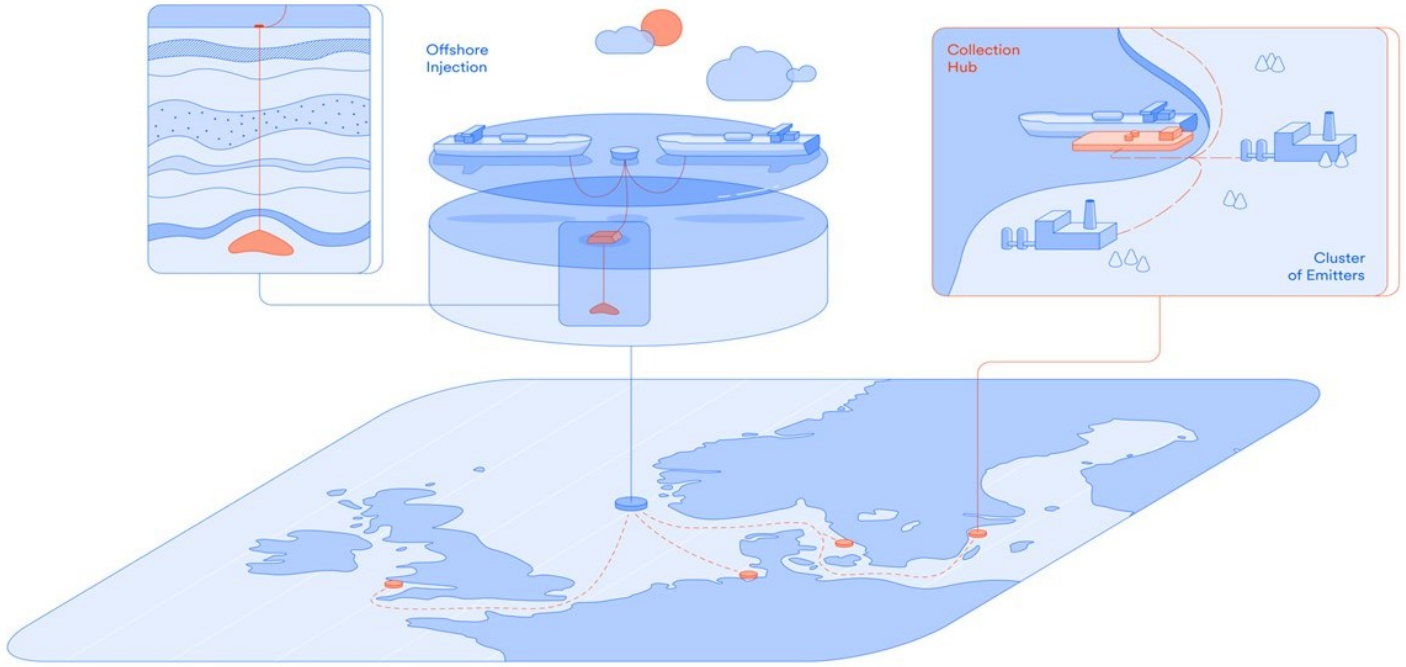
Altera and Höegh LNG scaling up CCS

The Stella Maris Project



Höegh LNG

altera HÖEGH LNG

Höegh LNG and Altera at a glance

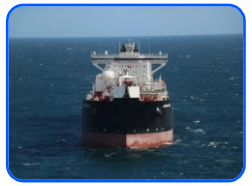
Altera

29 Shuttle Tankers

9 FPSO & **5** FSO

10 Towing Vessels

- Industry leader and pioneer in harsh weather FPSOs
- Industry leader and market segment developer of Dynamically Positioned Shuttle Tankers
- 30+ years of experience



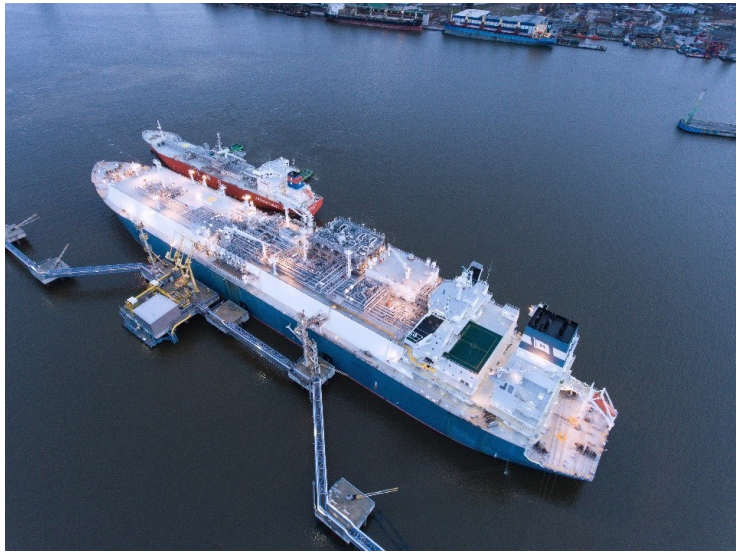
Höegh LNG

10 FSRU & **2** LNGC

- Industry leader in the FSRU market
- 45+ years of gas handling experience
- Developed floating LNG import terminals worldwide
- Part owner & ship management of small LNG carrier fleet

Our collective competence and experience in these three industry segments makes us unique and puts us in a stellar position to lead our industry to a sustainable CCS future.

