Fondation Tuck

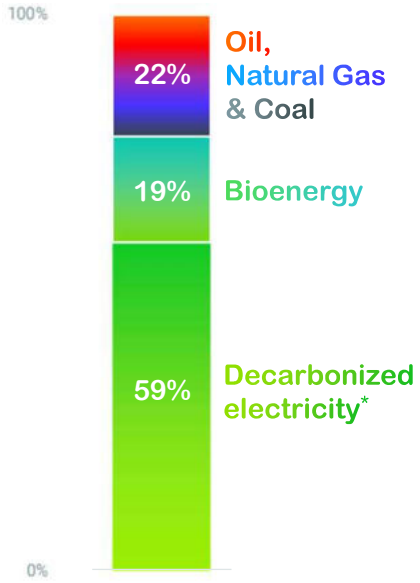
Think Tank Idees

TotalEnergies CCS

Etienne Anglès d'Auriac – 5 fev 24

TotalEnergies in 2050: a vision for a Net Zero company, together with society

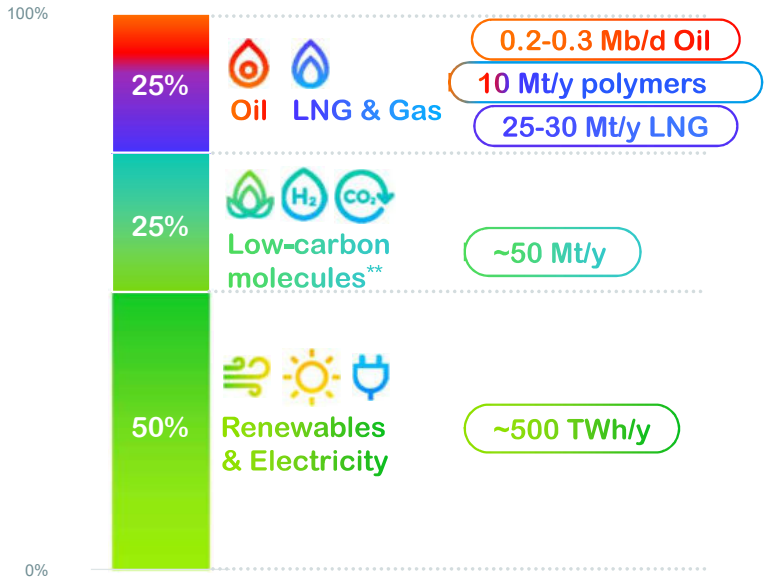
IEA NZE energy mix in 2050



CCS: 7 $GtCO_2e$

* Hydro, solar, wind and nuclear
** Biofuels, biogas, hydrogen and e-fuels/e-gas

TotalEnergies' 2050 energy production & sales

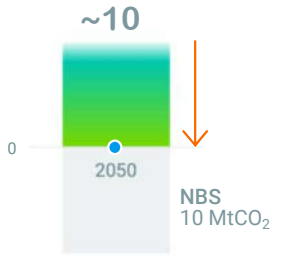


CCS: 50-100 $MtCO_2e$

(a) From operated facilities
(b) From energy products used by our customers (GHG Protocol Category 11)
(c) Average carbon intensity of energy products used by our customers worldwide (Scope 1+2+3)

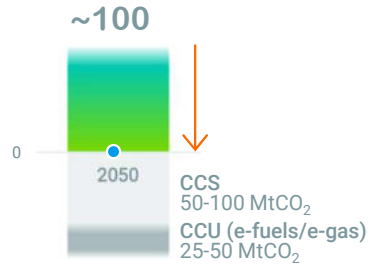
TotalEnergies Net zero Scope 1+2(a)

$MtCO_2e$



TotalEnergies Net zero Scope 3(b)

