

# CCS VALUE CHAIN WORKSHOP INNOVATION FUND

*Closed Door Workshop*

**02 October 2024, 09:00h-15:30h**

# Welcome and Information

## **The goal:**

Open discussion with EU co-funded CO2 capture projects & prospective CO2 storage operators in the EU & Member States experts on strategic full value chains for CO2 projects in the North Sea area.

**Topic:** Timely operational availability of the CO2 storage sites. What concretely are the challenges to take FIDs? What are the steps to get there timely?

**Modus operandi:** Chatham House rules, i.e. the topics discussed can be referred to in general terms, but one cannot disclose who said what.

*Disclaimer: no commercially sensitive information should be disclosed.*

## **Results:**

- An anonymised public summary of the meeting discussion will be prepared and published.
- Useful contacts & exchanges of views among front-runners

# Agenda for the day

**09:30, Welcome and agenda – CINEA**

**09:35, Introductory remarks – DG CLIMA**

**09:45, Session 1 - Supply of CO<sub>2</sub>**

*Speakers: GO4ECOPLANET (Lafarge Cement), CalCC (Lhoist, Air Liquide), K6 (EQIOM, Air Liquide), Beccs Stockholm (Stockholm Exergi), Kairos@C (BASF, Air Liquide).*

**11:00 – 11:15 – coffee break**

**11:15, Session 2 - Availability of CO<sub>2</sub> injection capacity**

*Speakers: Harbour Energy, Carbfix, INEOS, ENI, Total Energies, Shell, Equinor.*

**13:00 – 14:00 – lunch break**

**14:00, Session 3 - Enabling conditions**

*Speakers: Denmark, Norway*

**14:30, Open Discussion of all participants**

**15:25, Wrap-up and conclusions – DG CLIMA**

**15:30 – End of workshop**

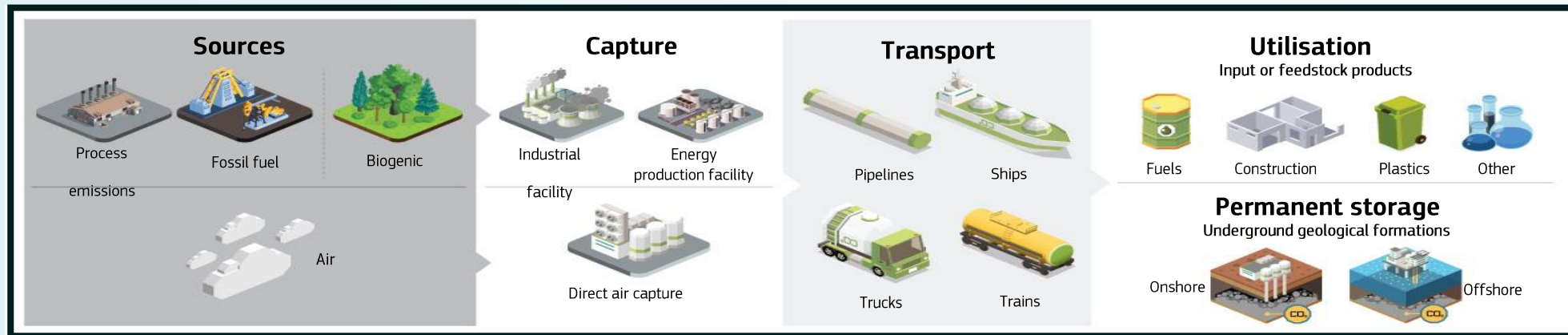
# Main EU and national funding mechanisms for ICM projects

- **Innovation Fund:** one of the world's largest funding programmes for the deployment of net-zero and innovative tech – including CCS.
- **Strategic Technologies for Europe Platform (STEP):** STEP Seal for Innovation Fund projects
- **Grants-as-a-service** and **national support mechanisms**
- **Connecting Europe Facility:** CO2 infrastructure projects that are on the PCI list (14 PCI/PMIs) can apply for support under CEF - 5 CO2 infrastructure projects have been selected for support at the end of 2023.
- **Horizon 2020:** available for research and demonstration projects 39 ongoing CCUS projects with EU funding.
- **LIFE Programme:** supports sustainable finance activities, awareness raising, training and capacity building, knowledge development and stakeholder participation in climate change mitigation and adaptation areas.

# Industrial Carbon Management (ICM)

- **Commission Communication (6.2.2024)\***, with actions for the Union and Member States to implement
- Focuses on three main “ICM” technological pathways:
  - **Capturing CO<sub>2</sub>** emissions for **storage** (CCS)
  - **Removing CO<sub>2</sub>** from the atmosphere (BioCCS and DACCS)
  - **Capturing CO<sub>2</sub>** for **utilisation** (CCU)

**CO<sub>2</sub> transport infrastructure = key enabler** necessary to establish a CO<sub>2</sub> market in Europe.



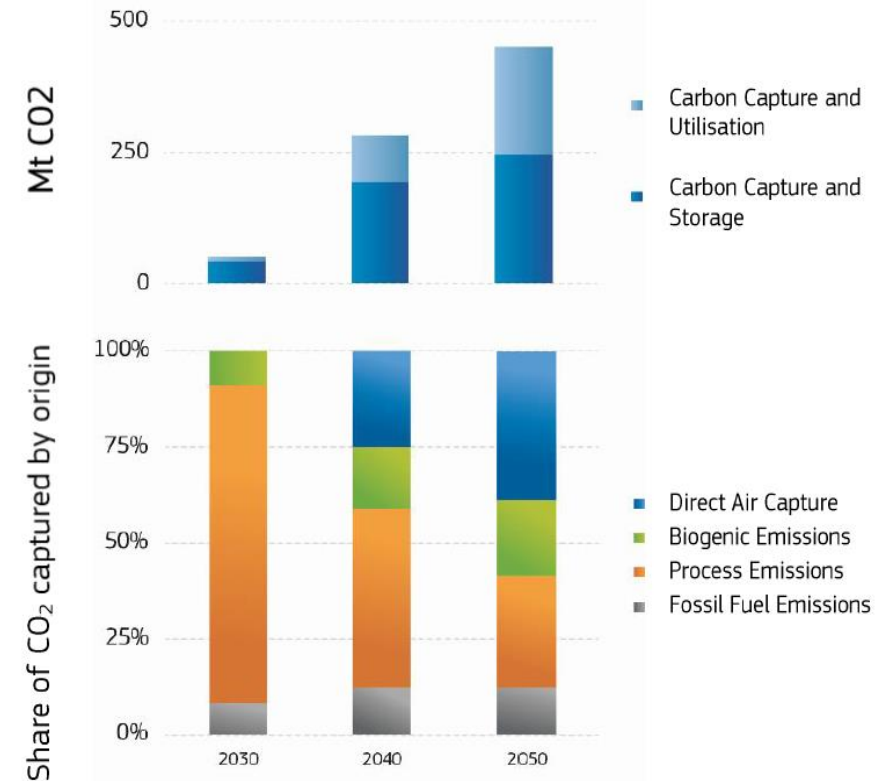
\* [COM/2024/62 final](#)

# The 2040 Climate Target Communication\*

- ICM essential complement to mitigation that is necessary in the first place
- ICM key to reduce and manage carbon emissions in industrial processes
- Then, need for a shift towards biobased and air-captured CO<sub>2</sub> streams
- CO<sub>2</sub> capture needs:
  - 2030: ~50 Mtpa
  - 2040: ~280 Mtpa (~250 Mtpa for storage)
  - 2050: up to 450 Mtpa
- **EU today:** >10 Mtpa capture projects supported by the Innovation Fund – no CO<sub>2</sub> storage site operational

\* [COM/2024/63 final](#)

## Volume of CO<sub>2</sub> captured for storage and utilisation in the EU<sup>1</sup>

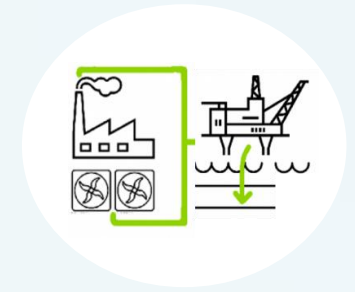


## Share of the CO<sub>2</sub> captured by origin<sup>1</sup>

<sup>1</sup> See: [SWD\(2024\) 63 final, Part 3/5](#)

# Net-Zero Industry Act (NZIA)\*

## = the 1st legal building block for ICM



- **Legal objective** for the EU to enable an **annual 50 million tonnes** of CO<sub>2</sub> to be stored permanently underground by 2030.
- European oil and gas producing **industries must contribute** with their assets and/or their financial resources to develop operational geological CO<sub>2</sub> storage sites.
- More **transparency for investors** on:
  - Demand and supply: CO<sub>2</sub> storage, CO<sub>2</sub> capture, and CO<sub>2</sub> transport in the Member States.
  - Geological data for future storage sites to be made public
  - Annual progress of ongoing CO<sub>2</sub> value chain projects
- **Support for manufacturing** of carbon management technologies **& deployment** of Net-zero strategic projects (capture, transport & storage)

# CO<sub>2</sub> value chain projects = net-zero strategic projects



Member States **shall recognise** as net-zero strategic projects the deployment of **full value chain Net-Zero “CO<sub>2</sub> hubs”** that include:

- ✓ Any **CO<sub>2</sub> storage projects** that : (a) is located **in the EU**, (b) **will be operational by 2030 without EHR\***, and (c) has **applied for a storage permit** in accordance with Directive 2009/31/EC; and
- ✓ Any **CO<sub>2</sub> capture project** and the related **CO<sub>2</sub> infrastructure projects** that are necessary for the transport of captured CO<sub>2</sub> to such a CO<sub>2</sub> storage site.

*\* Enhanced Hydrocarbon Recovery (EHR) refers to the recovery of hydrocarbons in addition to those extracted by water injection or other means.*



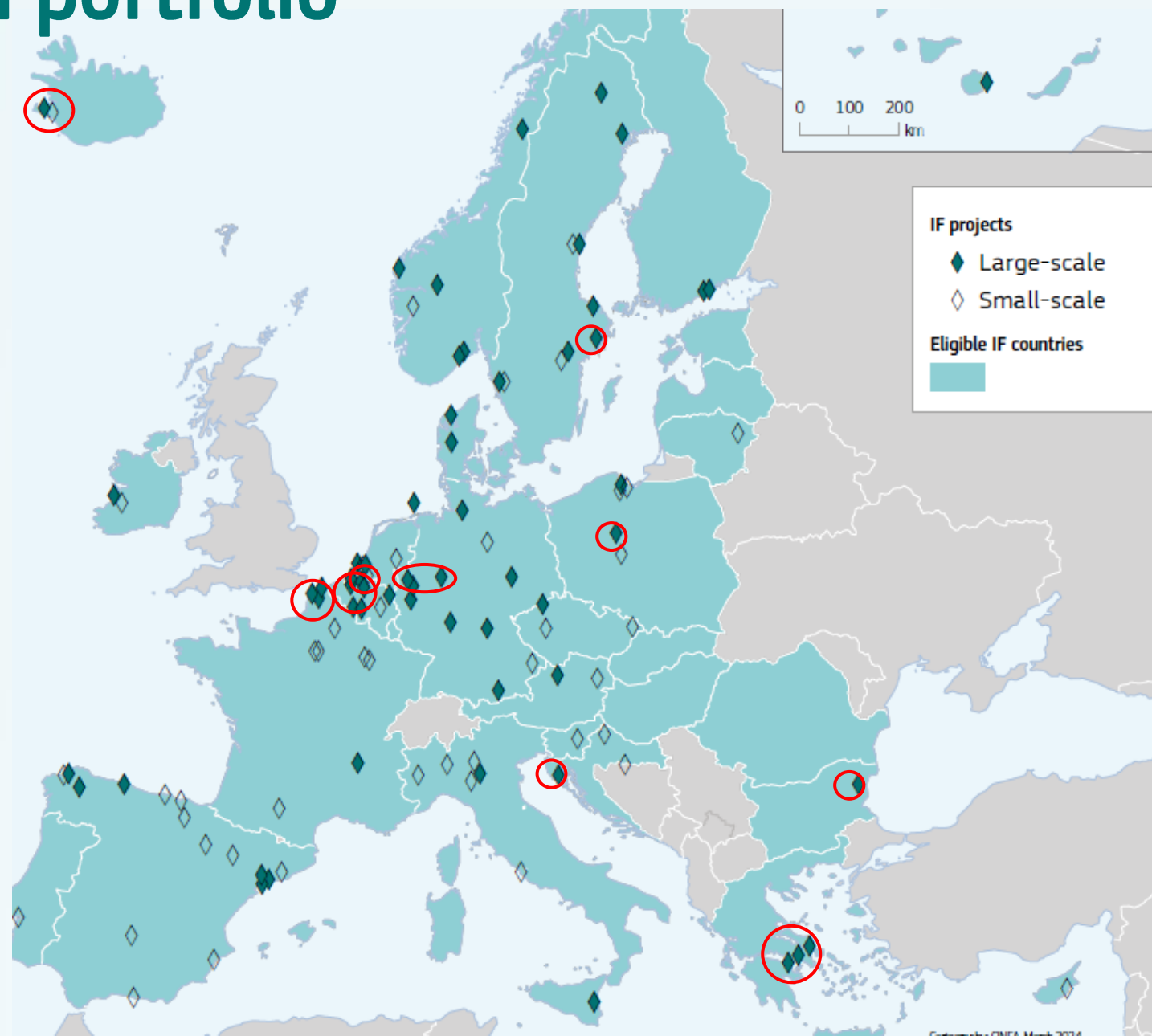
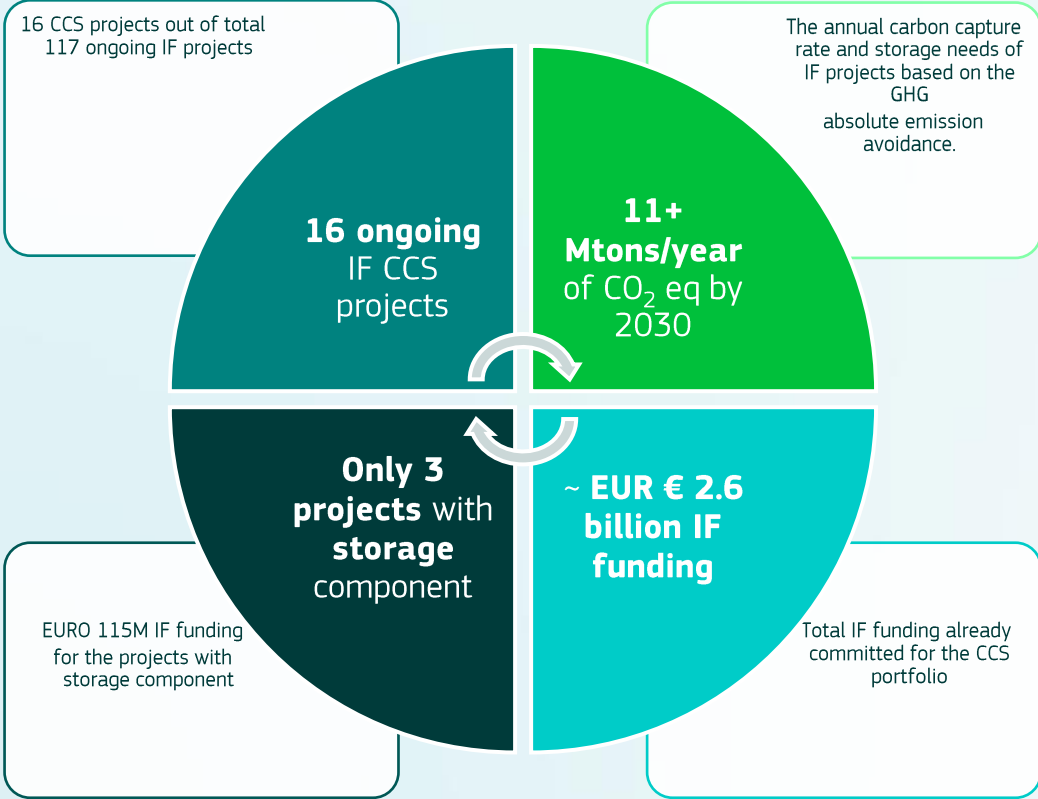
# Benefits for net-zero strategic “CO2 hubs”