Offshore CO2 transport, injection and storage – FPSO, shuttle and FSRU business “in reverse”



Collection, Processing and Export

Transport and DP offloading

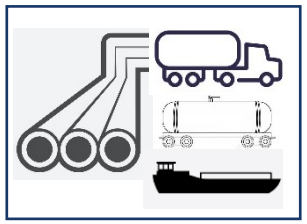
Offshore Injection and storage

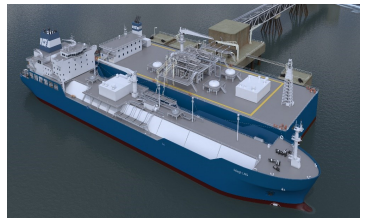
O&G related competence used to realize CCS

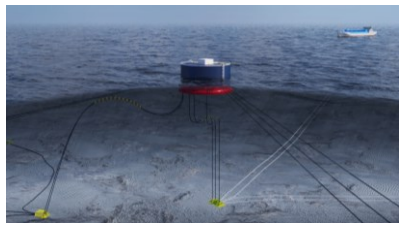
The Stella Maris CCS Project

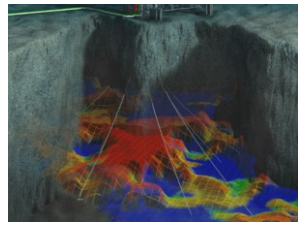
To get CCS costs down, large scale flexible solutions are required!

Infrastructure planned can handle ≥ 10 mtpa of CO2







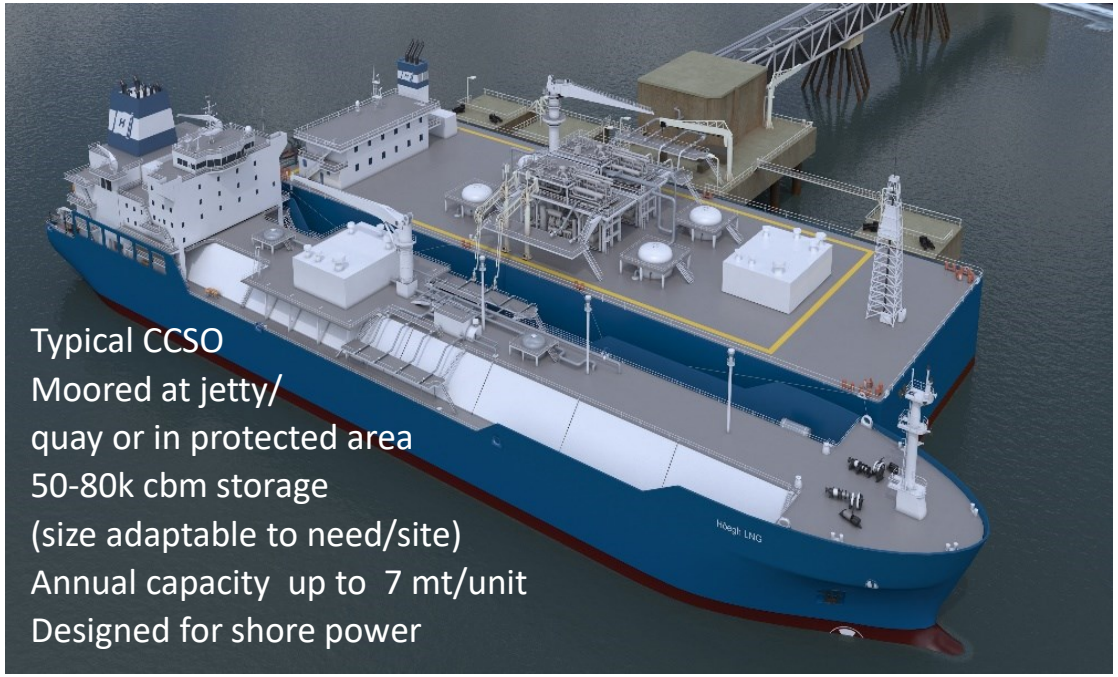


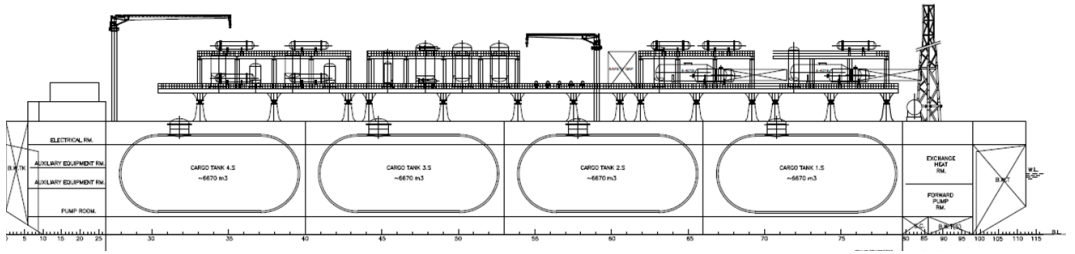
Capturing Technology	Transport CO2 from Emitter to CCSO	**Collection & export**	**Transportation**	**Injection of CO2**	**Offshore Storage Reservoir**
Emitter specific but Stella Maris CCS can offer in cooperation with capture technology company	*In cooperation with emitter (pipeline, truck, rail, barge, etc)*	CO2 Collection, Storage and Offloading (CCSO) 2 units (50-80 cbm)	CO2-shuttle carriers 4 units (50k cbm low pressure)	Floating Injection Unit 1 unmanned unit connected to 2 STL systems	