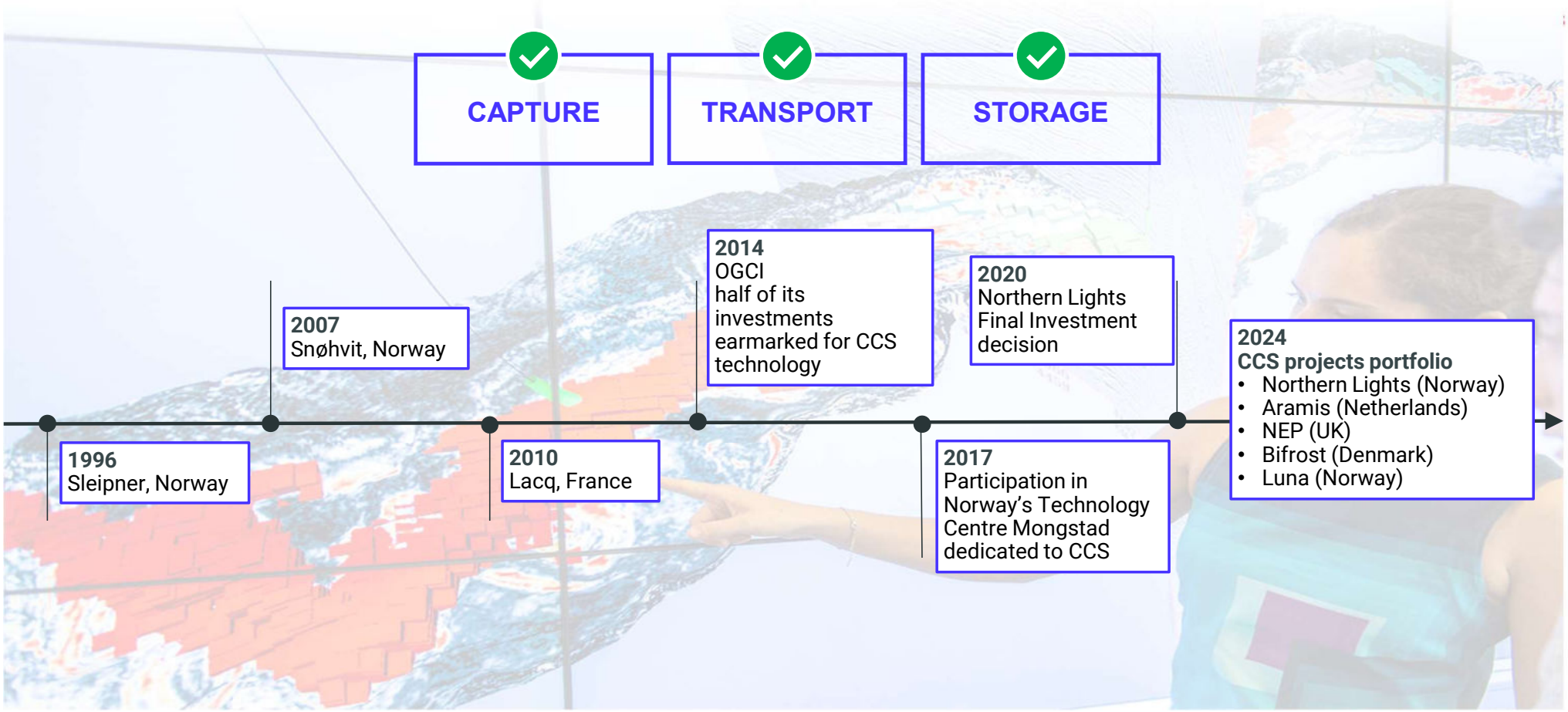
$MtCO_2e$



Net zero lifecycle carbon intensity(c)

-100%

Building up CCS specific competencies & delivering projects



Mobilizing expertise spread across the Company

Deploying CCS strategy

Reducing emissions and developing profitable business

Incorporating CCS in our assets

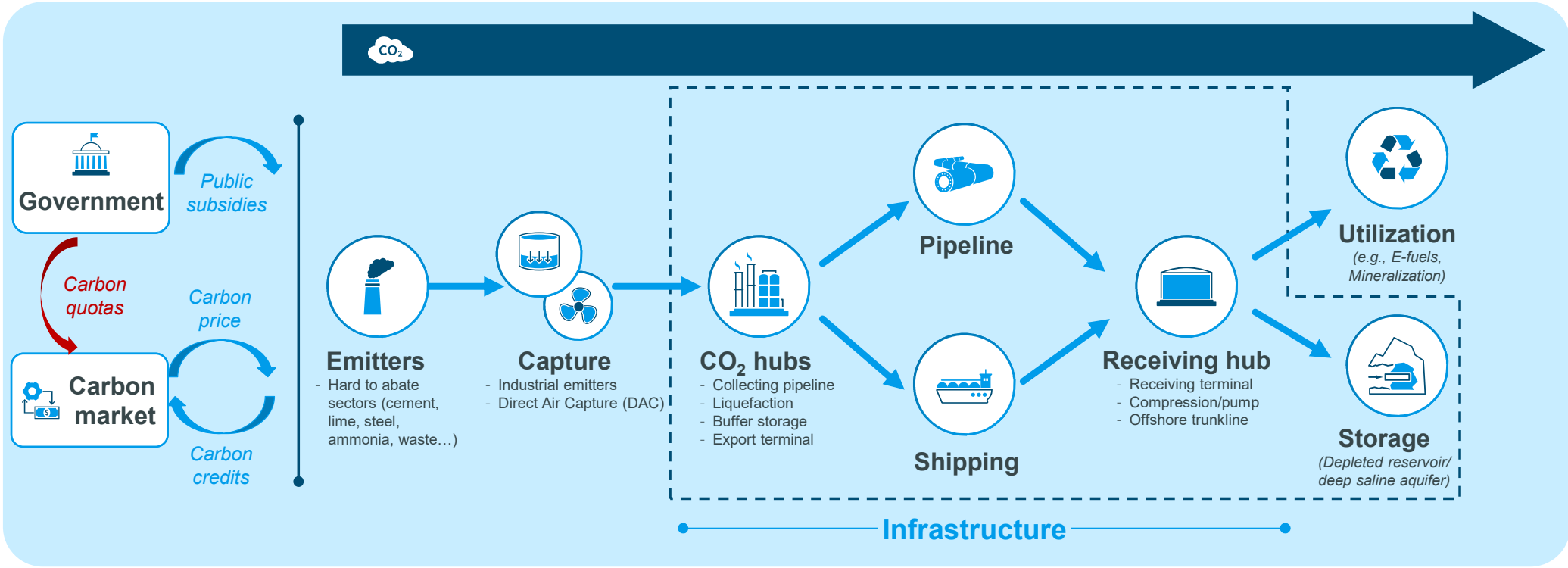
- → Reduce emissions from existing assets
  - Ichthys (Australia)
    awarded GHG storage assessment permit
  - Cameron LNG (US)
    Hackberry Carbon Sequestration project under development
  - Refineries
- → Avoid emissions in greenfield projects
  - North Field East & South (Qatar)
  - Papua LNG (Papua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