- ✓ All relevant processes treated in the **most rapid way** possible
- ✓ The status of the **highest national significance** possible
- ✓ Being of **public interest** and may be considered to have an **overriding public interest**
- ✓ All **dispute resolution procedures**, litigation, appeals and judicial remedies (etc.) **shall be treated as urgent** in line with national law
- ✓ **Receiving all necessary permits** to operate a storage site in accordance with Directive 2009/31/EC **within 18 months after the acknowledgement that the application is complete.**

# CCS Innovation Fund portfolio

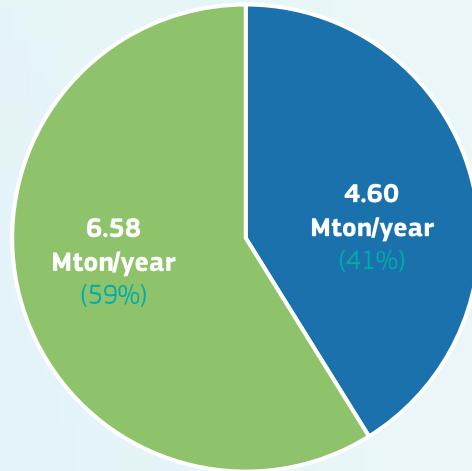
\*IF portfolio as of 31 December 2023



+ IF23-NZT call results coming soon

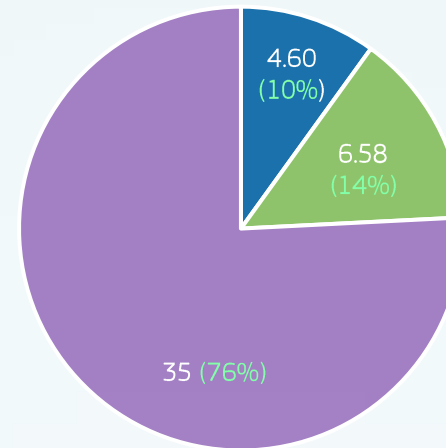
# CO<sub>2</sub> storage demand and potential market growth

Storage demand by 2030, IF CCS portfolio



- Storage demand by the frontrunners
- Storage needs by the other ongoing IF CCS projects

Potential growth of the storage demand (Mton/year)



- Storage demand by the frontrunners
- Storage needs by the other ongoing IF CCS projects
- Storage demand by the proposals from the 23NZT call



+ 1,7 Mtpa by 2030  
*(not in the room today)*

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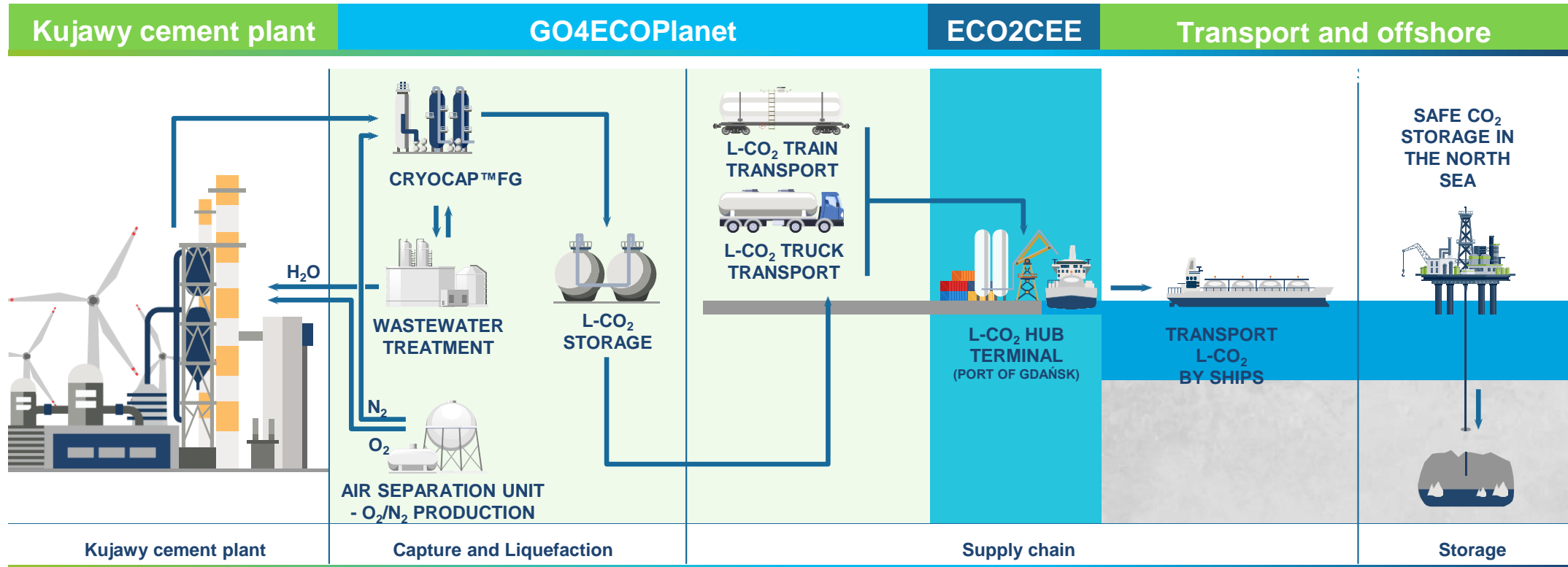
**15:30 – End of workshop**

# 9:45h – 11:00h – Session 1 – Supply of CO2

**Presentation of the CO2 capture plans by front-runner IF funded projects, e.g. volume, timelines, transport needs, business conditions.**

# GO4ECOPLANET KUJAWY - VALUE CHAIN

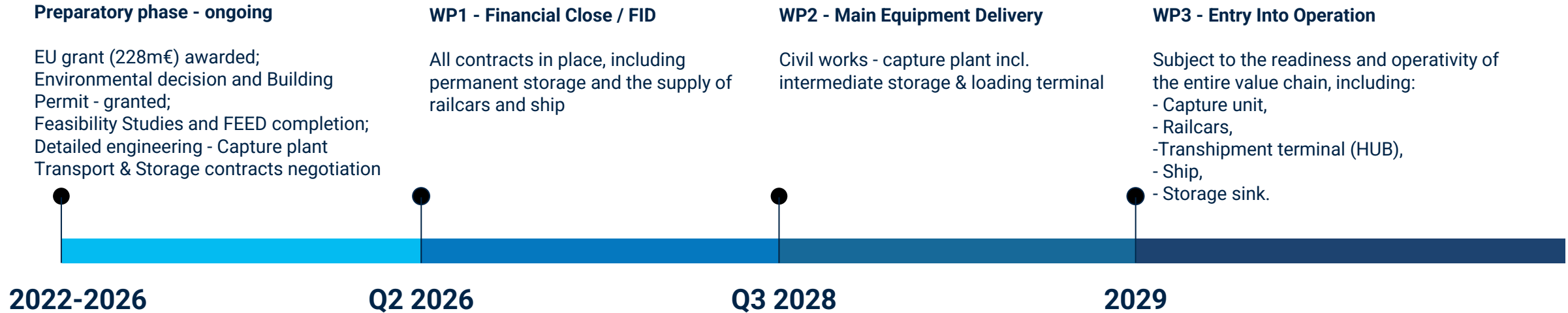
FROM CAPTURE TO STORAGE



- 1.1 mtpa CO<sub>2</sub> capture capacity
- Inland transport: ~200 railcars, regular rail freight service (up to 2 trains per day)
- Maritime transport: up to 2 vessels, 1-2x/week

# TIMELINE & KEY BUSINESS CONDITIONS

## TO REALIZE THE PROJECT



## Critical areas

- Alignment of FID and Start of Operations across the CCS value chain
- CO<sub>2</sub> Export terminal ready on time
- Cost effective, safe and timely CO<sub>2</sub> storage solution
- Infrastructure development maturity of the CO<sub>2</sub> transport, export/conditioning & Storage
- Acceptable and standardized CO<sub>2</sub> specification, considering the entire value chain
- Favorable project economics at FID

# Go4ECO Planet

[www.go4ecoplanet.com](http://www.go4ecoplanet.com)



 **HOLCIM**

**ECO2CEE**



Co-funded by  
the European Union

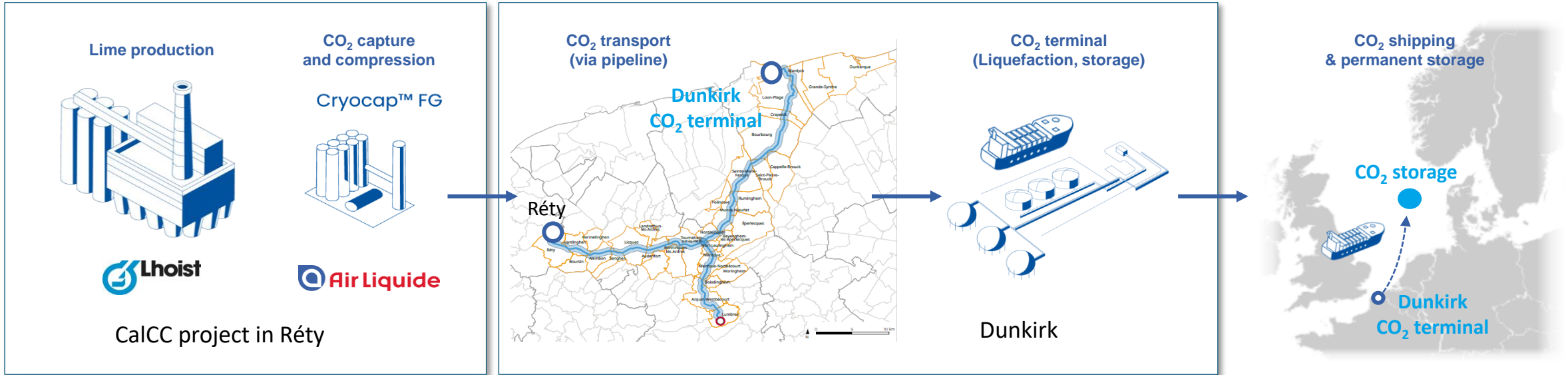
 **HOLCIM**



# THE CALCC PROJECT: DECARBONIZING FRANCE'S LARGEST LIME PLANT



## « D'Artagnan » scope



**Content:** The Réty CCS project aims at fully decarbonizing France largest lime plant using AL's Cryocap™ FG technology

**Target:** Start of operations in 2028, avoiding approx. 600 ktpy of CO<sub>2</sub> (up to 650 ktpy CO<sub>2</sub> transported)

**CO<sub>2</sub> Transport needs:** onshore dense phase pipeline & shipping from Dunkirk CO<sub>2</sub> Terminal to storage (terminal)

*IFLS Project Start*

*Decision to invest*

*Start-up*



## **Business case:**

Today's cost of storage is higher than cost of product (in EU, with CEF & IFLS)

We need to further optimize costs all along the value chain

We need to secure CCfD funding

We need to secure large quantities of local biogenic fuels

We need long term customer commitments for low carbon lime ready to absorb the costs

## **Risk Management:**

Today's CCS value chain remains complex to set up, contract and manage

We need to find ways to further mitigate risks and increase flexibilities

We need (new) insurance products wrt delays at start up, forced venting and business interruptions

## **Cost-effective and flexible Shipping & Storage contract(s):**

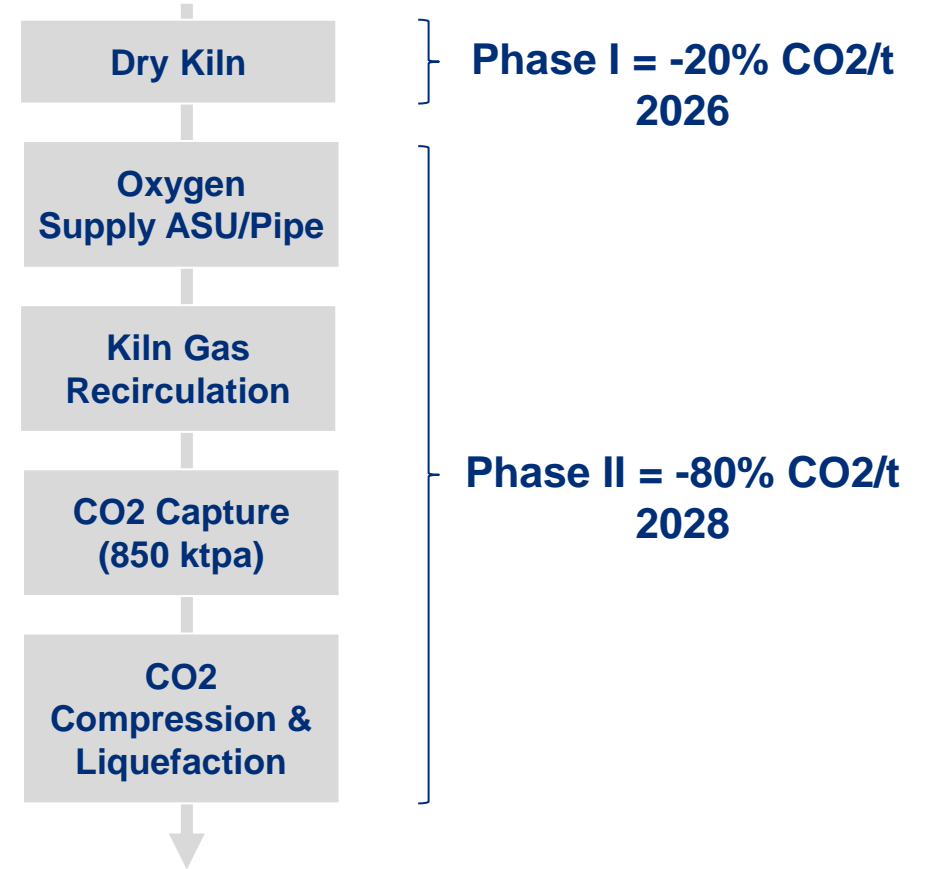
Based on definite "reasonable" CO<sub>2</sub> quality specifications