- One stop-shop from collection to storage
- Zero emission capable
- Solution to be deployed for large scale emitters and clusters in 2026/27
- Cooperate close with industry and policy makers nationally and internationally
- Scalable Worldwide – design one – build many

altera HÖEGH LNG

Carbon Collection, Storage and Offloading Unit (CCSO)





Designed to receive and process:

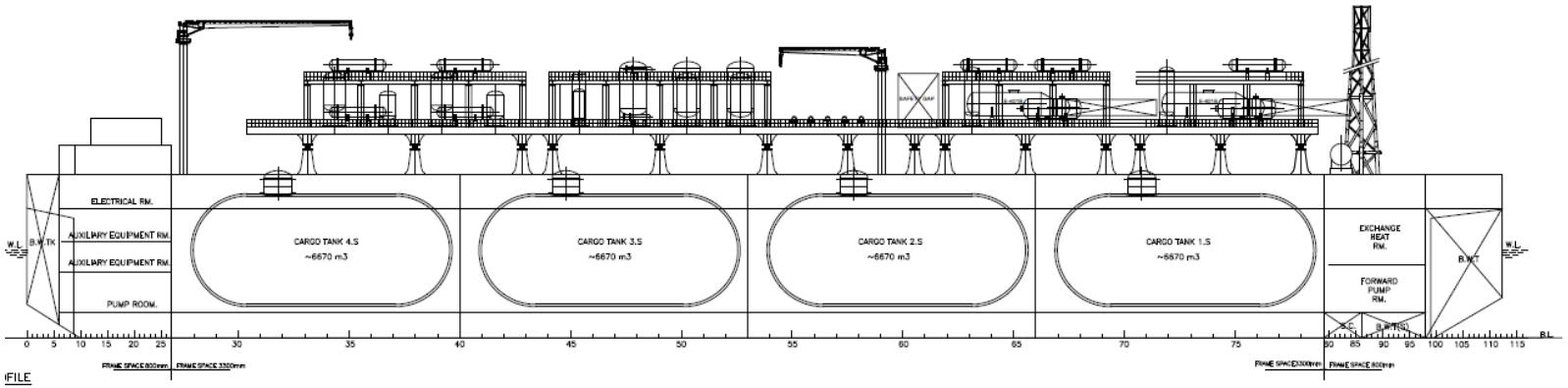
- High- & low-pressure gas from pipelines
- Medium & low-pressure liquid from trucks, rail, ships, barge
- Various qualities with different levels of impurity

Principal Dimensions (80k cbm design):

Length o.a.	220m
Breath (M)	58m
Depth (M)	24,5m
Design Draft	13m

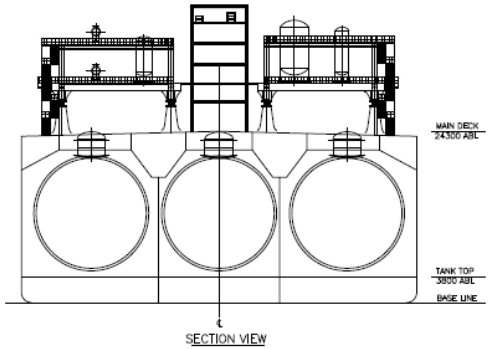
altera HÖEGH LNG

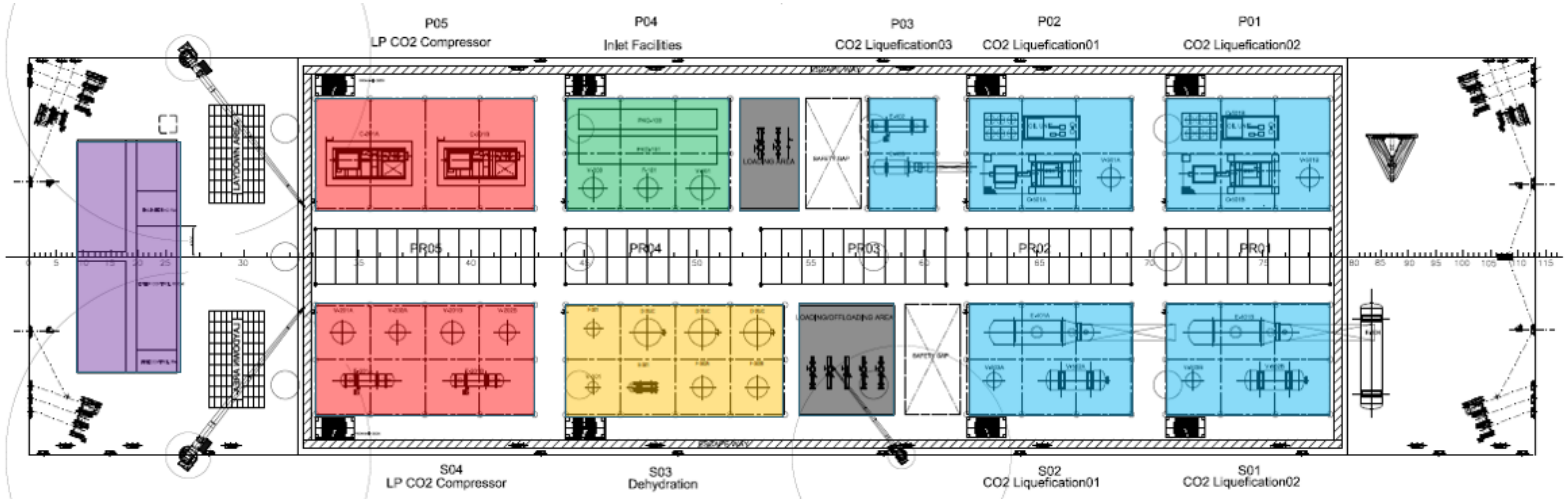
Carbon Collection, Storage and Offloading Unit (CCSO)