Offering Carbon Transport & Storage 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 options

2030 target (Company share)	Growing investment to
> 10 Mt/y	**~300 M$/y**

CO_2 capture, transportation and storage



Building a safe, reliable and flexible chain for emitters

CCS: investing in CO_2 storage services for our customers

Norway

Northern Lights (TotalEnergies 33%, Equinor 33%, Shell 33%)

- → **Pioneering merchant CCS project**
- → **Phase 1**
  - **1.5 Mtpa**, start-up 2025
  - Capacity booked
- → **Phase 2**
  - Expansion to **5.2 Mtpa**
  - FEED completed

Luna (TotalEnergies 40%, Wintershall Dea 60% op.)

- → CO_2 storage license (under study)
  - Potential capacity 5 Mtpa

Netherlands

Aramis (TotalEnergies 60% op.*, EBN 40%)

- → **Storage**
  - **2,5 Mtpa**, start-up 2029 (Ph.1)
  - Expansion to **5,5 Mtpa** (Ph.2)
- → **Transport & gathering**
  - 22 Mtpa transport capacity
  - CO_2 terminal for gas & cryo
  - Sourcing: gas pipe (local) + shipping (international)

** Storage part, equities differ on transportation, and terminal*

UK

NEP** (TotalEnergies 10%, BP 45%, Equinor 45%)

- → Onshore and offshore infrastructure for storage in the Endurance reservoir, a large-scale saline aquifer
  - **4 Mtpa**, start-up 2028 (Ph.1)
  - Up to 10 **Mtpa** with following stage

***Northern Endurance Partnership*

Denmark

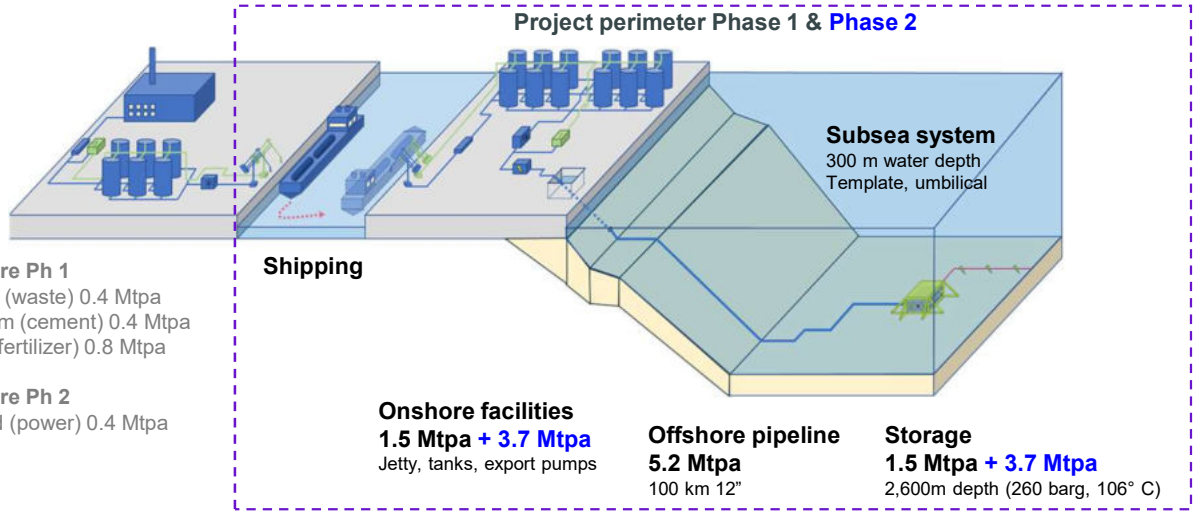
Bifrost (TotalEnergies 80% op., Nordsøfonden 20%)

- → **Project**
  - Infrastructure to link EU industrial hubs with offshore storage in depleted gas field and saline aquifer
  - **> 5 Mtpa**
  - Under study (2 licenses)