# Eqiom K6 Program Oct. 2024



# K6 Program – Two Phases to achieve Carbon Neutrality before 20230

Air Liquide, EQIOM, CINEA



# ***K6 Program – Cornerstone of a full value chain to achieve Carbon Neutrality before 20230*** ***Air Liquide, Dunkirk LNG, EQIOM, Lhoist, CINEA***

**CO2 transport  
Pipeline**  
Lumbres → Dunkerque  
Combined volumes  
with Lhoist CalCC



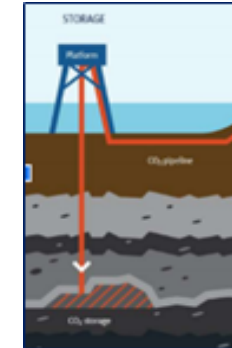
**Dunkerque Hub**  
CEF D'Artagnan

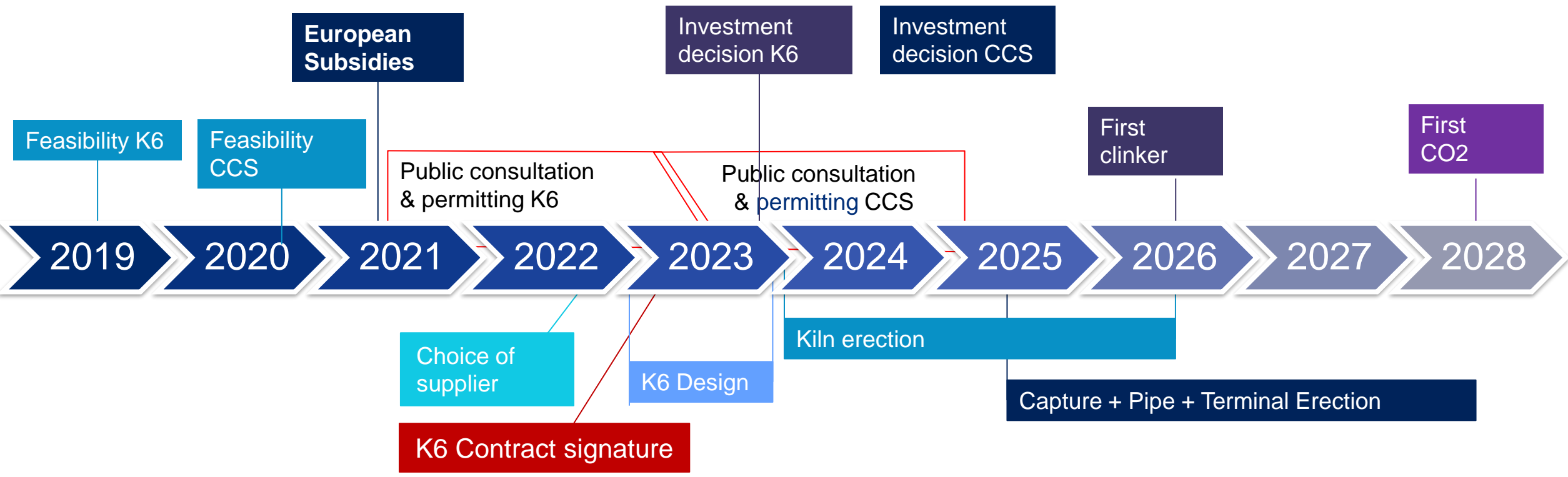


**CO2 shipping**



**CO2 Storage**  
Mer du Nord





# Beccs Stockholm

**Objective:** Capture of 800 kt biogenic CO<sub>2</sub> from an existing bio-fuel fired heat & power plant (KVV8)

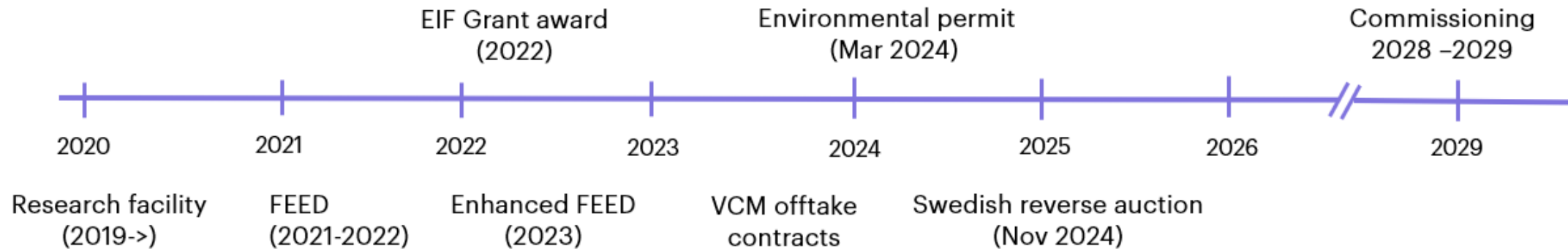
**Location and participants:** Located at Värtaverket, Stockholm, in the heart of Stockholm's district heating system. Implemented by Stockholm Exergi, Sweden's largest district heating company. (Owned by the City of Stockholm and Ankhiale.)

**Project overview:** Investment in a post-combustion Carbon Capture facility based on HPC technology, as well as liquefaction and intermediate storage for further transport of the CO<sub>2</sub>



# CO2 transport and storage needs

- The project will capture 140 t per hour or ~100 kt per month at full load. 800 kt on a full season due to seasonality (lower summer load)
- Project financing in a combination of EiF grant, the voluntary carbon market (VCM) and the Swedish reverse auction
- Final storage site not yet appointed/selected. Coordination of time-lines, project milestones and conditions crucial
- Pre studies on further CCS implementation on two WtE-plants in Stockholm Exergi's network initiated







# WORLD'S LARGEST CROSS-BORDER CCS CHAIN

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CCS VALUE CHAIN WORKSHOP, INNOVATION  
FUND, BRUSSELS, 2-10-2024



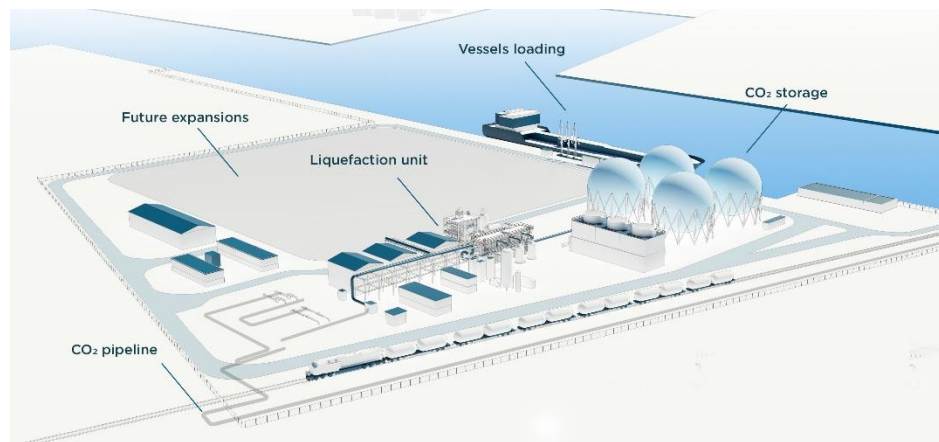
Funded by  
the European Union



**BASF**  
We create chemistry

# THE KAIROS@C PROJECT

- Integrated CO<sub>2</sub> capture of **5 world scale chemical productions plants**
- Focus on **hard-to-abate process emissions** (no clear alternatives)
- Total yearly volume of 1,55 mtpa or **14,0 mt over first 10 years**
- Use of **Antwerp@C infrastructure** (backbone and liquefaction terminal) in the port of Antwerp
- Supporting innovative development of **liquid CO<sub>2</sub> vessels**
- Driving the implementation of CCS directive for **cross border CO<sub>2</sub> transportation and storage**, including the required legislative framework
- Current timeline: financial close 1H 2025, start-up 2028



# CURRENT CHALLENGES

- CO2 specifications:
  - CO2 specifications need to consider the industrial reality and minimize the total costs over the whole chain
  - Specifications based on customer portfolio or “food grade” are not acceptable and detrimental to industrial CCS chains
- Storage tariffs:
  - Lack of transparency on storage tariffs in a context of massive “public funding” remains not acceptable
  - Tariffs which do not relate to cost (not a cost+ model) lead to unbalanced economics throughout the CCS value chain in a context of volume scarcity / excessive profit – return expectations
  - Indexation of tariffs on ETS is not acceptable
  - Regulated environment needed?
- Unbundling of shipping and storage:
  - Need to ensure freedom of choice for emitters to choose their own shipping provider
  - Need to ensure effective “non-discriminatory” access to receiving terminals and to prevent “technical barriers” to 3rd party shipping
    - Storage providers shall not impose “more stringent” rules to access terminals at the sink than at the loading port “e.g. shorter windows of arrival”
- Rapid development of storage capacity is lacking:
  - More demand than supply
  - License holders deliberately(?) delaying developments?
- Early movers are heavily penalized by “childhood diseases” (i.e. logistic disruptions along the CCS value chain)
  - Consider “insurance principle” for early movers: free ETS allocation in case of logistic disruptions/force majeure ?)
- These principles were underscored by the EU commission (Feb 2022 workshop), but are still not yet implemented
- Innovation Fund subsidy model does not provide a solution for the “exceptional inflation” experienced since subsidy award

# THANK YOU!

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**11h15 - 13:00h - Session 2**

# **Availability of CO2 injection capacity**

**Presentations of ongoing CO2 storage project timelines by storage operators that plan to start operations before 2030.**

# Greenstore

Dr. Anne-Mette Cheese  
Country Lead CCS Denmark  
2nd October 2024

## Building an advantaged CCS portfolio, anchored by Harbour's Viking project, with long term cash flow potential



Greensand, Denmark: 1<sup>st</sup> CO<sub>2</sub> storage, March 2023

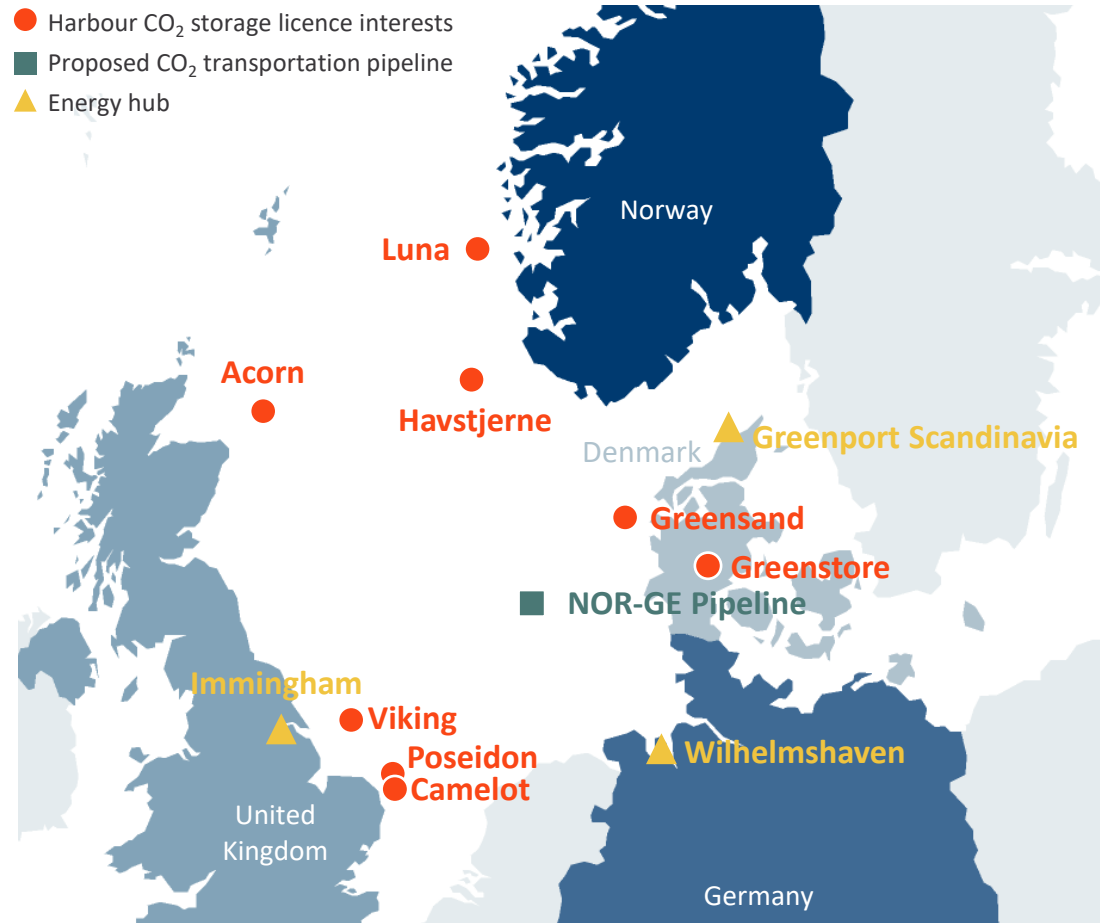


Viking: Located to serve UK & European markets



Access to key energy hub Wilhelmshaven, Germany

- Harbour CO<sub>2</sub> storage licence interests
- Proposed CO<sub>2</sub> transportation pipeline
- ▲ Energy hub



Germany is the EU's largest CO<sub>2</sub> emitter at >600 mtpa but currently has limited domestic CO<sub>2</sub> storage capacity.