DNV

APPROVAL IN PRINCIPLE





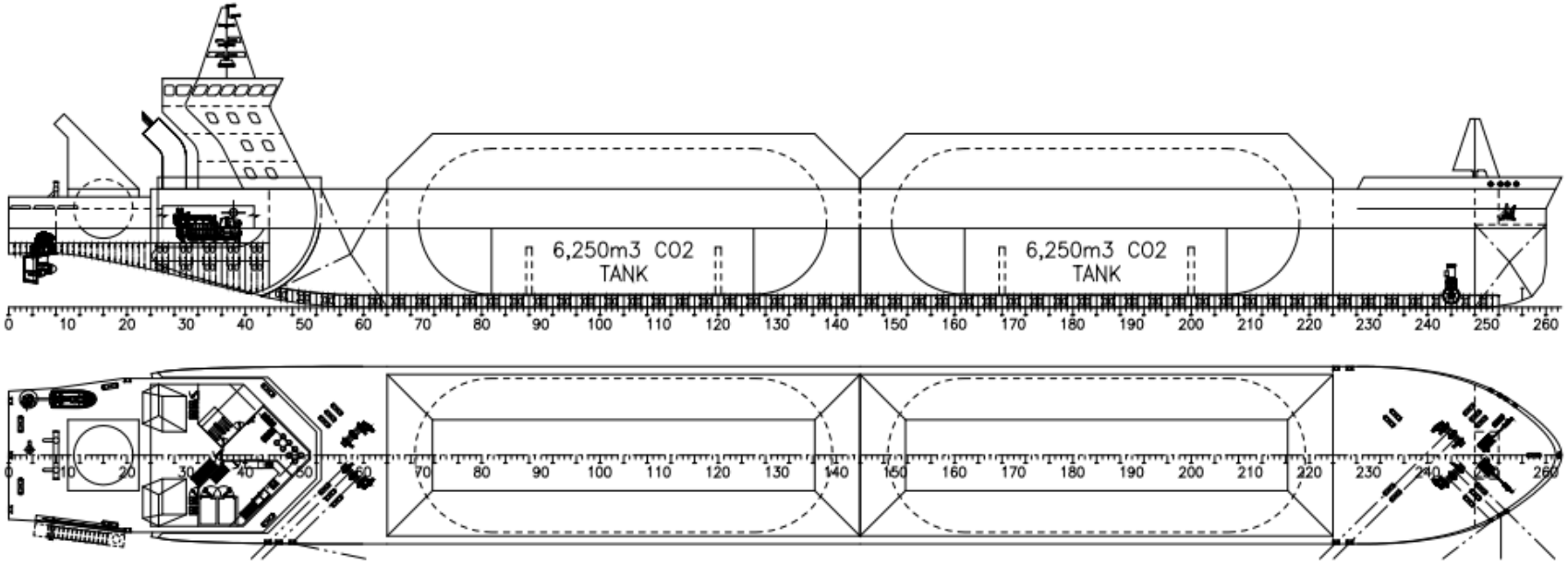
Work ongoing to update the design with
- 80 k m^3 size (2 x 4 tanks) &
- 60k m^3 (2 x 3 tanks) version

PRINCIPAL DIMENSIONS :	
LENGTH O.A.	app. 219.80m
BREATH(MOULDED)	57.80m
DEPTH (MOULDED)	24.30m
DESIGN DRAFT	~13.00m
CARGO CAPACITY TOTAL	80,000 m3

altera HÖEGH LNG

Push barge solution for local collection/tranportation

With 2 or more barges combined with one push-tug;
-one of the barge's recieves CO_2 in port (intermediate storage/no onshore tanks),
- while the other transport CO_2 to collection hub



LOA Barge I:	143,2 m
LOA Barge I + tug:	157,6 m
Beam:	18,0 m
Depth:	12,0 m
Draught fully loaded:	9,0 m
Max draft:	11.1 m
Max LOA:	162,0 m

10 knot (max service)

