

CO₂ storage under the North Sea

Offshore Technology /Hydrocarbon Technologies & Energy Transition



ebn

Energising the transition

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Outline

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1 EBN

2 CCS in Context

3 Project Porthos

4 Offshore CO₂ storage

5 What's next

6 Q&A





Energie Beheer Nederland

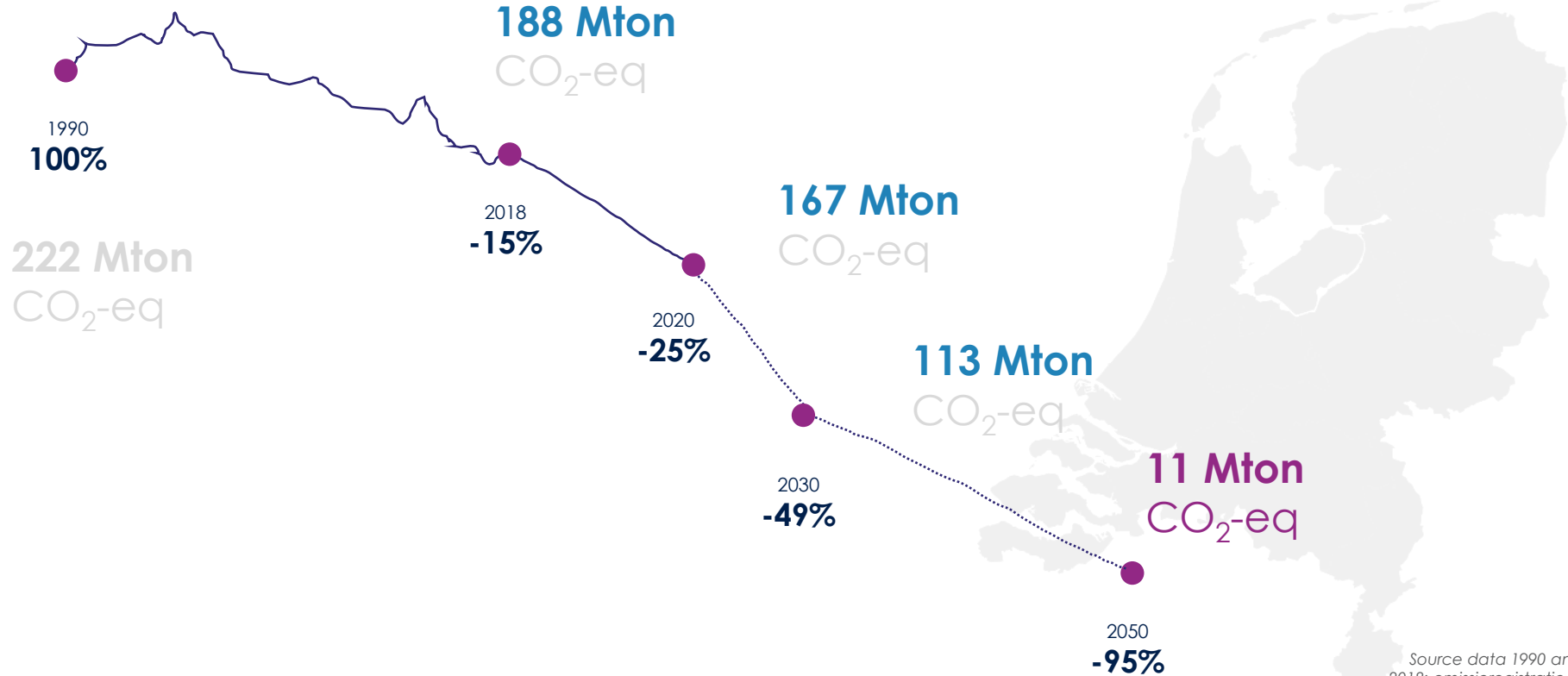
Energising the Transition

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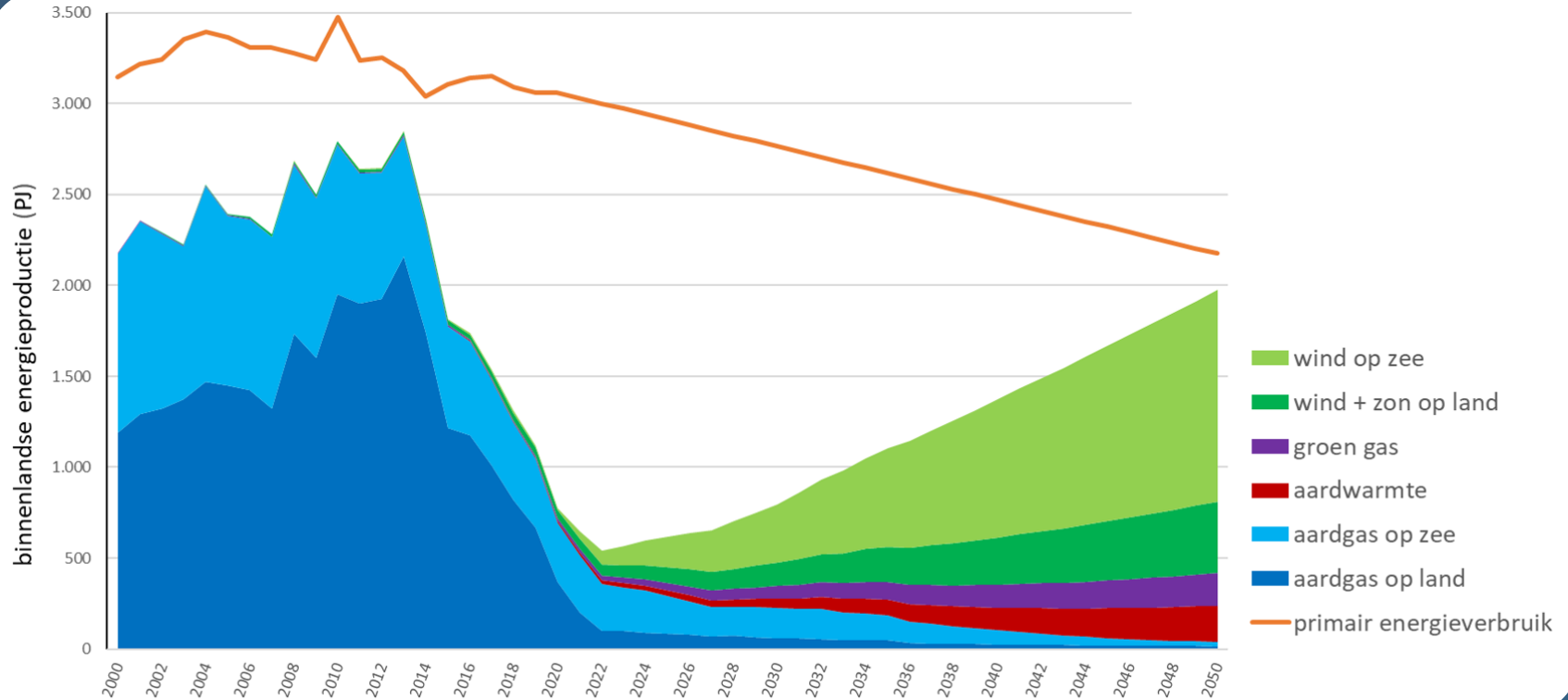
CCS in Context