- Broad, pan European portfolio of CO<sub>2</sub> transport and storage projects
- Long term relationships with premier European emitters in hard to decarbonise sectors
- Access to key energy hubs, including strategically located Wilhelmshaven, in Germany, and Immingham, in UK.

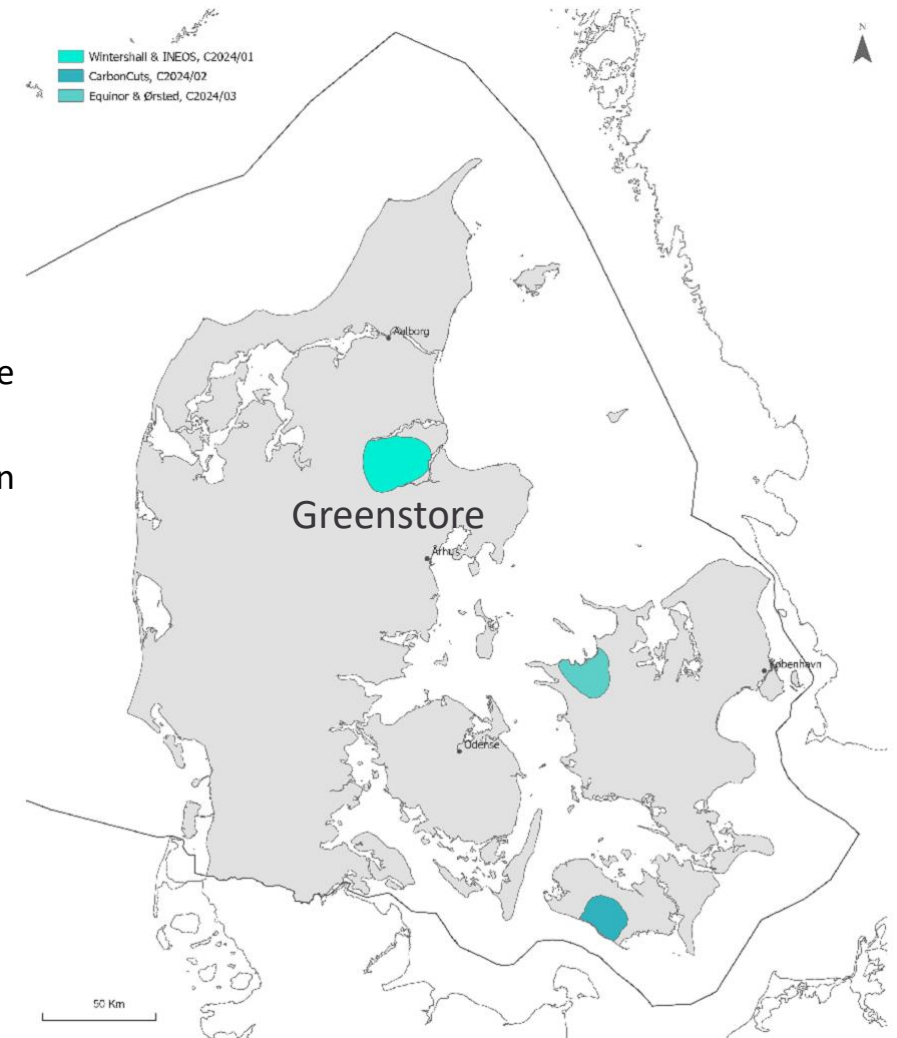
Harbour has a leading CO<sub>2</sub> storage position in Europe



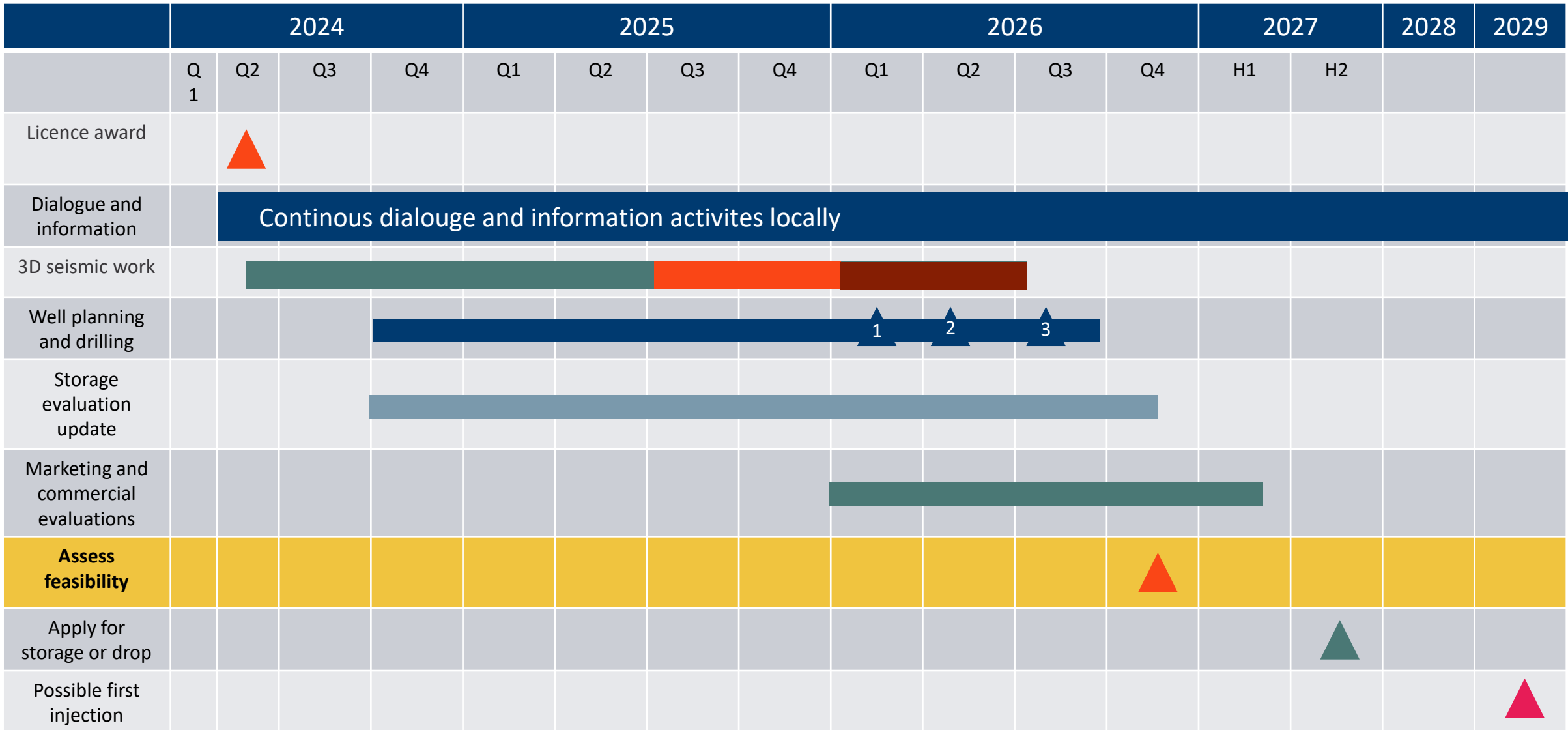
# Onshore Greenstore

## Greenstore Awarded June 20, 2025

- Initially estimated storage capacity in Greenstore:  
**250 millions tons of CO<sub>2</sub>** in two separate geological formations at between 2000 meters and 3000 meters depth below surface
- The Gassum structure holds one legacy exploration well Gassum-1
- The structure is defined on vintage and newly acquired 2D data and forms a 4-way dip closure with some crestal West-East trending faults. Structure & Trap size is large with > 200 km<sup>2</sup> closure area
- The storage complex is comprising two storage units, **the shallow Gassum Fm storage unit** (main target) and the deeper **Skaggerak Fm storage unit** (mature upside)
- The storage unit is overlain by thick and competent Jurassic seals and Chalk acting as effective top seals for the injected CO<sub>2</sub>
- Main subsurface risk are related to the trap effectiveness (faults) and on reservoir effectiveness (lateral connectivity)
- Detailed work program to assess underground, drill wells, clarify commercial solutions



# Greenstore Timeline



- A functioning **CCS market** demands an **entire CCS value chain**

● **Capture at the emitter** ● **Transport to Collection Points** ● **Storage**



**Storage site**

- Onshore storage considerably more economical attractive than offshore solutions.



**Emitters**

- Available CO<sub>2</sub> committed to storage sites



**Infrastructure**

- Need for development of open access infrastructure solutions, both in Denmark and the continent



**Timing & volume**

- CO<sub>2</sub> from emitters ready for infrastructure at the right time



Contact details

Kristinn Ingi Lárusson – CCO & CBO

# Coda Terminal

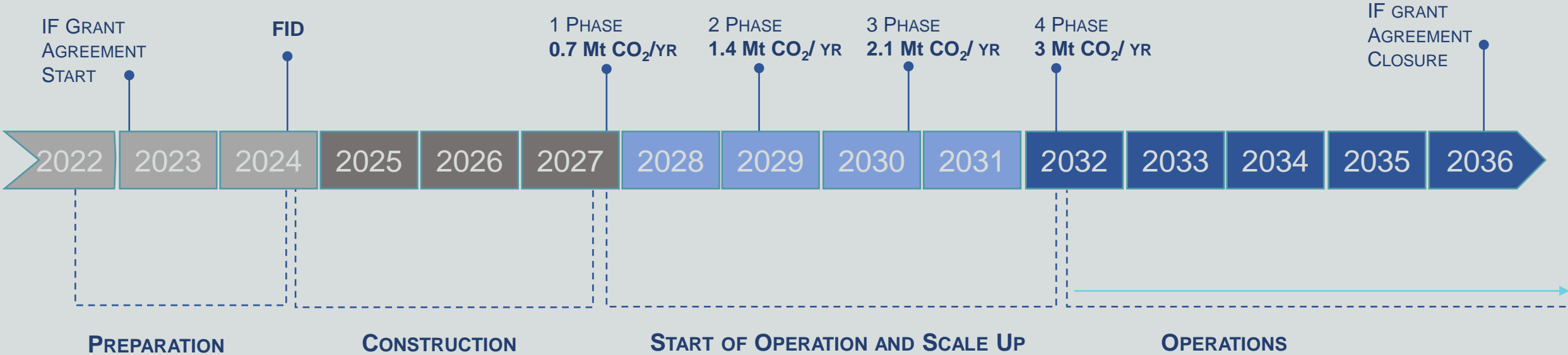


Funded by  
the European Union



**Carbfix**

# PROJECT TIMELINE



# Key figures

**Safe:** risk of leakage is fully eliminated by dissolving CO<sub>2</sub> in water

**Cheaper** than alternative solutions, lower up-front capital costs and risk

**Environmentally friendly:** imitates and accelerates nature's way of storing CO<sub>2</sub> in rocks

**Permanent:** minerals are stable for thousands of years limiting the need for long-term monitoring

Built on firm **scientific foundation** and robust monitoring campaigns

**Highly flexible** and modular with respect to capture technology, injection strategy and up-scaling



Funded  
the Euro



Project   
Silverstone

**Carbfix**

Kristinn Ingi Lárusson CCO & CBO

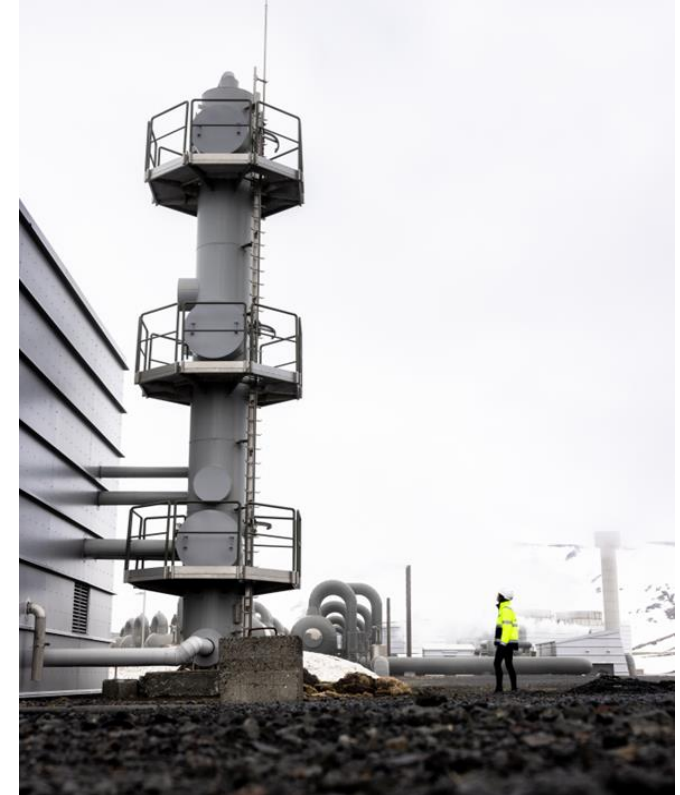


Funded by  
the European Union

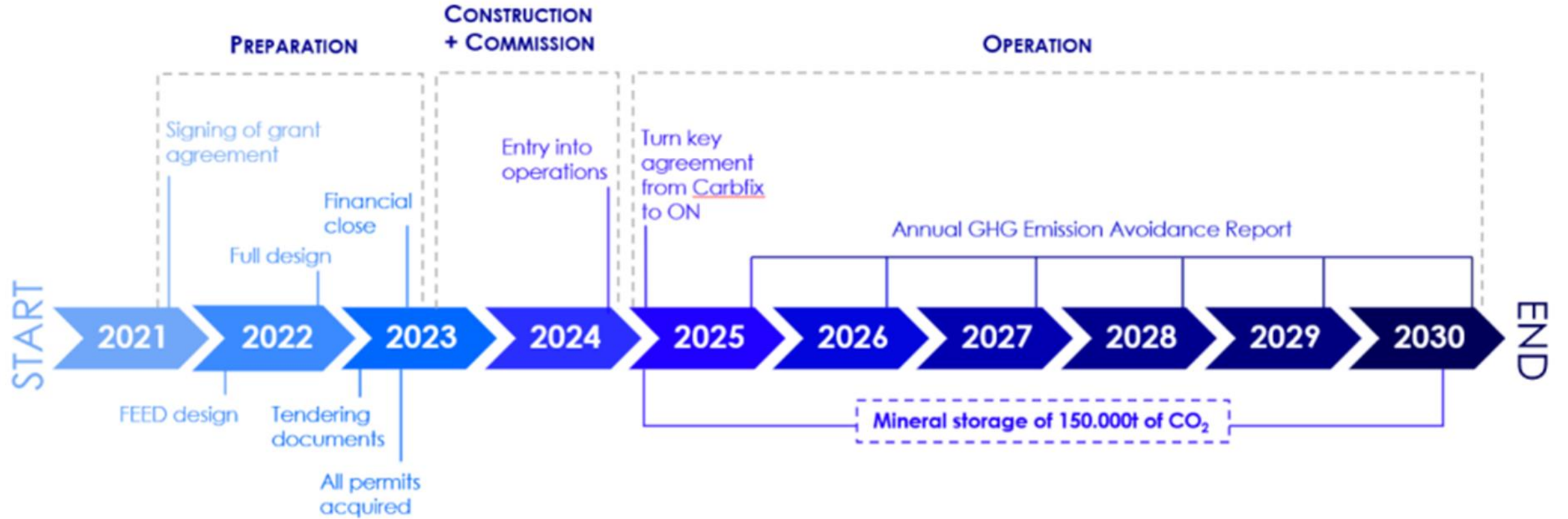




- Silverstone project received funding from EU Innovation Fund small scale call
- Full-scale point source capture and injection at Hellisheidi from 2025 enabling zero emission power production
- Mineralizing 95% of the CO<sub>2</sub> emissions from the largest single site geothermal power plant in Europe, operated by ON Power
- 34,000 tonnes of CO<sub>2</sub> mineralized annually
- 150,000 tonnes of CO<sub>2</sub> mineralized over the project lifetime
- Scalable innovation that makes climate neutrality feasible for geothermal power plants by mineralizing CO<sub>2</sub>