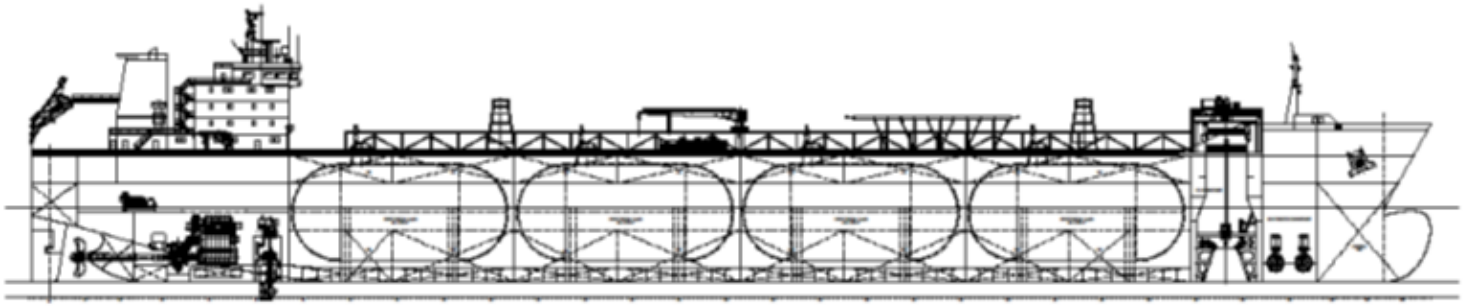
Two sizes available now (two tanks or one tank)
Design can be adapted to restrictions on dimensions, draft and tank capacity depending on service location

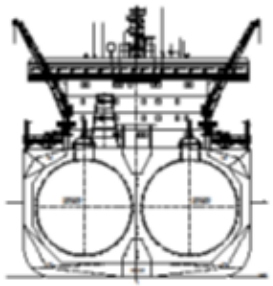
altera HÖEGH LNG

CO2 Shuttle Carriers

DNV

APPROVAL IN PRINCIPLE





Principal dimensions:

Length o.a:	238m
Breadth (M):	38m
Depth (M):	22m
Design draft:	13m
Cargo cap:	50k cbm

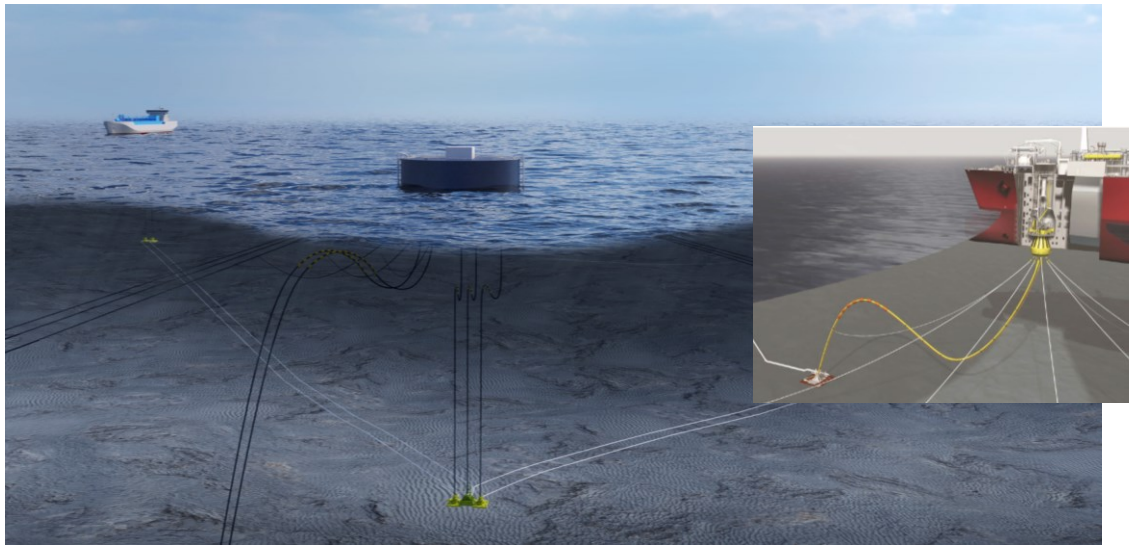
- New, state of the art CO_2 shuttle carrier design
- 50 000 cbm - low pressure tanks (8 x IMO C tanks)
- CO2 stored and transported as liquid at 6.5 barg & -47°C
- STL buoy connection up to 5.5m H_s
- Electric Power transmission to FIU during offloading (< 15 MW)
- Battery hybrid installation?
- Zero emission capable - LNG/Bio gas/NH3 as fuel

Key Innovations
- Low pressure CO2 tanks
- Dynamically positioned CO2 carrier
- Equipment for offshore loading of CO2
- Power Source for injection unit