High volumes, very cost effective

Climate objectives of the Netherlands



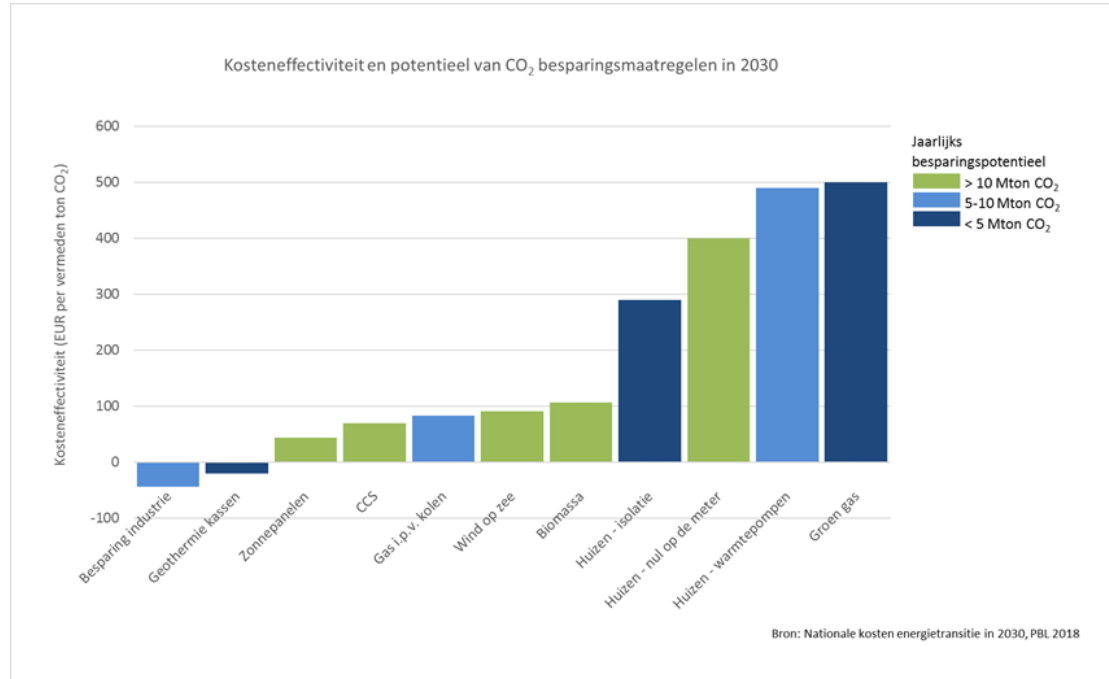
The challenge



Why CCS?



- Has the potential to reduce **large volumes** of CO₂
- Can be realized in the **short term**, crucial in terms of carbon budget
- It is **cost effective**
- Potential for **utilisation**, mainly in greenhouses
- Important for the development of **hydrogen**: via blue to green



ETS CO2 price development



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Project Porthos

Who, What, Where

Porthos

Carbon Capture & Storage from Rotterdam



Co-financed by the
Connecting Europe Facility
of the European Union



Porthos
CO₂ TRANSPORT & STORAGE

Porthos in the news

upstream
ENERGY EXPLORED

OPINION: CCS has role to play in a geared approach to energy transition

World Oil

Dutch government invites Shell, Exxon to join \$2.6B subsea carbon storage plan

"Le CO2 doit repartir d'où il vient: dans le sol"



Economy | Oil and Gas

Dutch g'ovt gives \$2.4bn in subsidies to fund carbon capture plan

The plan, which starts in 2024, aims to reduce emissions in the industrial cluster surrounding Europe's largest port.

NOS

Miljardensubsidie voor CO2-opslag onder Noordzee is rond



Dutch government grants €2 billion in subsidies to huge carbon storage project

Bloomberg Green

Energy & Science

Netherlands Pledges \$2.6 Billion Subsidy to Bury CO₂ Under the Sea

The project at Rotterdam port could capture 2.5 million tons of emissions per year from oil refineries and hydrogen plants



shipenergy
EC proposes €102 million funding for Porthos carbon capture project

The project will store CO₂ supplied by the Rotterdam operations of Air Liquide, Air Products, ExxonMobil and Shell in the North Sea seabed

rtl.nieuws

Pijpleiding voor CO₂

EC wil Rotterdams CO₂-opslagproject 102 miljoen euro subsidie geven



De haven van Rotterdam vanuit de lucht met onder meer industriegebied Vondelingenplaat, de Tweede Petroleumhaven en de raffinaderij van Shell.

Het grootste klimaatproject in de haven van Rotterdam is een grote stap dichterbij gekomen. De Europese Commissie wil 102 miljoen subsidie geven voor de aanleg van een systeem voor de afvang en opslag van CO₂ van de zwaar vervuulende industrie in de haven.



Europese subsidie in aantocht voor belangrijk milieuproject van de Rotterdamse haven

Een groot milieuproject in de Rotterdamse haven staat op de nominatie voor meer dan 100 miljoen euro Europese subsidie. Dat is ongeveer een vijfde van de totale kosten van het Porthos-plan.

