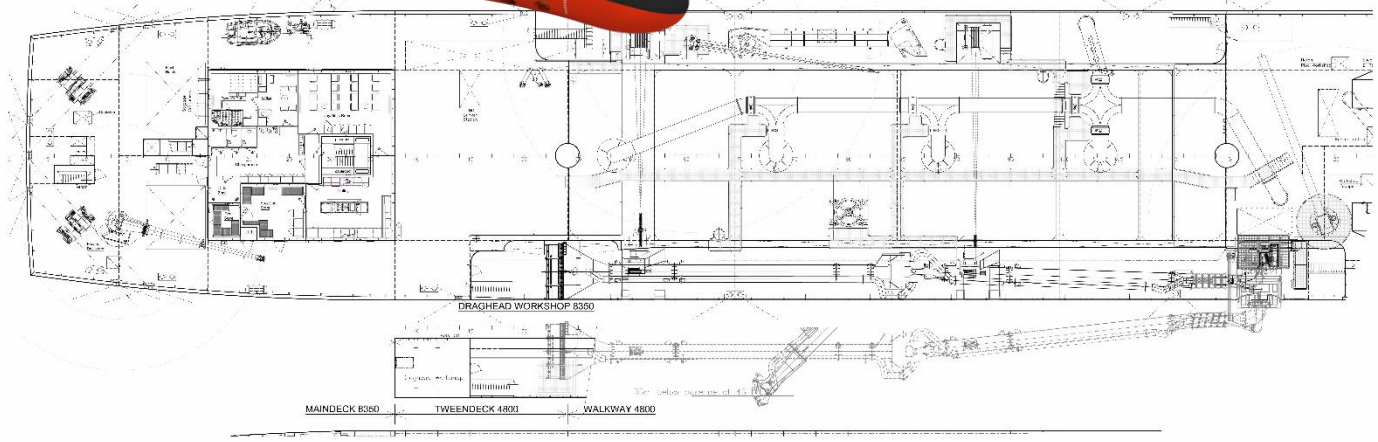

System integrator!

‘ECODELTA’: “H2 READY” ~ CLOSED CARBON LOOP

LNG = Liquid Natural Gas => 80 ~ 85% Methane = **CH4** at – 163 degrees Celsius

Future: wind-E-power => 6 **H2** + 2 **CO2** = 2 **CH4** + 2 H2O + O2=> synthetic Methane

Liquid synthetic Methane = CH4 at -163 dg C => ready to fuel Ecodelta

In LNG-engine : CH4 + 2 O2 = 2 H20 + CO2 => Capture CO2 on board + store

Switch CO2 containers while bunkering LNG: **CO2 feedstock** for production synthetic Methane

Thank you for your attention

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Why capture at source?

CO_2 Concentrations:

- Coal fired power plant: 12% (120000 ppm)
- Gas engine: 4.5% (45000 ppm)
- Atmosphere: 0.04% (400 ppm)