Work ongoing with 4 yards

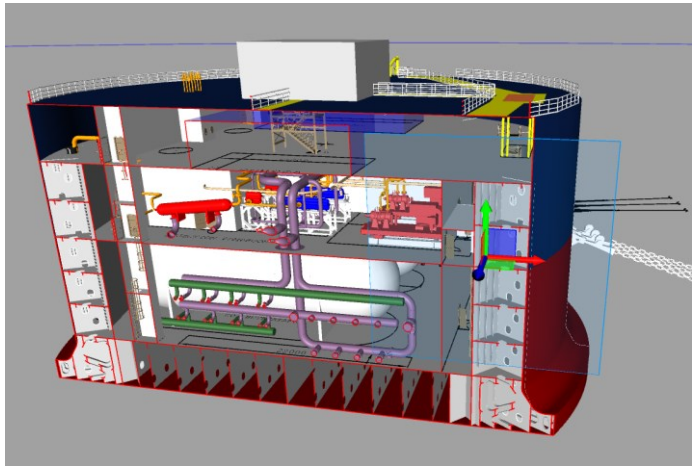
altera HÖEGH LNG

Floating Injection Unit (FIU)



Principal dimensions:

Hull Diameter	50m
Bilge Box diameter:	62m
Main Deck diameter	50m
Hull Depth:	22m
Design draft:	13m
Draft loaded	14m



- Allows continuous injection
- Heating and injection modules below deck
- Power from Shuttle carrier (+ battery back-up)
- Unmanned and operations from shore, communication via shuttle carrier
- CO2 heated and injected into reservoir in dense phase (>5°C & 65 -160 barg)

Alternatives:

- Injection facilities on an existing offshore installation or on new fixed offshore structure
- Direct injection from shuttle carrier

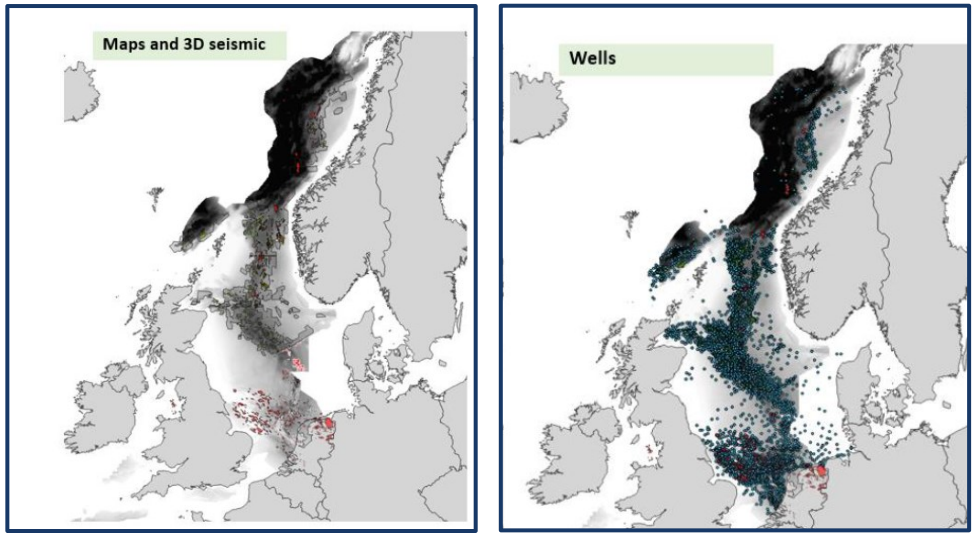
DNV

APPROVAL IN PRINCIPLE

Key Innovations
- Power from CO2 Shuttle Carrier
- Normally Unmanned
- Equipment for offshore loading of CO2
- Zero emission capable