Funded by  
the European Union



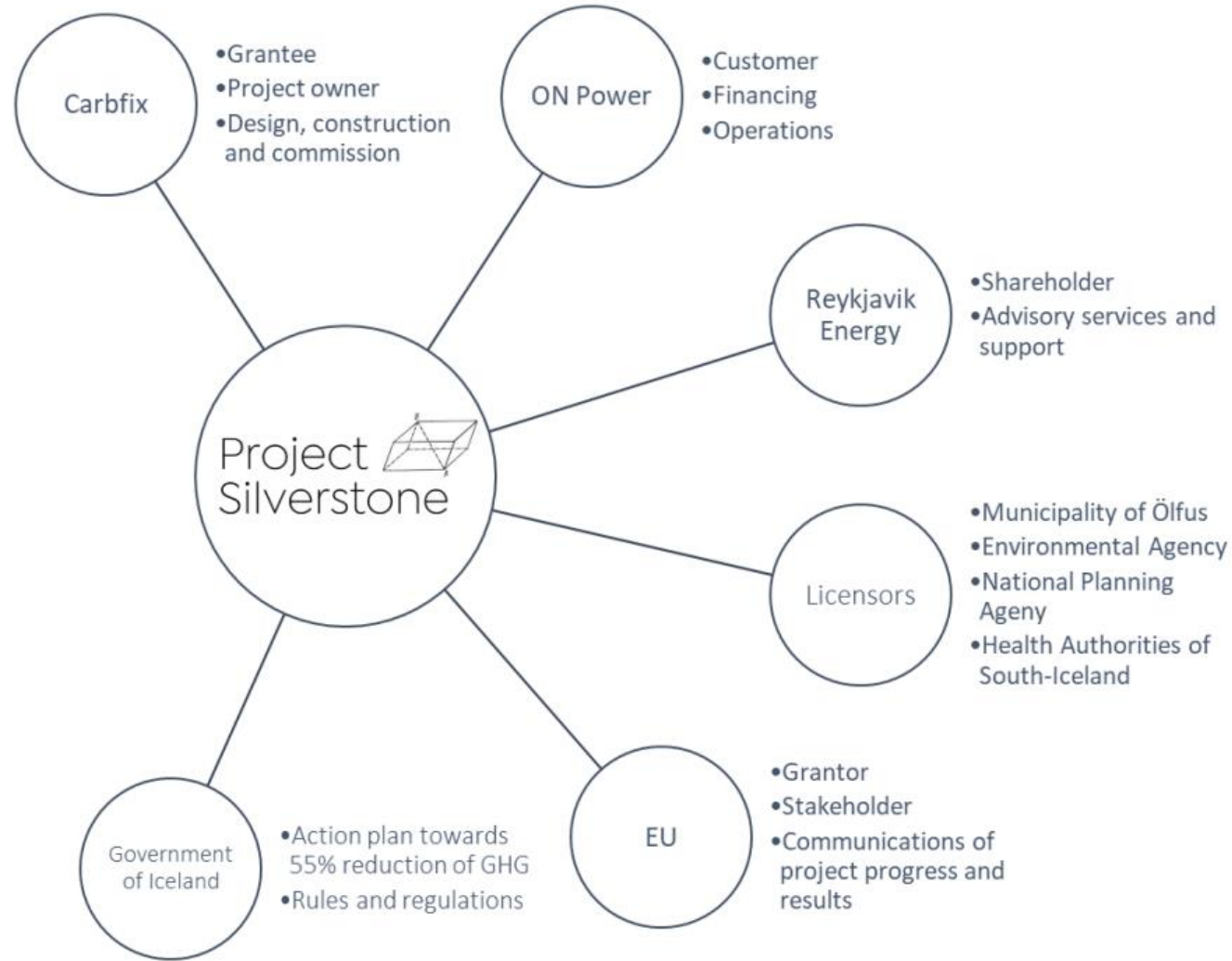


Figure 15: The project diagram for Project Silverstone, showing the main parties associated with the project and the main stakeholders.





# CCS workshop by the Innovation Fund

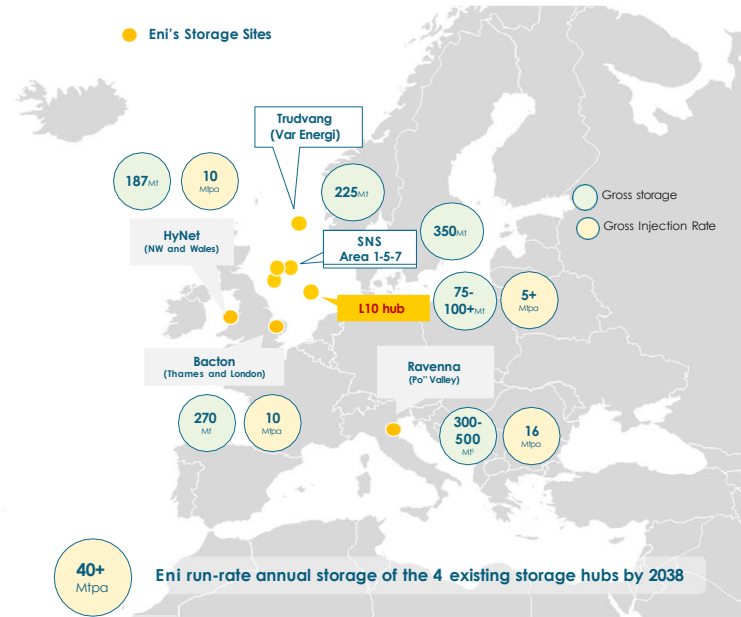
Eni - 02/10/2024, Brussels

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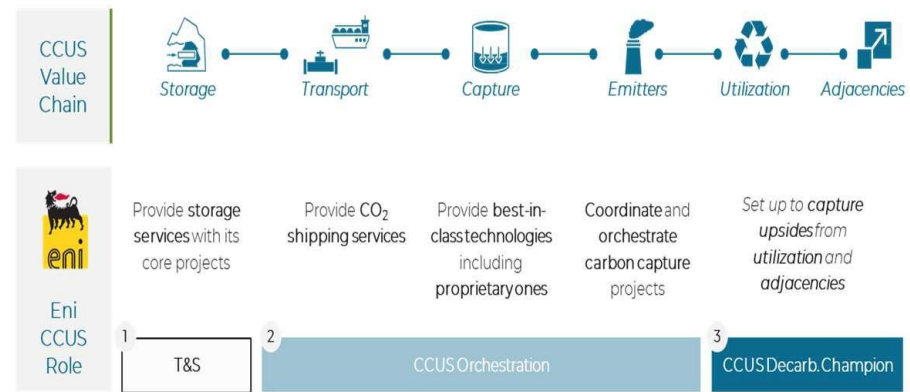


# Eni CCS portfolio

4 storage hubs in Europe with advantageous positioning  
 - HyNet, Bacton, Ravenna & L10 under development

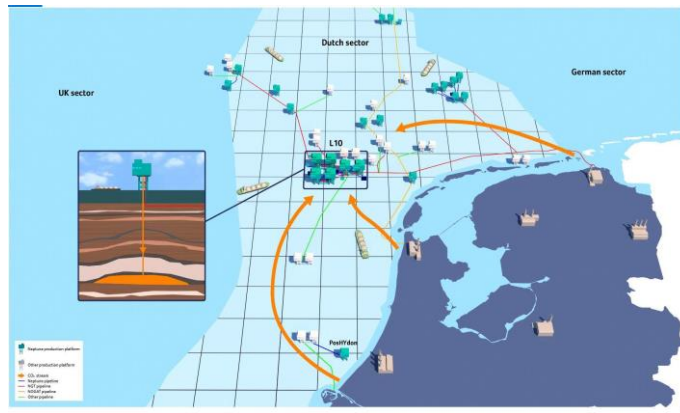


Eni CCUS is well positioned to champion the CCUS value chain, both in northern and southern Europe, creating a fully rounded and comprehensive carbon ecosystem



# L10 CCS hub

2+ stores - Dutch North Sea, L10 area



- Depleted gas fields
- Potential for re-use facilities
- Interconnected
- 2 “value chains” targeting Rotterdam area, major cryogenic hubs and dispersed clusters
- Accessible to local and international customers

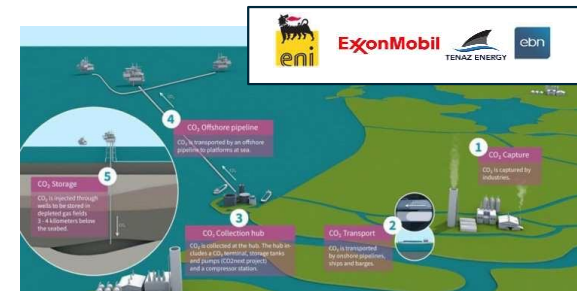
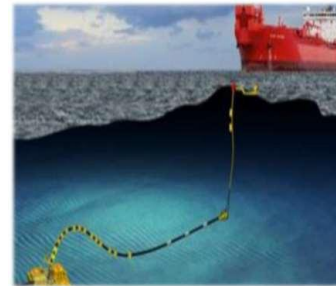
3 \* Aramis schedule dependent;

- Up to ~100MT or **5MTPA** capacity accessible via **Aramis transport system** ready in **2028-29\***;

\* SLA submitted in June 2023

\* Currently in FEED

\* Focus on integration towards FID



- Targeting an additional 70+ MT or **4+MTPA** accessible via “High Pressure direct injection to store shipping” solution by **2030**

\* currently in concept select.







TotalEnergies

# Carbon Capture and Storage Business Unit

October 2<sup>th</sup>, 2024



# Deploying CCS strategy

## Reducing emissions and developing profitable business



### CCS for our assets

- Reduce emissions from existing assets
  - Ichthys (Australia) awarded GHG storage assessment permit
  - Cameron LNG (US) Hackberry Carbon Sequestration project under development
  - Refineries
- Avoid emissions in greenfield projects
  - North Field East & South (Qatar)
  - Papua LNG (Papua New Guinea)

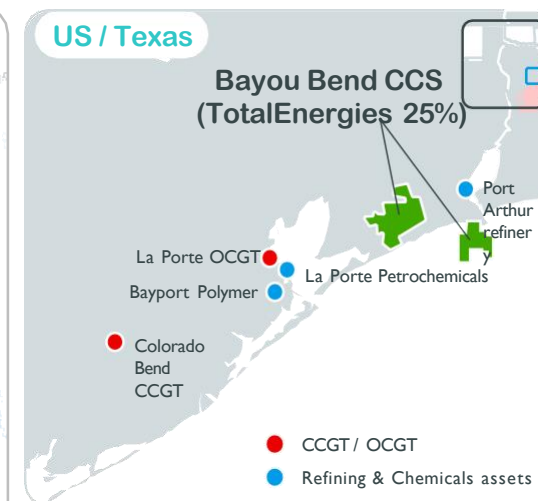
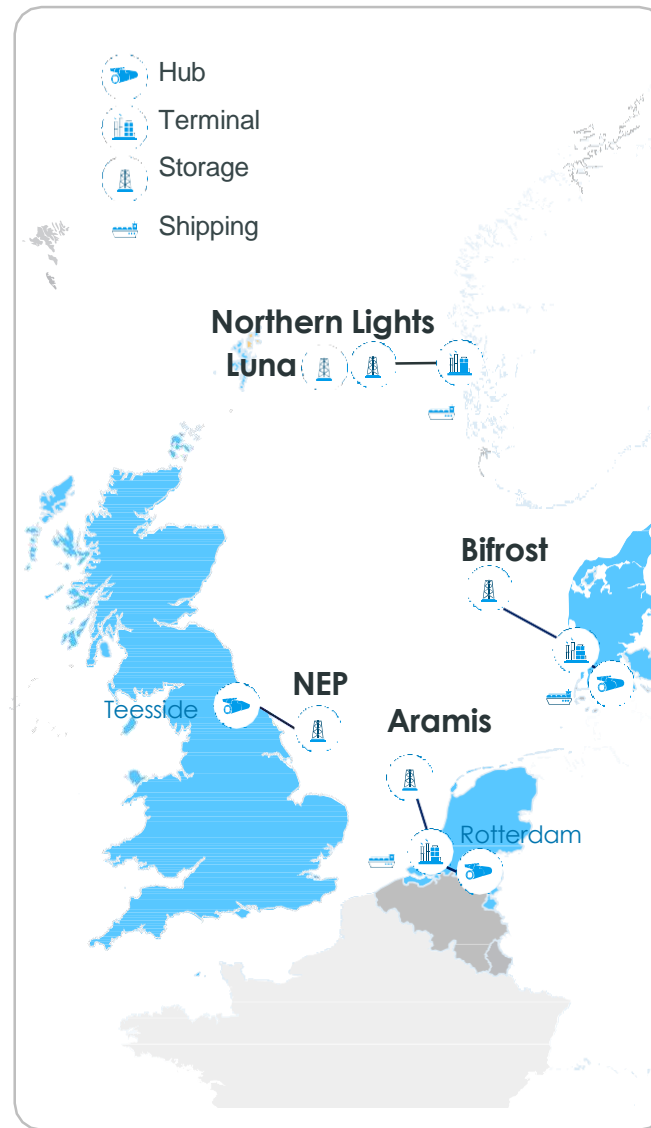
### Offering CCS services