Targeting ~10 Mtpa storage capacity by 2030

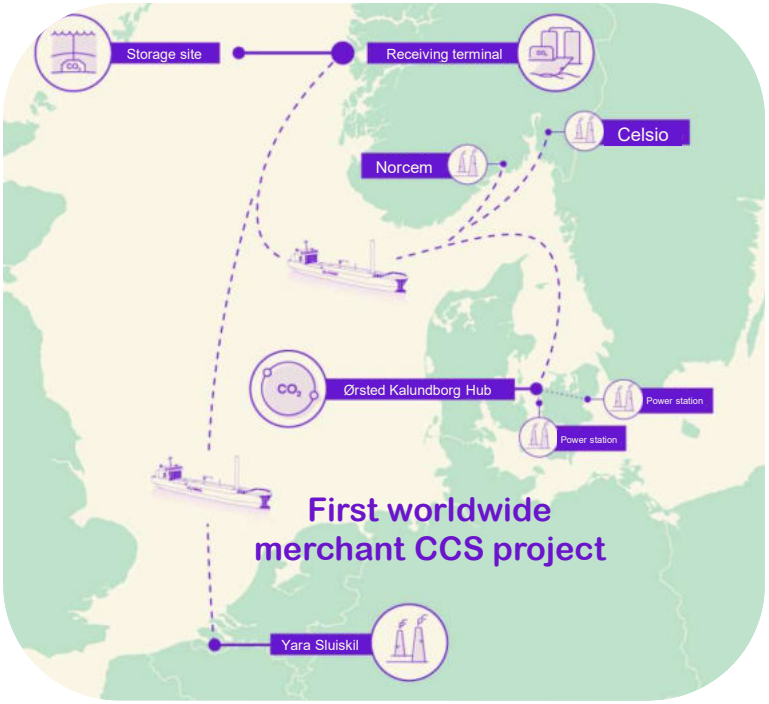
Norway - Northern Lights

1/3 | 1/3 | 1/3



Capture Ph 1
Celsio (waste) 0.4 Mtpa
Norcem (cement) 0.4 Mtpa
Yara (fertilizer) 0.8 Mtpa

Capture Ph 2
Ørsted (power) 0.4 Mtpa

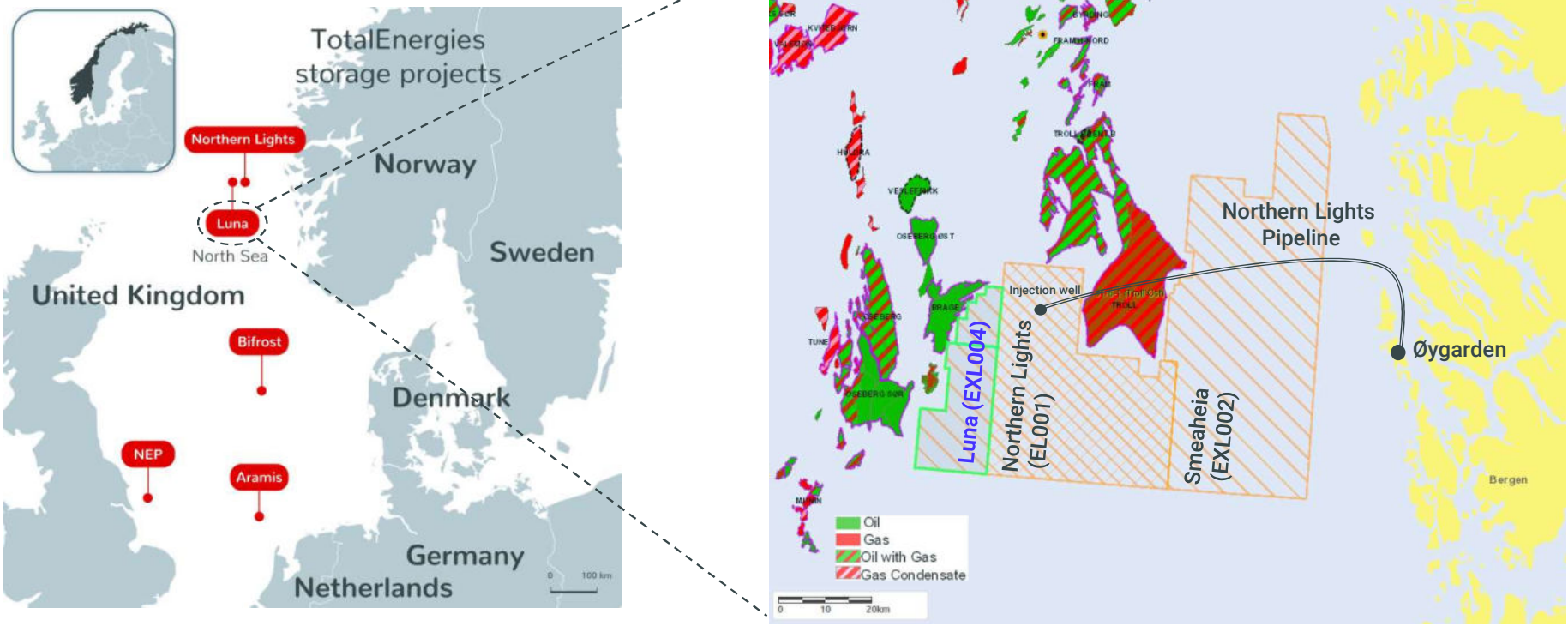


Phase 1: 1.5 Mtpa, FID taken 2020, progress > 87%, start-up 2025

Phase 2: 5.2 Mtpa, FEED completed, FID targeted 2024, start-up 2028

Norway - Luna

40% | 60%, op.