Leon van Heel 02-10-20, 15:12



REUTERS

Dutch govt grants \$2.4 billion in subsidies to huge carbon storage project



NOS Nieuws Sport Uitziendingen

Milieuorganisaties willen harde grens aan ondergrondse CO₂-opslag



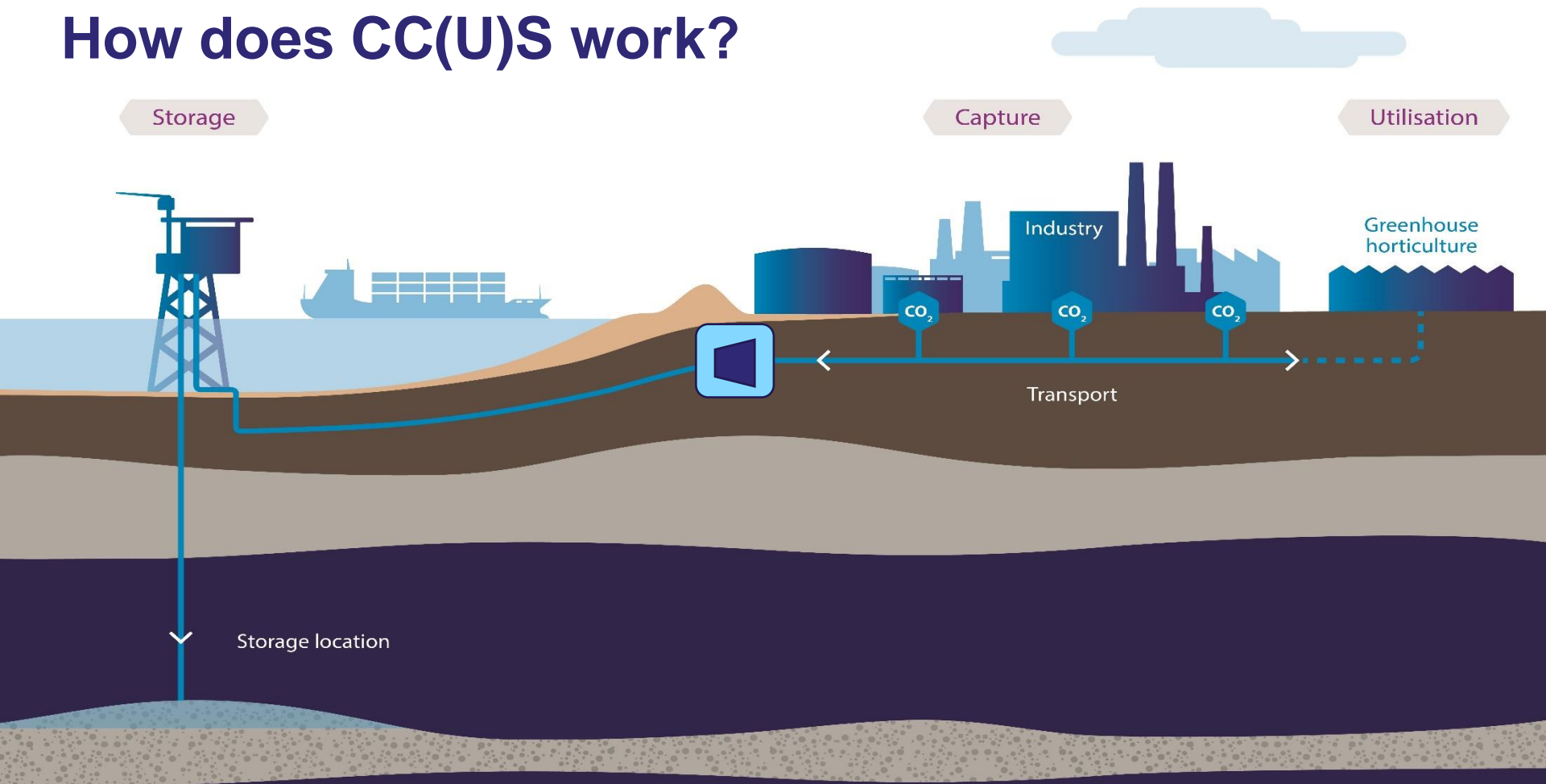
CO₂-opslag in de Noordzee met behulp van capture and storage (CCS) xxi



De hele wereld kijkt naar CO₂-project Rotterdam: 'Als het hier slaagt, gaan anderen volgen'



How does CC(U)S work?