- Build a profitable, scalable business and offset Scope 3 emissions by offering CCS solutions to our customers
- North Sea core area
  - Under Construction, **Northern Lights**
  - Under development
    - Focusing on our depleted assets and saline aquifers
    - **Aramis (NL, op.), Bifrost (Denmark, op.), NEP (UK), Luna (Norway)**
- Worldwide growth
  - **Bayou Bend (US), Southern Cluster (Malaysia)**



2030 target (Company share)

> 10 Mt/y





# CCS Bifrost project development



Maturity: **Appraisal**      RFSU: **2030**      Capacity<sub>100%</sub>: **5.5 MTPA**      Transport & Storage: **80% (op)** nordsø fonden **20%**

Bifrost	2022				2023				2024				2025				2026				2027				2028				2029				2030				2031																																		
	Q1		Q2		Q3		Q4		Q1		Q2		Q3		Q4		Q1		Q2		Q3		Q4		Q1		Q2		Q3		Q4		Q1		Q2		Q3		Q4																																
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
<b>Studies</b>	Preliminary				Feasibility				...				Conceptual				pre-FEED				FEED				★ FID				EPCI				★ RFSU																																						
<b>Licence</b>	Licence application				◆ Application				◆ Licence award				Exploration period				Storage period				Storage licence extension				◆ Application				◆ Approval																																										
<b>Dagny Aquifer appraisal phase</b>	Data Interpretation/storage models								Seismic Processing				Inversion				✘ Well																																																						
					Tender process								Drafting				Approval process																																																						

- 2 exploration licences awarded.
- **CO2 storages appraisal planning on track.**
  - 3D seismic full processing by end Dec. 2024.
  - Well preparation (Permitting, Geophysical/tech site survey and LLI in 2024) with the target to be ready to drill the Dagny-1 appraisal well in April 2025.
  - Storage licence application : Nov. 2025.
  - Conceptual study phase Jun. 2024 to Dec 2025.
- PCI status
- **Project critical path : transportation and onshore infrastructures.**



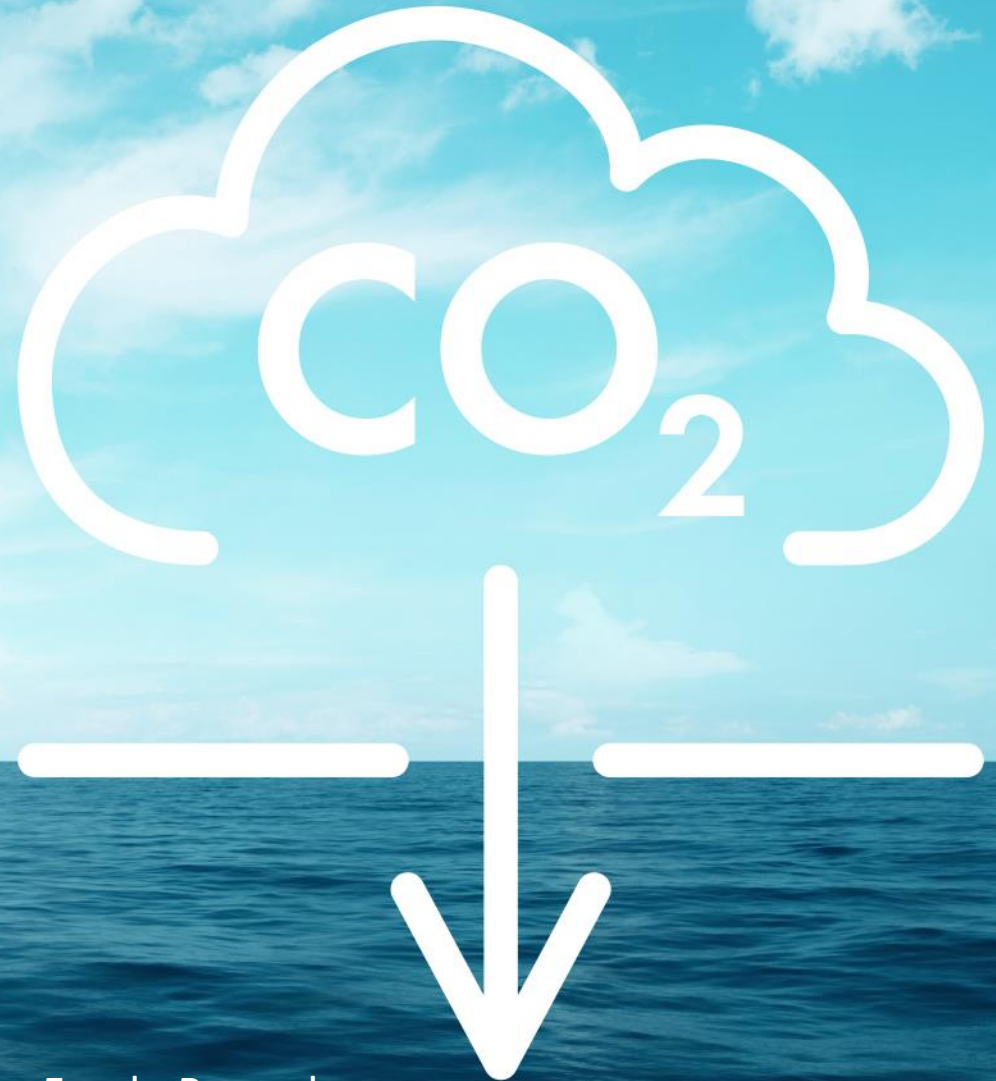


# Shell Offshore Carbon Storage NL

K14 (Aramis Launch) Store

Working together to provide  
reliable carbon storage solutions

2 October 2024 – CCS Value Chain Workshop by Innovation Fund - Brussels



# SOCSNL CCS Portfolio in SNS



- SOCSNL matures portfolio of multiple stores – linked to the Aramis
  - Depleted reservoirs and saline aquifers
- K14 store is part of Aramis Launch – onstream 2028/29
  - Capacity 2.5 mtpa for 15 years
  - Joint Marketing with K4 (TTE) store – nearly sold out
  - FEED completed – FID expected in 2025
  - Multiple innovations allowing a multiple-emitter–multiple- stores value chain
- Key K14 challenges are
  - To offer affordable tariff to emitters
  - To mature projects along the value chain at same pace / FID alignment
  - Duration permitting/licensing process
  - CO2 Specifications
- L09 store onstream in 2030 – actively marketed
  - Capacity 3.7 mtpa for 15 years.
  - Key challenges - as above but also to create a fair performance risk taking along the T&S value chain



# K14 Scope

CCS Chain

Project Phase

Start-up Year

C

T

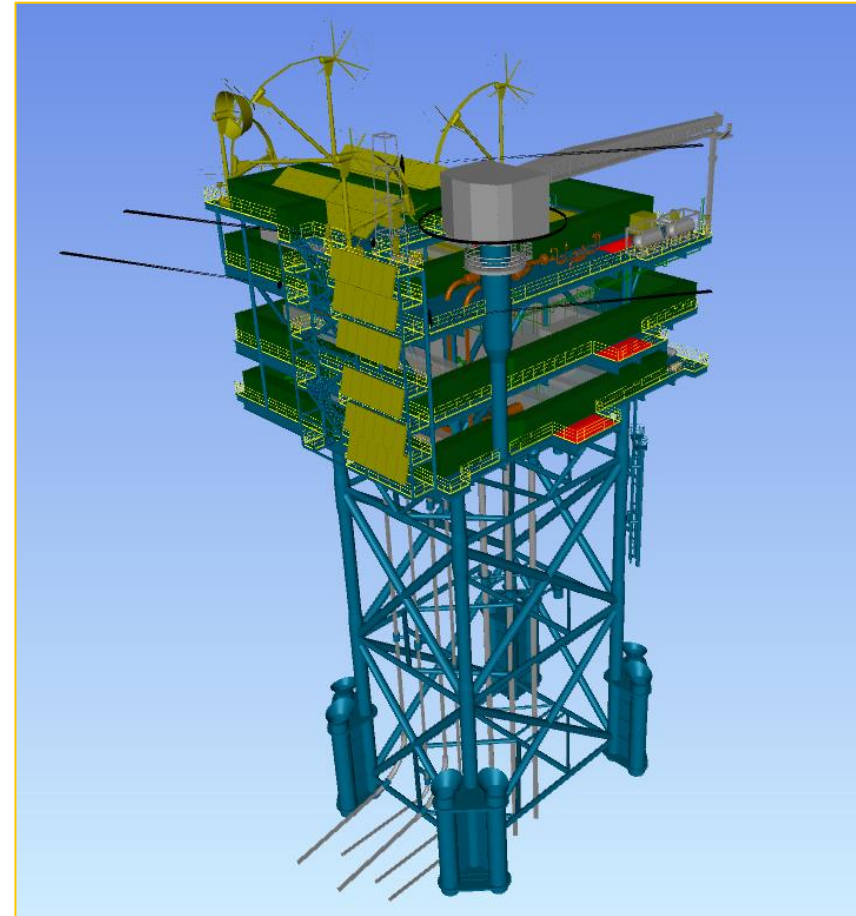
S

FEED

2028

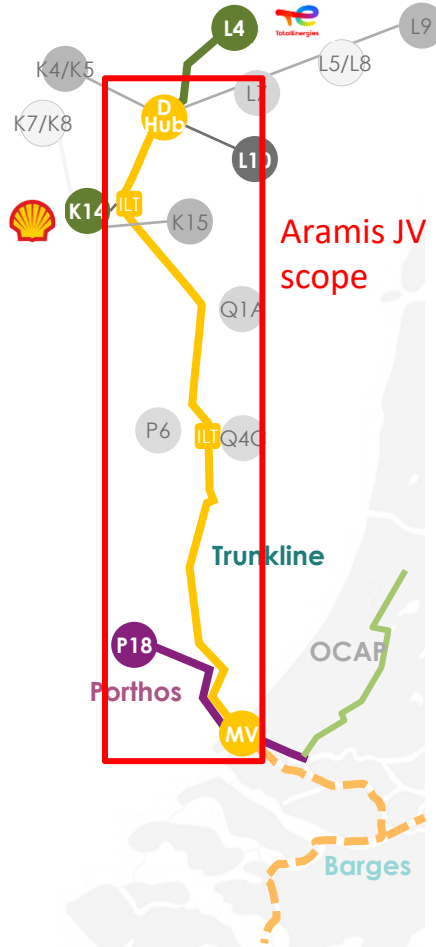
- New Platform and 4 new Wells to meet **97% Store Availability**

<b>Injection wells</b>	4x new CO2 injector wells targeting the ROTL K14-FA reservoir
	Upper completion: 2x 3 ½" & 2x 4 ½" tubing. Lower completion: C&P liner
	Well design for thermal cycling associated w/ injection transients
	N2 cushion in A-annulus. DHPT gauges, DAS/DTS
<b>Platform</b>	New Normally Unmanned Installation. ~850m NE of existing platform
	HP (180bar) CO2 piping w/ limited onsite facilities (sampling, filtering, metering)
	Marine access only (Walk-To-Work). Fixed platform crane & 250m2 deck space for well interventions. Temporary Safe Refuge and Free Fall Lifeboat, 2 export risers of 16" for future connection nearby fields.
	Renewable energy package for power supply
<b>Spurline</b>	~800m 16" spurline connecting the main 32" Aramis trunkline
	Subsea manifold and umbilical





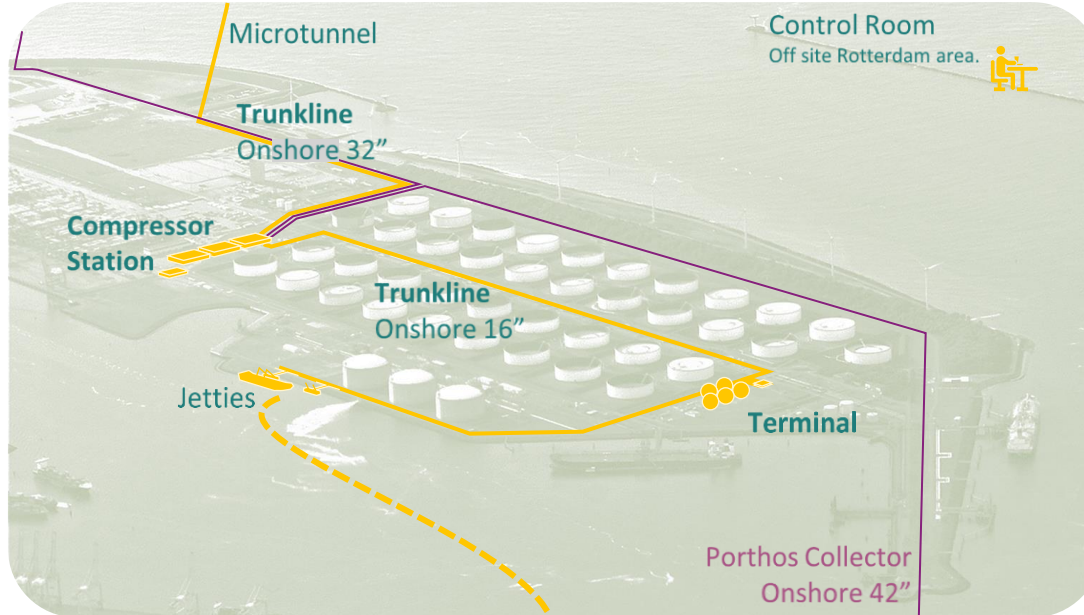
# K14-FA store (Shell operated) and Aramis project - Trunkline, DHUB and Control Centre (Aramis JV)



Legend for Store Maturation Timeline

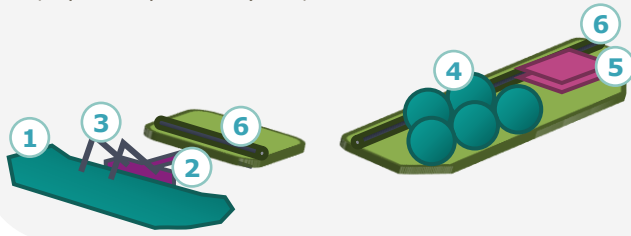


## Maasvlakte CO<sub>2</sub> Hub



### Terminal

1. Barges (2 x 6.8 km<sup>3</sup>)
2. 2 Jetties (Space for 4)
3. 3-4 Loading Arms per Jetty (Liquid, Vapour & Hybrid)
4. 32 – 40 km<sup>3</sup> Storage Tanks
5. 6 Mtpa HP Export Pumps
6. 16" Onshore Trunkline