Luna (Exploration license EXL004) → Appraisal ongoing (exploration well targeted in 2025)

Potential storage capacity 5 Mtpa

Netherlands - Aramis

JV 1: Storage

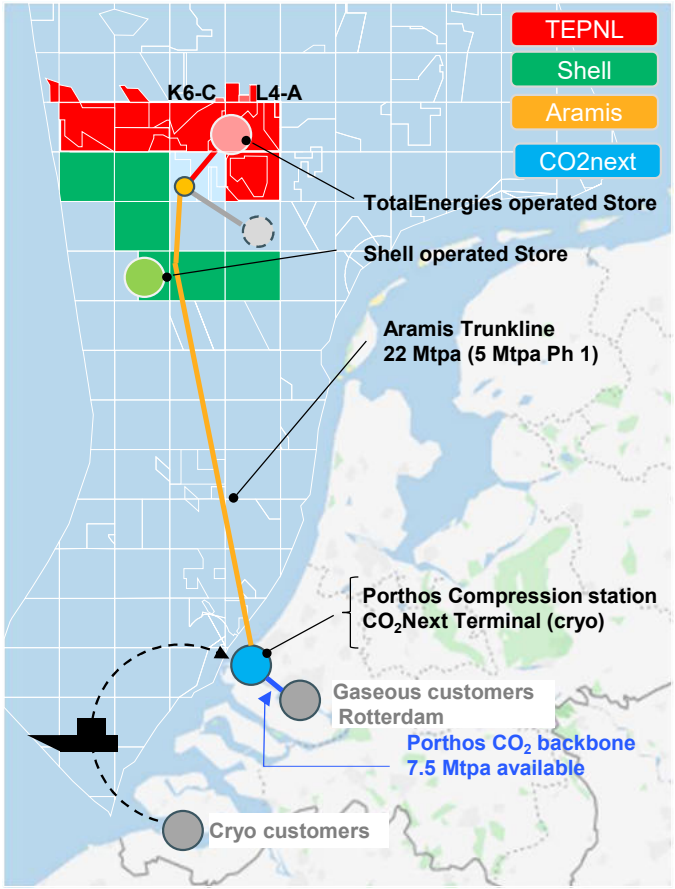
TotalEnergies 60% (op.), EBN 40%

- 2.5 Mtpa (Phase 1)
- Expansion to 5,5 Mtpa (Ph.2)
- Re-use of existing platforms

JV 3 : Terminal (CO_2Next)

TotalEnergies 20%, Shell 20%, Vopak 30%, Gasunie 30%,

- Standalone independent terminal
- Built next to Gate LNG (Vopak/Gasunie)



JV 2: Trunkline & Compressor (Aramis)

TotalEnergies 25 %, Shell 25%, EBN 25%, Gasunie 25%

- 32'' open access, ~ 200 km (22 Mtpa)
- Multimodal (cryo, gas) hub in Rotterdam: Terminal + Compression station in synergy with Porthos project