altera HÖEGH LNG

Potential CO_2 injection and storage reservoirs



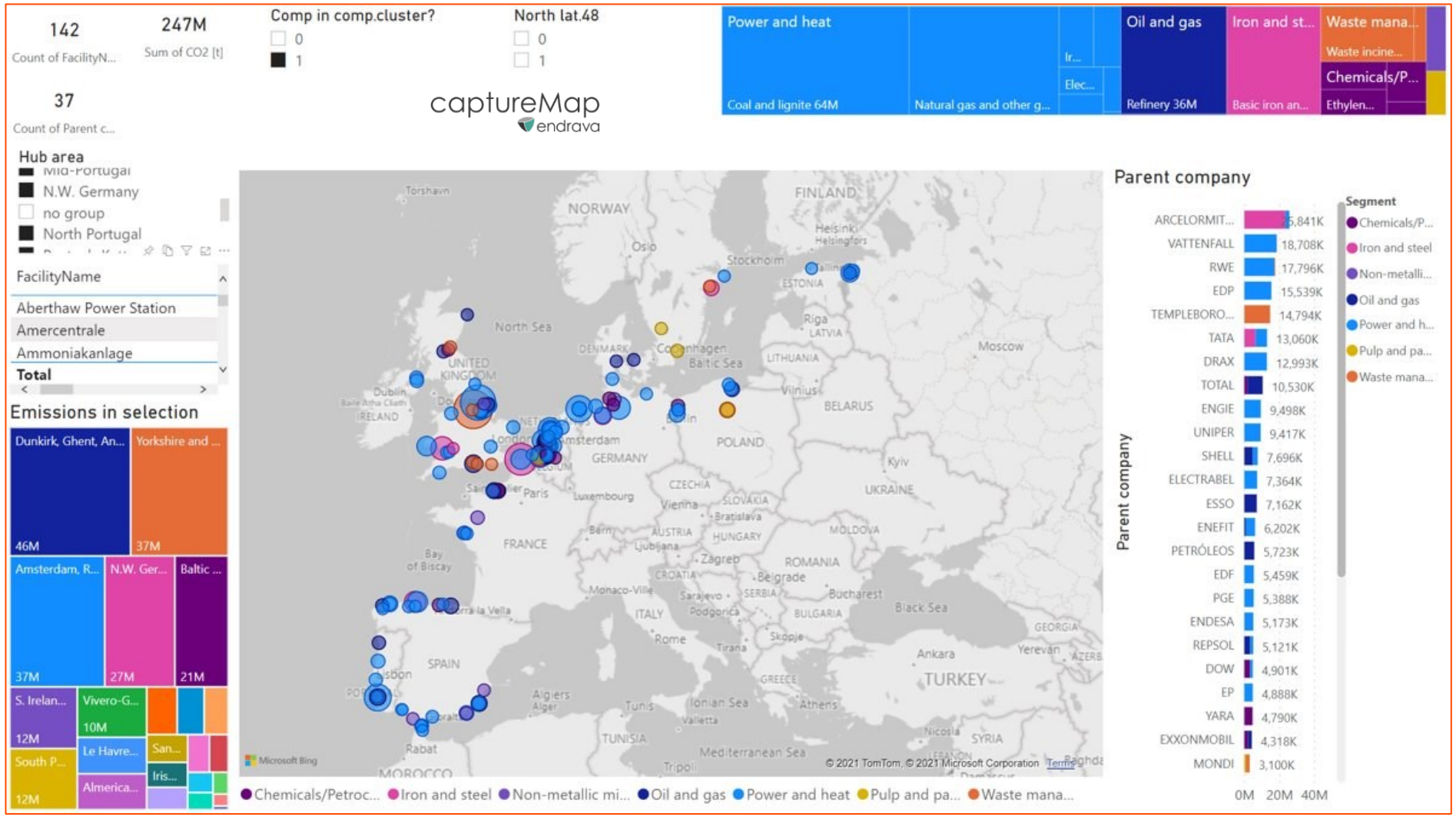
Data coverage (wells, 3D seismics and maps)

- Screening of potential reservoirs on the Norwegian Continental shelf (NCS) to identify;
  - ✓ Geologically stable areas with strong confining seals, adequate size, permeability, porosity and depth so that the pressure and the temperature in the reservoir are high enough to permanently maintain the injected CO2 at supercritical condition
  - ✓ Saline reservoirs without HC
- A work program carried out in 2021/22 to identify suitable reservoirs and develop geological models
- Cooperate with recognized E&P company(ies) to be part of Stella Maris CCS and to be subsurface operator
- **A license application was submitted to MPE in July'22. Expected license award 1Q 2023**

altera HÖEGH LNG

Building business cases

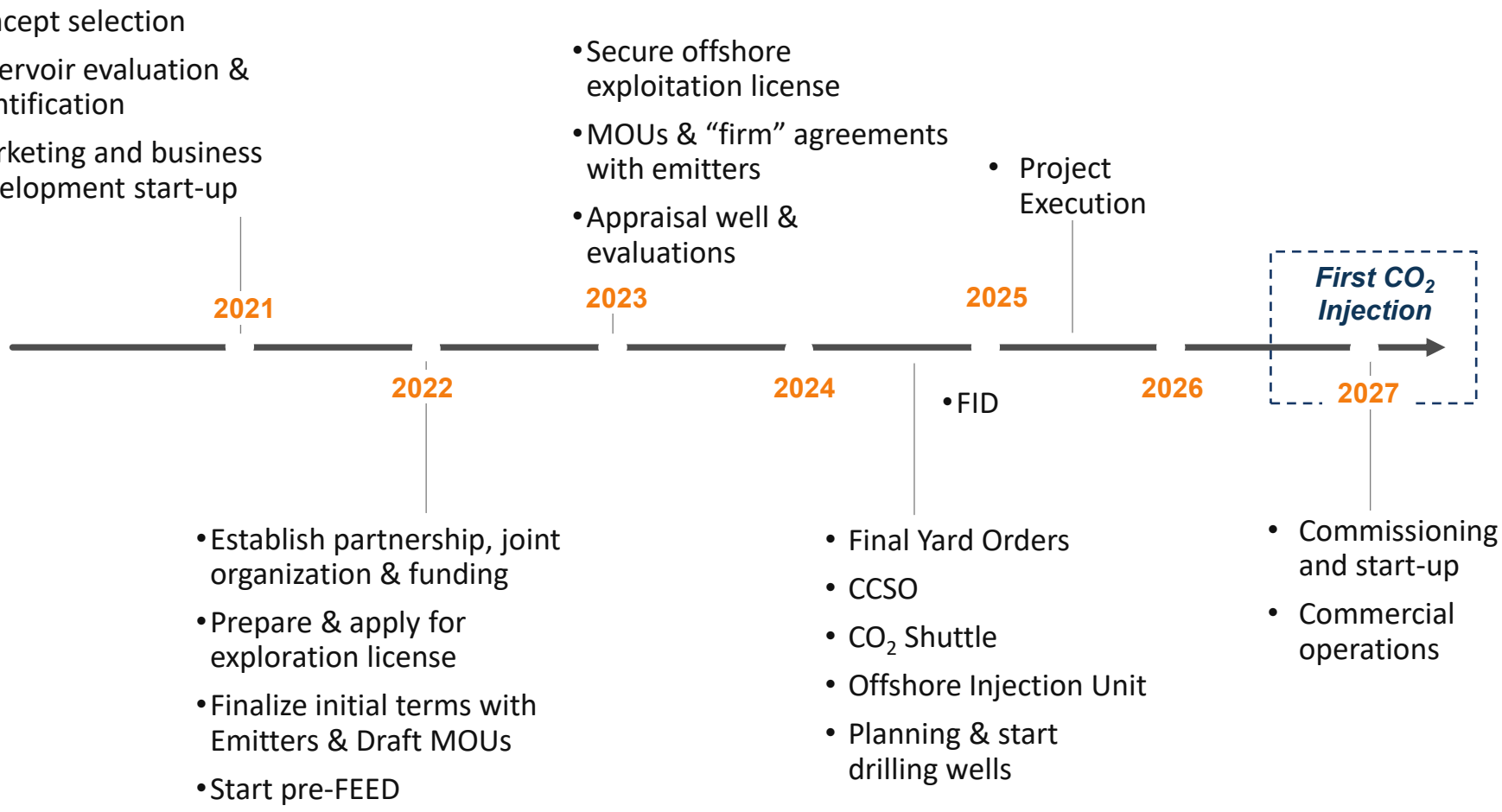
- Identify hub areas
- Variances in magnitude and type of industry
- Focus on largest contributions in each cluster first, and company emitters