### Compressor Station

1. 2. Buildings
3. 2 (+ 1) Aramis Compressors
4. 2+1 Porthos Compressors
5. Pig Launcher
6. 7. 8. Utilities
9. Heat Integration

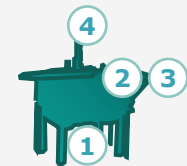


### Trunkline

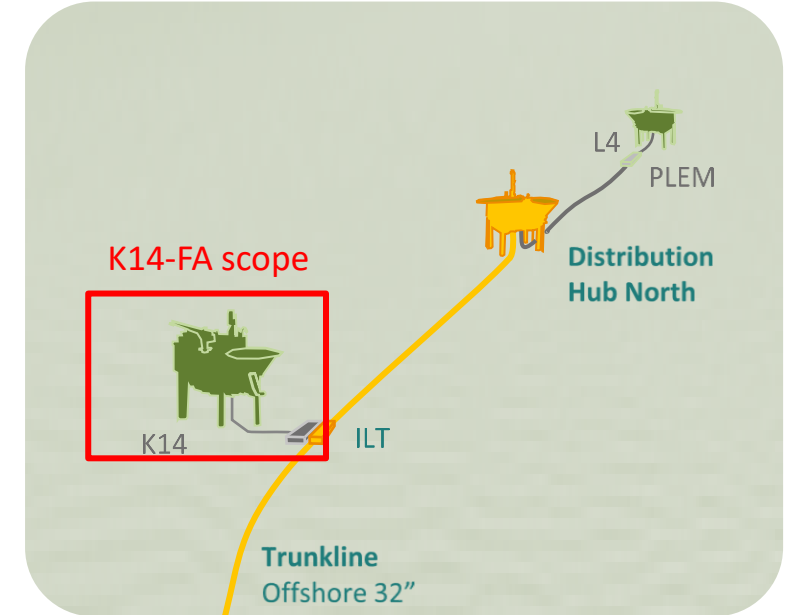
- Operating pressure: 180bar  
Design pressure: 200 bar
- 16" Onshore Trunkline CO2next via MOT (t.b.c.)
  - 32" Onshore Trunkline Buried, Inside Corridor. Pig Launcher at Porthos Plot
  - Maasgeul crossing with Microtunnel
  - 32" Offshore Trunkline, 200 km to D-Hub North, CS, 3mm corrosion allowance

### Distribution Hub North

1. 5 Export Risers
2. Pig Launchers & Receiver
3. Renewables Package
4. Vent for Trunkline



## Offshore Storages K14 and L4/K6





# Equinor CCS transport and storage services

Martijn Smit

October 2, 2024



# Equinor A LEADER in transport and storage services



## 30-50

MILLION TONNES/ANNUM

**CO<sub>2</sub> transport and storage capacity by 2035**

Equinor share

## 4-8

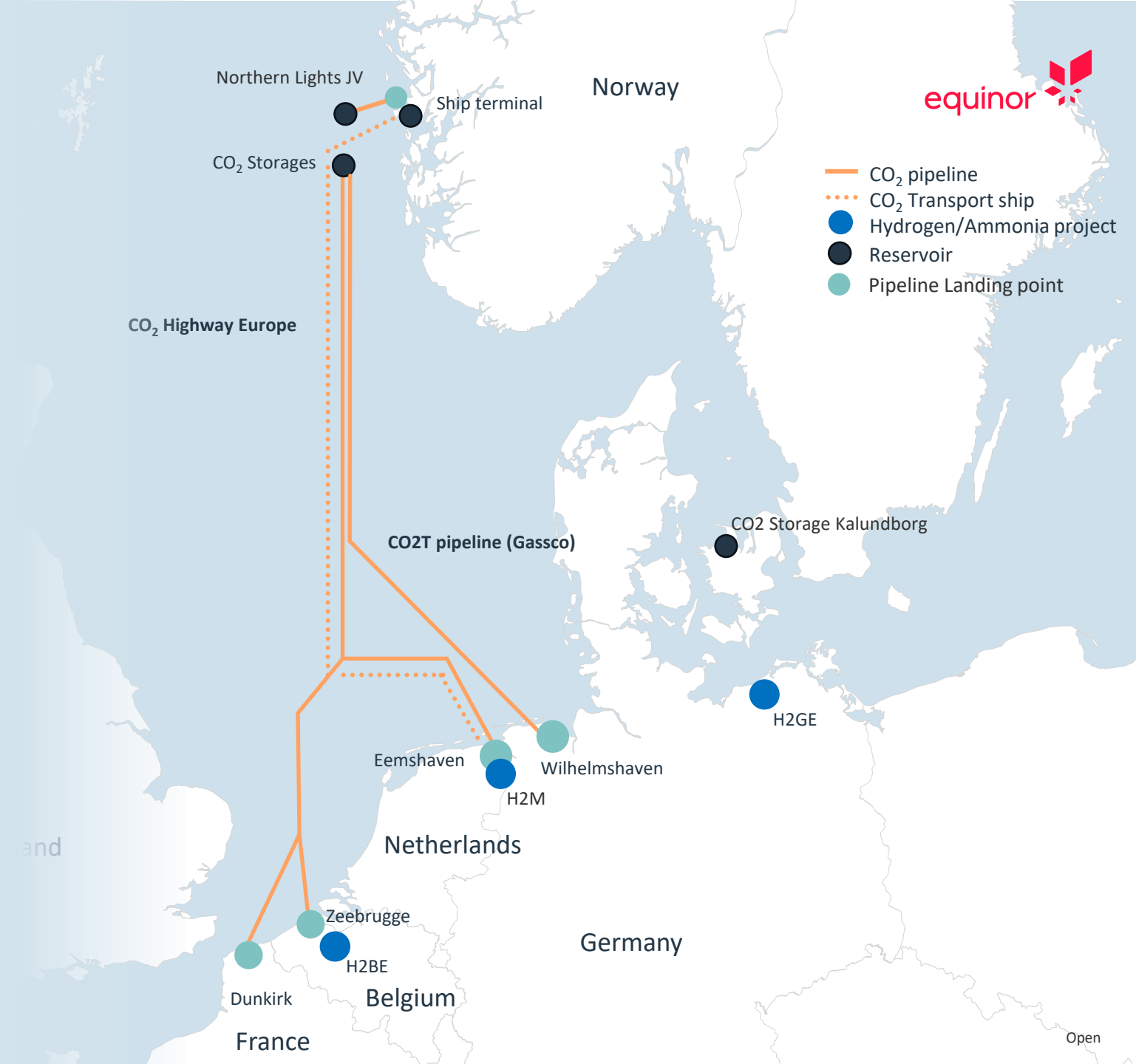
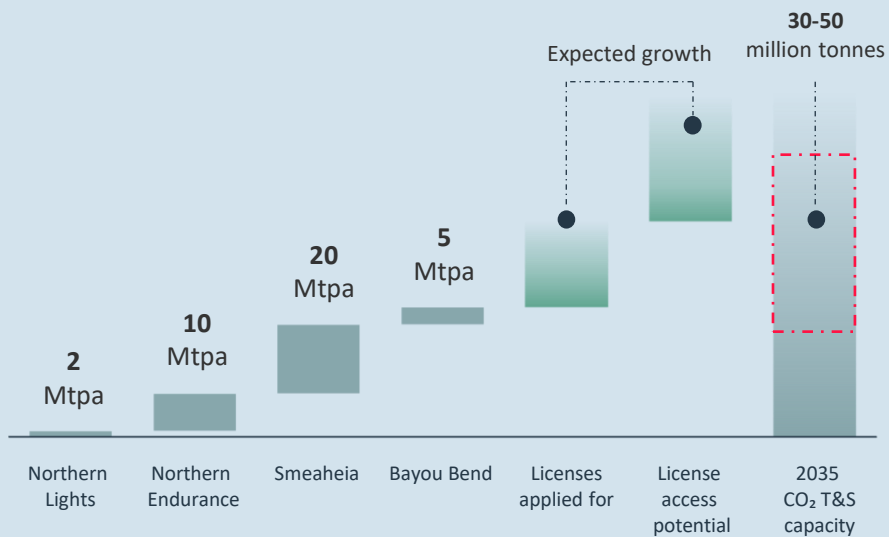
PERCENT

**Real base return**

Excluding effects from farmdowns and project financing

### CO<sub>2</sub> transport and storage portfolio in 2035

Equinor share, unrisks

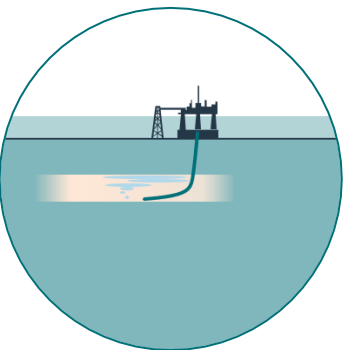


# CCS in Equinor | Stepwise build of new industry

## 28 year of experience

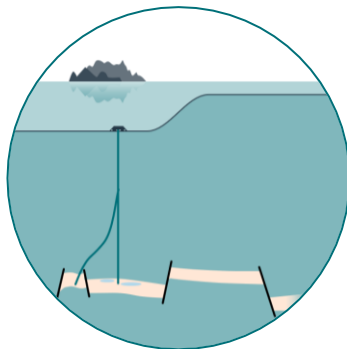
- Nearly 30 Mt stored to date
- Wide range of concepts

Sleipner | 1996



CCS works!

Snøhvit | 2008



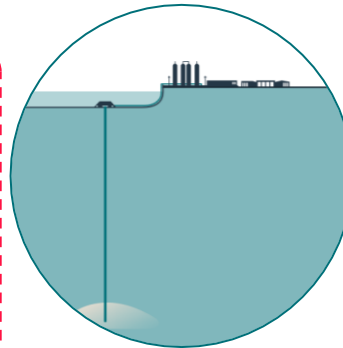
Expand technologies

TCM | 2012



Reduce capture cost

Northern Lights | 2024



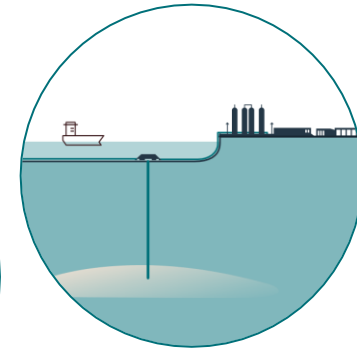
Market opener

NEP | 2027  
Bayou Bend | 2028



Beyond NCS

Smeaheia | 2028  
CO2 Highway | 2030  
Kinno, Albonidigas | 2030  
CO2 Storage Kalundborg | 2030



Bring costs down through scale-up

Future potential



NSB & US

## Future CCS ambitions

- 30 – 50 Mtpa by 2035 (Equity)
- Focus in the North Sea Basin (including Denmark) and Texas coastal area

Storage project	country	Ownership share	Capacity* (100% basis)	Start date**
Smeaheia	Norway	100%	20 Mtpa	2028
Kinno	Norway	100%	5 Mtpa	2030
Albondigas	Norway	100%	5 Mtpa	2030
CO2 storage Kalundborg	Denmark	60%	12 Mtpa	2030
Northern Lights	Norway	33.33%	5.5 Mtpa	2028/9
Northern Endurance Partnership	UK	45%	25 Mtpa	2028
Bayou Bend	USA	25%	20 Mtpa	2028
CO2 Highway		100%	25 – 35 Mtpa	2030
Vessel transport		100%	10 Mtpa	2029

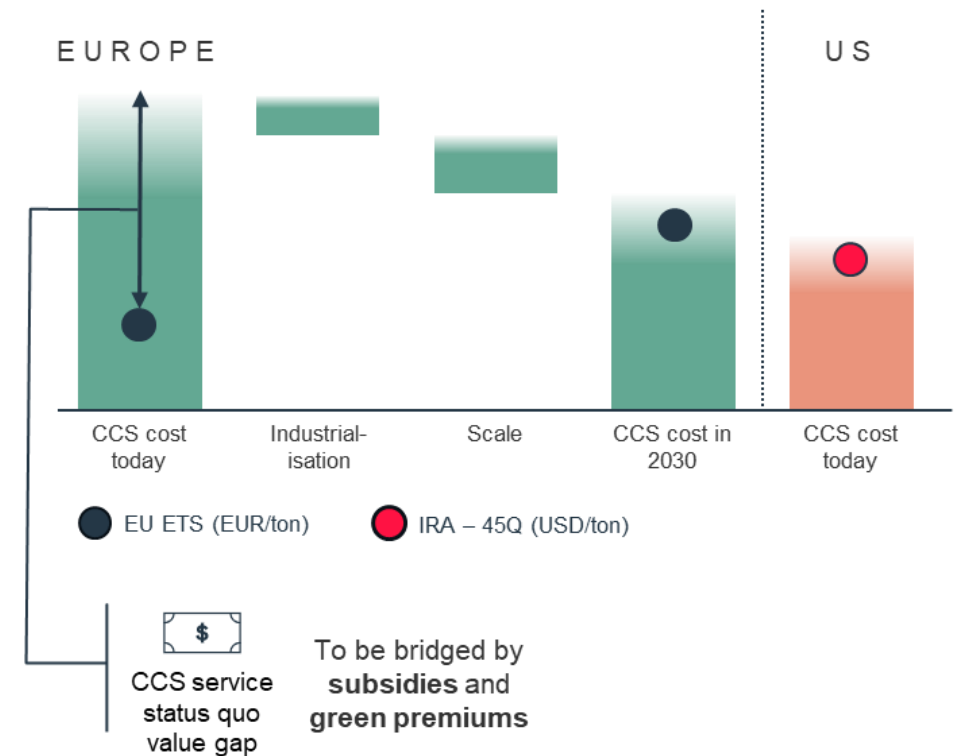
\*Capacities are unrisked and subject to further subsurface evaluations and may change

\*\* Start dates are project start dates that may change due to customer commitments and e.g. permitting timelines

## Next steps for CCS – making it happen

- **Value gap**; emitting is cheaper than CCS solutions, ETS price and allowance fail to provide sufficient incentives to industry to decarbonize.
- **Keep momentum** for climate solutions, over concerns of the impact of high energy costs on competitive position of EU industry and security of energy supply.
- A future sustainable CO2 storage business needs to be based on market value principle (not cost plus) i.e. promote the development of **green premium products for steel and cement and carbon credits**
- Governance of the **value chain, alignment of FID**. Value chain collaboration and integration is important. The less parties involved the easier an FID alignment becomes
- **Public acceptance** varies across countries, also Government commitment/acceptance and involvement varies (which is fine)
- **Regulations** & permitting processes and procedures should be stable and predictable to enable investments.
- **Soft side of the business**, first mover (dis)advantages, trust and communication are real (underestimated) challenges

Narrowing gap over time between cost of emitting (EU ETS) vs CCS cost



# Agenda for the day

**09:30, Welcome and agenda – CINEA**

**09:35, Introductory remarks – DG CLIMA**

**09:45, Session 1 - Supply of CO<sub>2</sub>**

*Speakers: GO4ECOPLANET (Lafarge Cement), CalCC (Lhoist, Air Liquide), K6 (EQIOM, Air Liquide), Beccs Stockholm (Stockholm Exergi), Kairos@C (BASF, Air Liquide).*

**11:00 – 11:15 – coffee break**

**11:15, Session 2 - Availability of CO<sub>2</sub> injection capacity**

*Speakers: Harbour Energy, Carbfix, INEOS, ENI, Total Energies, Shell, Equinor.*

**13:00 – 14:00 – lunch break**

**14:00, Session 3 - Enabling conditions**

*Speakers: Denmark, Norway*

**14:30, Open Discussion of all participants**

**15:25, Wrap-up and conclusions – DG CLIMA**

**15:30 – End of workshop**

# 14:00h – 14h30 – Session 3 – Enabling conditions

**The views of front-runner Member States regarding, application process, priority status and permitting support for recognised net-zero strategic CO2 projects.**



# Net-zero Strategic Projects in the Danish context

October 2 2024



Danish Ministry of Climate,  
Energy and Utilities



# Net-zero Strategic Projects and CCS

- Implementation still ongoing in Denmark.
- We are clarifying if tasks should be based in the Ministry of Climate, Energy and Utilities or the Ministry of Industry, Business and Financial Affairs.
- CCS differs from other technologies in NZIA. We are trying to clarify how the implementation of the CCS regulation is done best.