JV 4: Marketing / Shipping

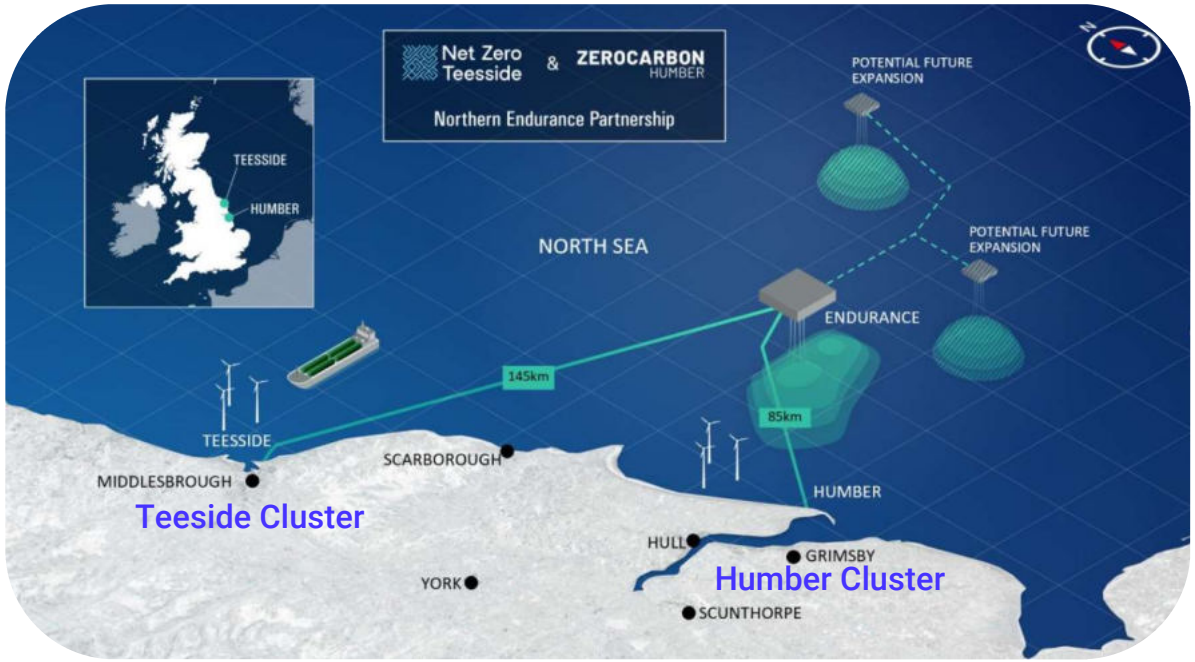
TotalEnergies 50%, Shell 50%

- Shipping: development of shipping solutions by TotalEnergies & Shell
- Marketing: joint TotalEnergies & Shell (Ph.1)

Large-scale, flexible carbon transportation services and open access to offshore carbon storage capacity
FEED ongoing (Ph. 1)

UK - Northern Endurance Partnership (NEP)

10% | bp 45%(Op.) | equinor 45%



Storage licenses
- License CS001: Endurance reservoir
- Licenses CS006, CS007 (awarded in 2022)
- License CS025 (awarded in 2023)

Phase 1: 4 Mtpa
- Hub on Teesside
- FEED completed
- FID target : sept 24

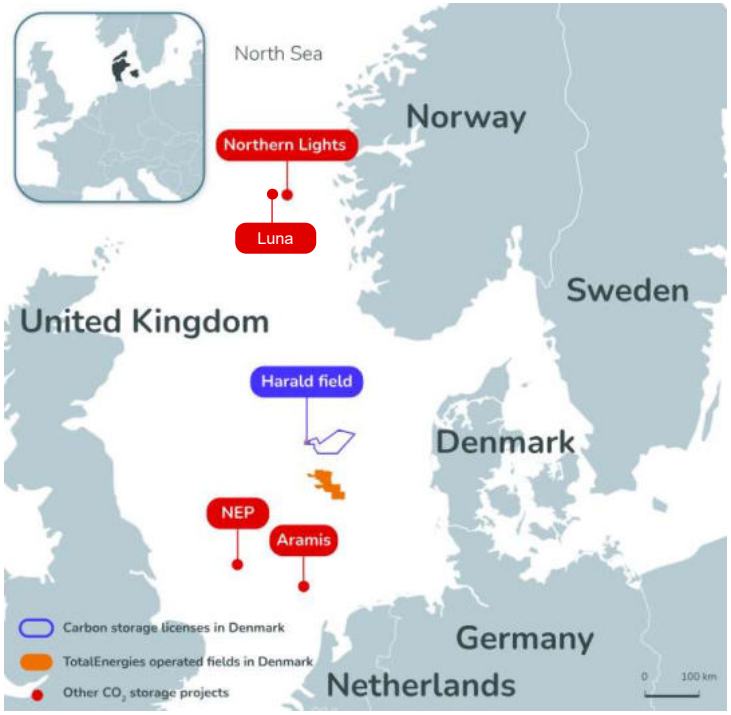
Next phase: + 6 Mtpa
- Hubs on Humber & Teesside

Aim to reach 23 Mtpa (in total) **by 2035**

The most advanced large CCS project in Europe after Northern Lights (Ph.1 FID targeted in 2024)
Regulated business model, government selects emitters

Denmark - Bifrost

80% (Op.) nordsø fonden 20% Transport & Storage



Storage Capacity

- Depleted offshore gas field (Harald West)
- Saline aquifer
- > **5 Mtpa**

Large geological storage potential and proximity to industrial emitters in Central Europe