Platform P18-A

GAS FIELD P18-4

GAS FIELD P18-6



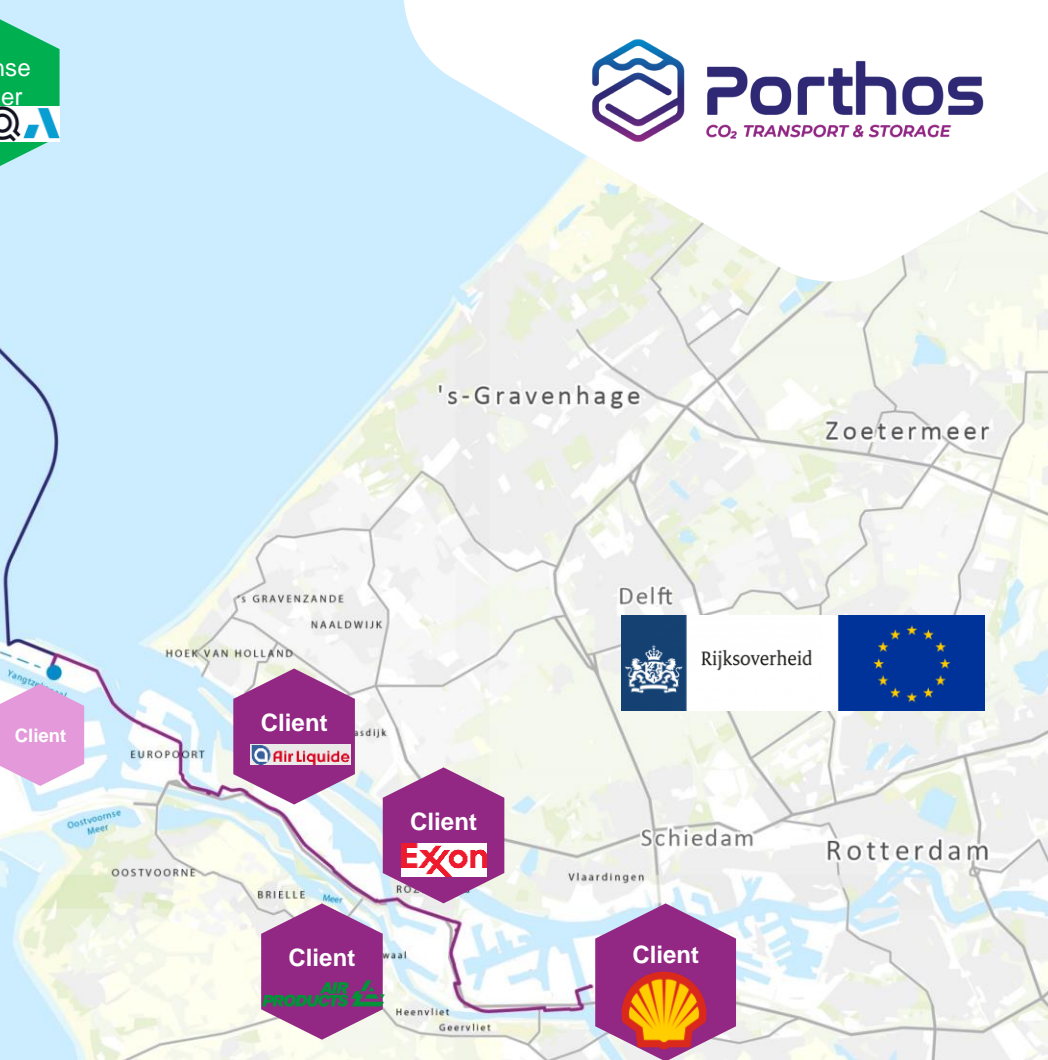
GAS FIELD P18-2



Compressor station Aziëweg



Rijksoverheid



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Offshore CO₂ Storage

A bit of technology

Storage



TAQA Operated Platform P18-A



P18 gas fields P18-2, P18-4 & P18-6



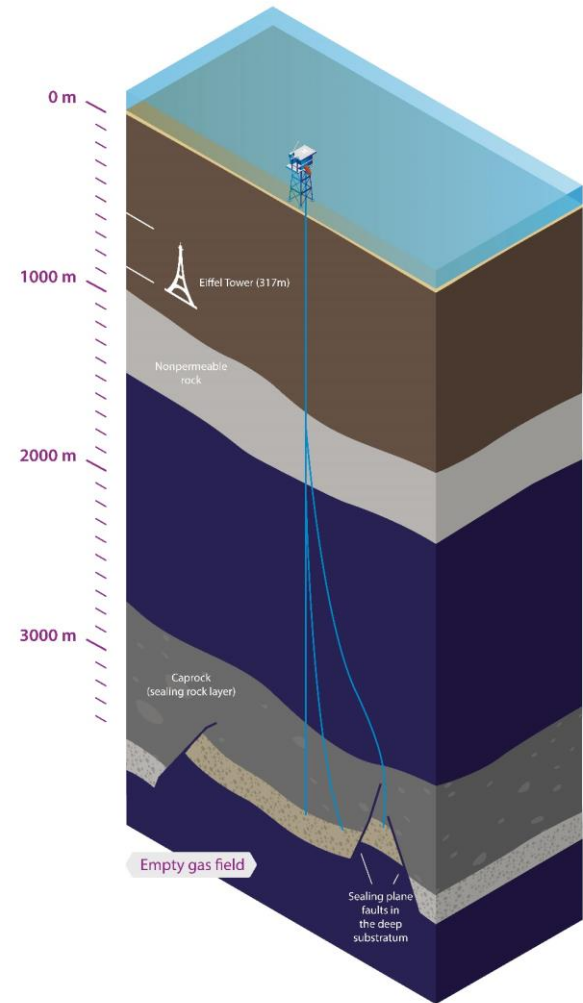
Storage Capacity: 38 Mton