# Questions/clarifications

- How do we define the criteria for capture and infrastructure projects that should be recognised as Net-zero strategic projects? What does it entail to be "related to" or "necessary for" a CO<sub>2</sub> storage site?
- What if all CO<sub>2</sub> storage projects in Denmark become Net-zero Strategic Projects? Will that reduce the effect of the benefits?
- Will it only be Net-zero Strategic Projects that can use the single point of contact/one-stop shop? Or will all CCS projects be able to benefit from this?

# Danish Taskforce for Authorities

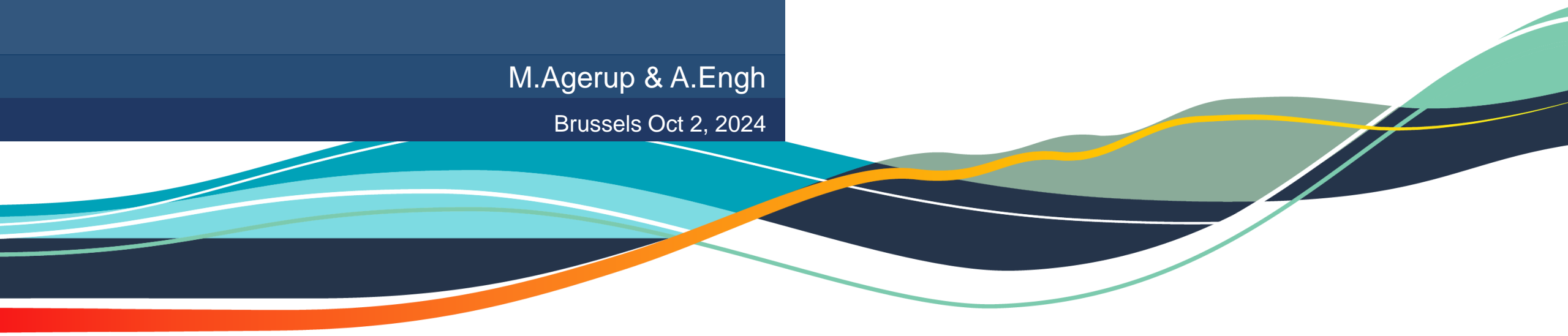
- Established with Agreement on Strengthened Framework Conditions for CCS in Denmark 20 September 2023.
- Members of the taskforce are eight relevant authorities for CCS projects in Denmark.
- Purpose:
  - › Knowledge-sharing and mutual updates on CCS developments with a particular fokus on regulation to enhance knowledge and understanding
  - › Identification of gaps in regulation (CCS is a brand new area, thus largely not covered by existing regulation)
  - › Enhanced coordination between authorities as regards of permitting and identify possibilities for advancing and speeding up permitting procedures.
  - › Development of a step-by-step guides for permitting procedures across the value chain (the first guide for onshore storage almost done).
- In addition, we have fora for regular dialogue with market actors.



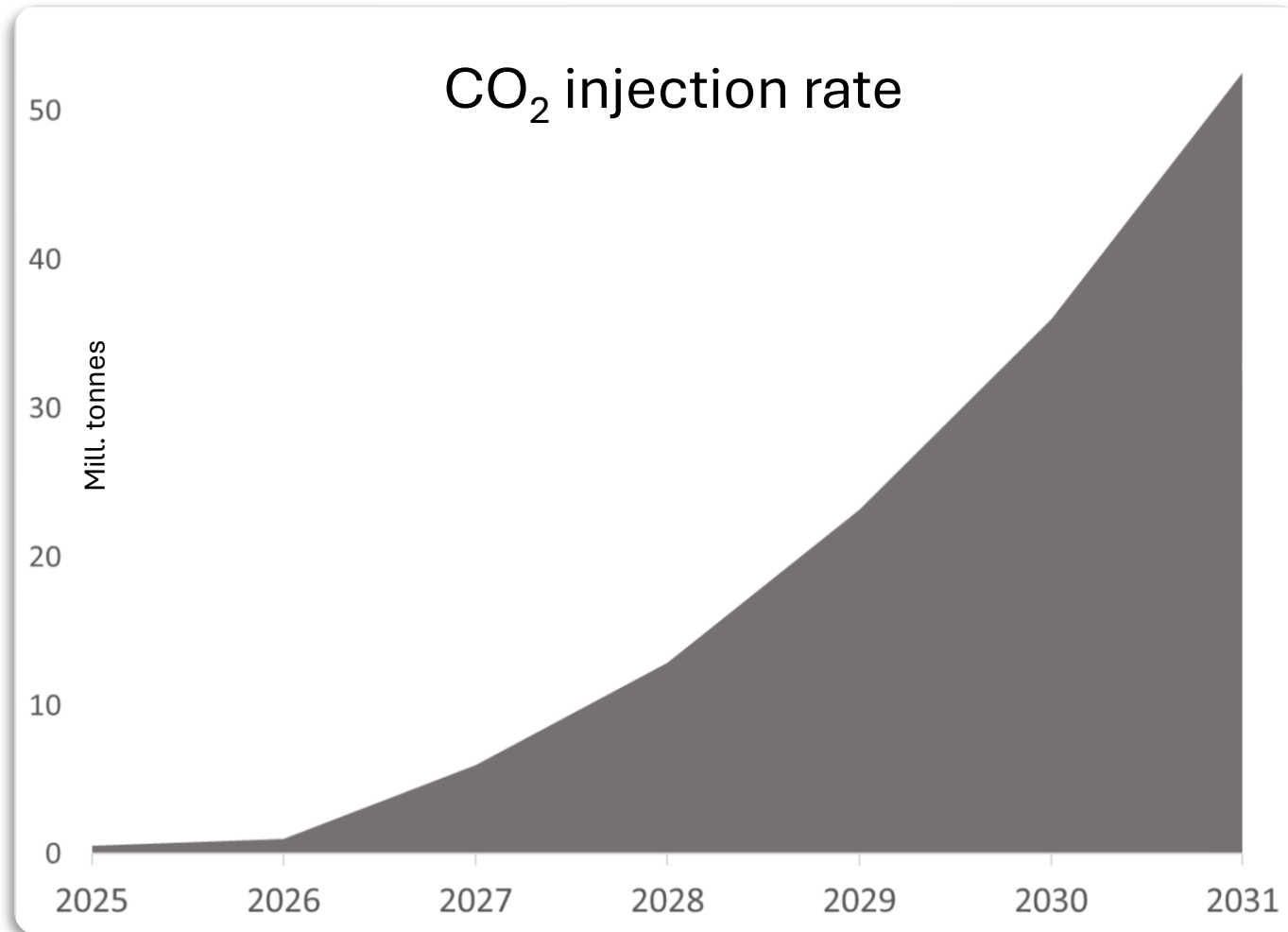
# CCS – status in Norway

M.Agerup & A.Engh

Brussels Oct 2, 2024



# Ambitions behind awarded exploration/exploitation licenses



Source: Norwegian Offshore Directorate

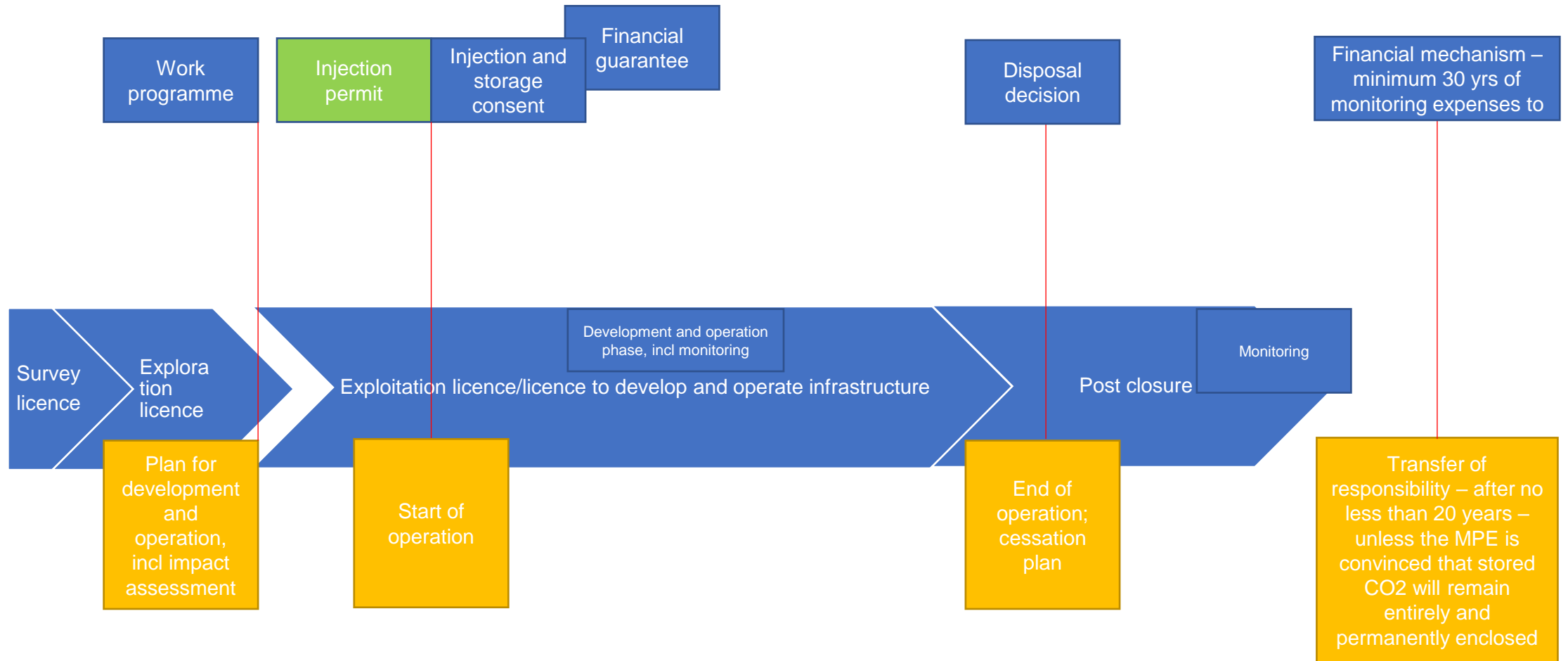


# Norwegian CO<sub>2</sub> regulatory regime

- An offshore licensing regime
- The State owns the resources; the resources are the storage sites below the seabed
- Licence provides access to resources
- Key licences: exploration licence and exploitation licence
- Open door policy
  - Interest in an area kicks off the licensing process
  - Public invitation to apply for licences – ensure competition
- Main licence terms; work program, geographical and stratigraphic limitations, duration



# The licensing regime



# Regulatory authority on CO<sub>2</sub> storage and transportation is shared

- The Ministry of Energy – licensing – approval of development of storage sites/infrastructure (resource management)
    - The Offshore Directorate
    - The Ocean Industry Agency
  - The Ministry of Climate and Environment - pollution control and protection of the environment
    - The Environment Agency
- 
- 2014 – Regulation relating to exploitation of subsea reservoirs on the continental shelf for storage of CO<sub>2</sub> and relating to transportation of CO<sub>2</sub> on the continental shelf
  - 2014 – Chapter 4A of the Petroleum Regulation – Storage of CO<sub>2</sub>
  - 2020 - Regulation relating to safety and working environment for transport and injection of CO<sub>2</sub> on the Continental Shelf
  - 2014 – Part 7A Chapter 35 of the Pollution Regulation – Storage of CO<sub>2</sub> in geological formations





# Main elements of the Storage Regulation

- Requirements for selection of storage sites
  - To achieve the objective of environmentally safe storage and good resource management
- Provisions on licensing of storage operators, incl qualification
  - Objective, published and non-discriminatory
  - «...financial strength, technical and geological competence and reliability deemed necessary...»
- Liability
  - Financial guarantee during operations
  - Financial security mechanism – long term (post closure) liability
- Requirements for reporting, measuring, monitoring etc.

# Licences awarded till now

- One exploitation licence (Longship – Equinor, Shell, TotalEnergies)
- 10 exploration licences (Equinor, Horisont Energi, Harbour, TotalEnergies, AkerBP ASA, OMV (Norge) AS, Stella Maris CCS AS, Sval, Storegga, Vår Energi CCS, Lime Petroleum)
- New applications recently received for three new exploration areas



# Works in progress:

- NZIA EEA relevance assessment
- Assessment of policy toolset for CO<sub>2</sub> capture in Norway
- Infrastructure development
- Update of storage regulations
- Longship development in its final stages



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**15:30 – End of workshop**

# 14h30 – 15h25 – Open Discussion

***Match-making: Criteria for taking FID?***

***Coordinated project milestones – joint planning ?***

***Can MS help with permits or coordination?***

# 15h25 – Conclusions

# Thank you



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