CCS international context

Global
- IPCC report 2022: highlight on CCUS

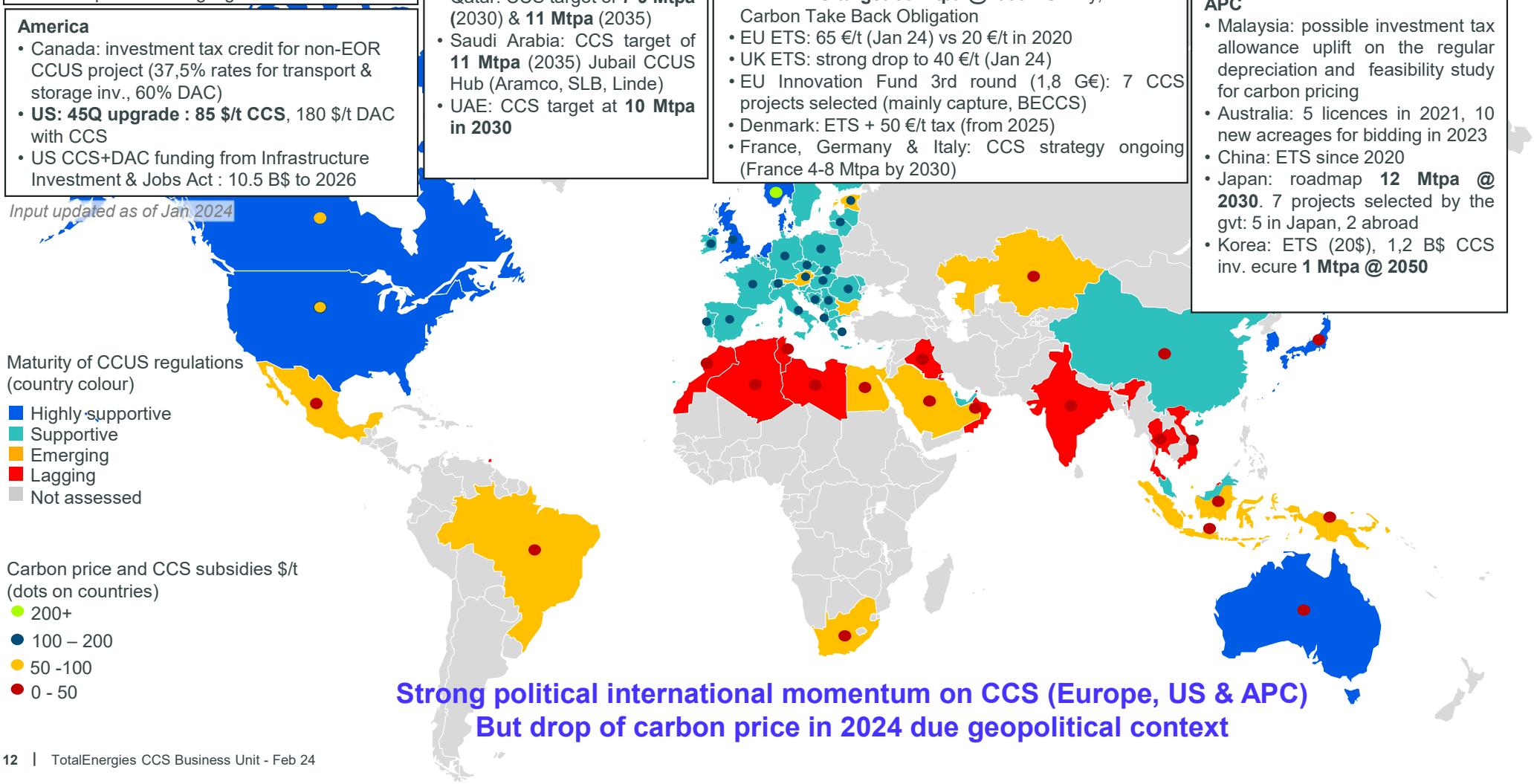
America
- Canada: investment tax credit for non-EOR CCUS project (37,5% rates for transport & storage inv., 60% DAC)
- **US: 45Q upgrade : 85 $/t CCS**, 180 $/t DAC with CCS
- US CCS+DAC funding from Infrastructure Investment & Jobs Act : 10.5 B$ to 2026

Input updated as of Jan 2024

MENA
- Qatar: CCS target of **7-9 Mtpa** (2030) & **11 Mtpa** (2035)
- Saudi Arabia: CCS target of **11 Mtpa** (2035) Jubail CCUS Hub (Aramco, SLB, Linde)
- UAE: CCS target at **10 Mtpa in 2030**