altera HÖEGH LNG

Stella Maris CCS – one of the keys to achieve global climate targets

Status and way forward



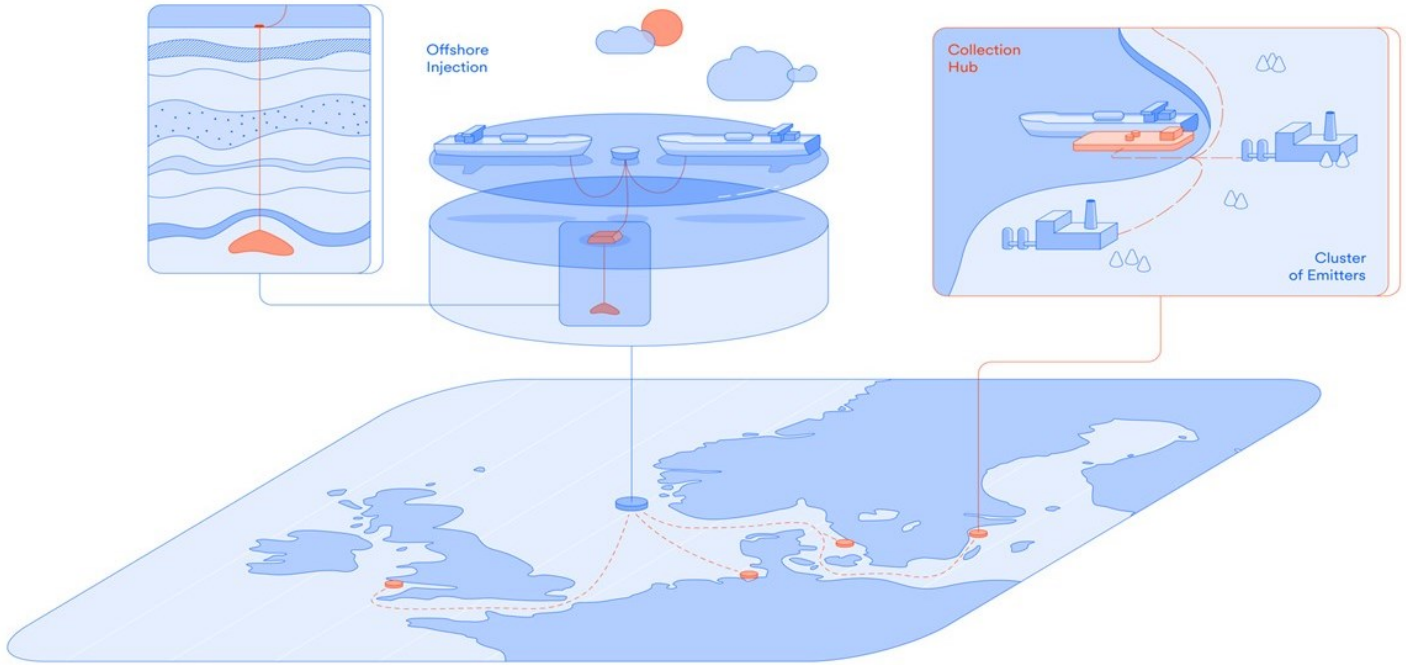
altera HÖEGH LNG

Stella Maris CCS

Large Scale, Flexible, Scalable Maritime CO_2 Logistics Solution

During the next 12 months we will;

- finalize technical concept and secure subsurface storage license
- finalize joint development agreements and joint project team to deliver Stella Maris CCS
- continue marketing our solution to individual companies, industry clusters and national authorities
- become a one-shop-stop provider of a competitive and cost-efficient CO_2 solution from collection to storage



altera HÖEGH LNG