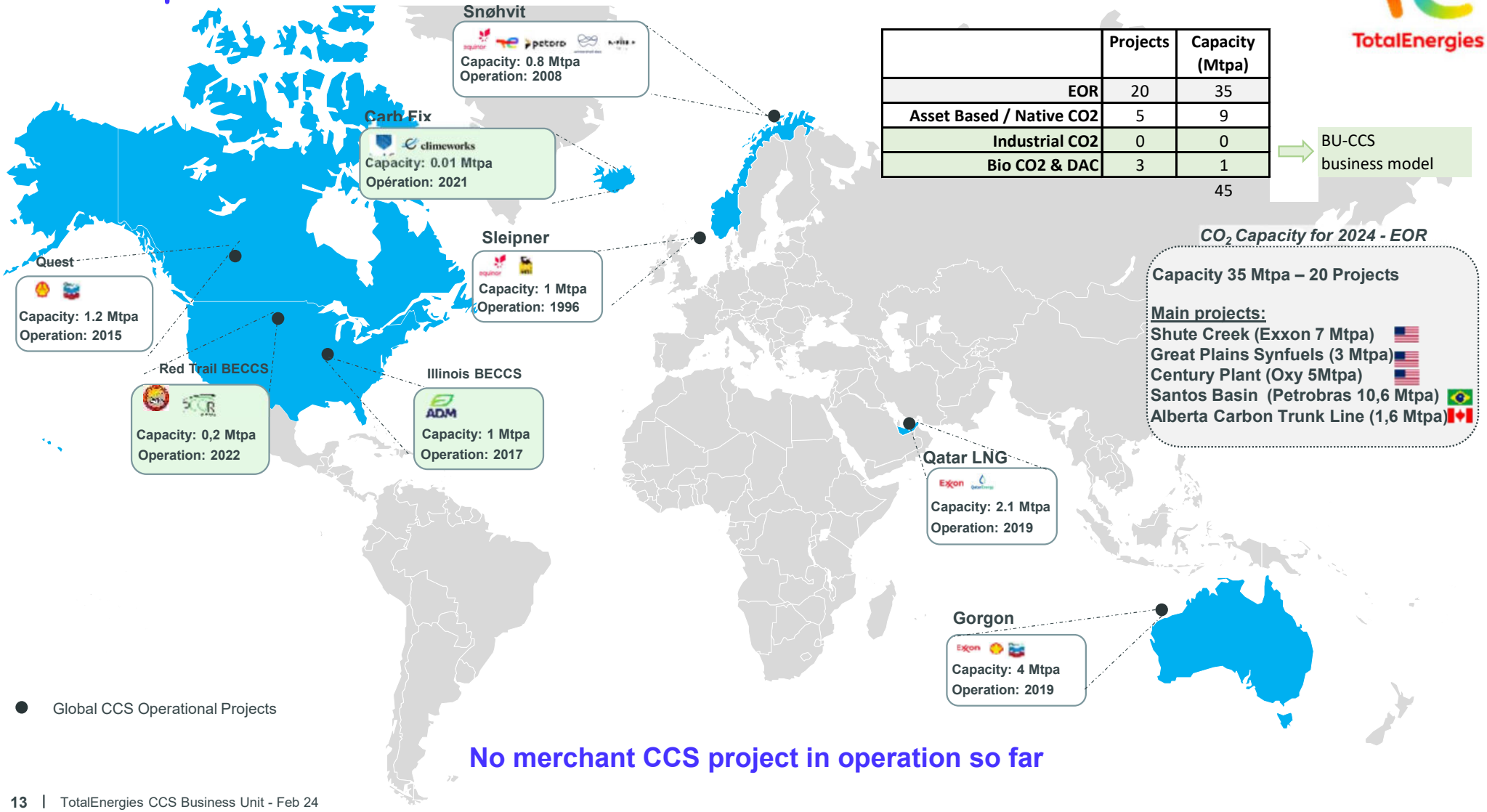
Europe
- NZIA: **CCS target 50 Mtpa @2030** EU only, based on Carbon Take Back Obligation
- EU ETS: 65 €/t (Jan 24) vs 20 €/t in 2020
- UK ETS: strong drop to 40 €/t (Jan 24)
- EU Innovation Fund 3rd round (1,8 G€): 7 CCS projects selected (mainly capture, BECCS)
- Denmark: ETS + 50 €/t tax (from 2025)
- France, Germany & Italy: CCS strategy ongoing (France 4-8 Mtpa by 2030)

APC
- Malaysia: possible investment tax allowance uplift on the regular depreciation and feasibility study for carbon pricing
- Australia: 5 licences in 2021, 10 new acreages for bidding in 2023
- China: ETS since 2020
- Japan: roadmap **12 Mtpa @ 2030**. 7 projects selected by the gvt: 5 in Japan, 2 abroad
- Korea: ETS (20$), 1,2 B$ CCS inv. ecure **1 Mtpa @ 2050**



Strong political international momentum on CCS (Europe, US & APC)
But drop of carbon price in 2024 due geopolitical context

CCS in operation



	Projects	Capacity (Mtpa)
EOR	20	35
Asset Based / Native CO2	5	9
Industrial CO2	0	0
Bio CO2 & DAC	3	1
		45

BU-CCS business model

CO_2 Capacity for 2024 - EOR

Capacity 35 Mtpa – 20 Projects

Main projects:
- Shute Creek (Exxon 7 Mtpa)
- Great Plains Synfuels (3 Mtpa)
- Century Plant (Oxy 5Mtpa)
- Santos Basin (Petrobras 10,6 Mtpa)
- Alberta Carbon Trunk Line (1,6 Mtpa)

● Global CCS Operational Projects

No merchant CCS project in operation so far

CCS projects in Europe

- **Northern Lights (TotalEnergies, Shell, Equinor):** start-up in 2025 delay due to 1st client availability (Norcem) and Ph2 FID delayed
- **Porthos** (EBN, Gasunie):, FID delayed to 2023, start-up in 2026
- **NEP** (BP op., Equinor, TotalEnergies): start-up in 2028, FID delayed to 2024 due to government approval process for the regulated model and main emitters selection by the government
- **Aramis** (TotalEnergies, Shell, EBN, Gasunie): start-up in 2029
- **Bifrost** (TotalEnergies, Nordsøfonden): start-up in 2030
- **Acorn** (Shell, Storegga, Harbour Energy, and North Sea Midstream Partners): no SU date
- **Greensand** (INEOS op, Wintershall Dea + others in consortium): start-up in 2026 1,5 Mtpa & potential to 8 Mtpa by 2030. Currently in pilot phase, full-scale project FID in 2024. Aggressive planning on a new development concept (offshore offloading).
- **Ravenna** (ENI op.): Start-up in 2026, delay due to local permitting regulation not in place
- **Anrav** (Petroceltic op.; Bulgaria): Start-up in 2028, delay on funding and study execution

Delays observed in most of EU projects

Delivering projects on time for emitters is the key challenge ahead