Injection rate: 2.5 Mton CO₂ per year



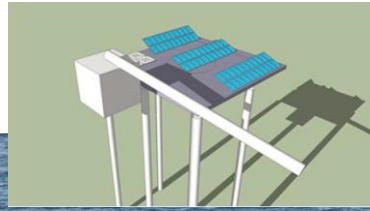
Proven natural geological containment



Platform Modifications

Energy neutral

- 64 solar panels, 360 Watt peak
- 2 wind turbines, 3 kW
- Battery pack at lower deck
- Diesel generator backup



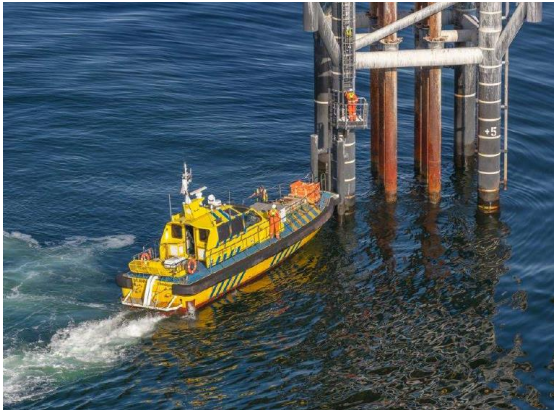
Porthos
CO₂ TRANSPORT & STORAGE



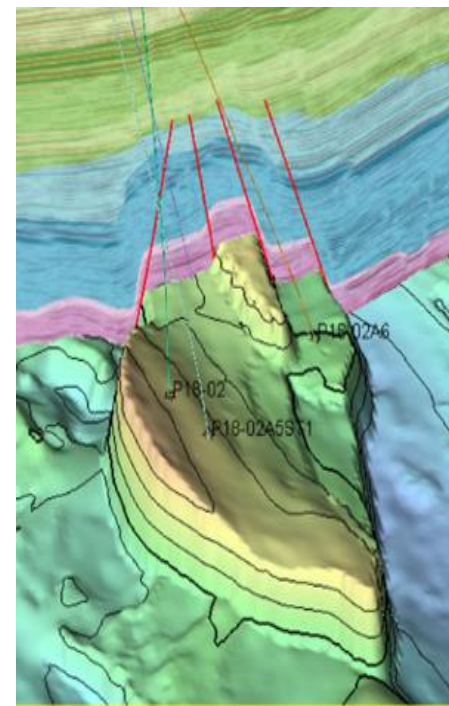
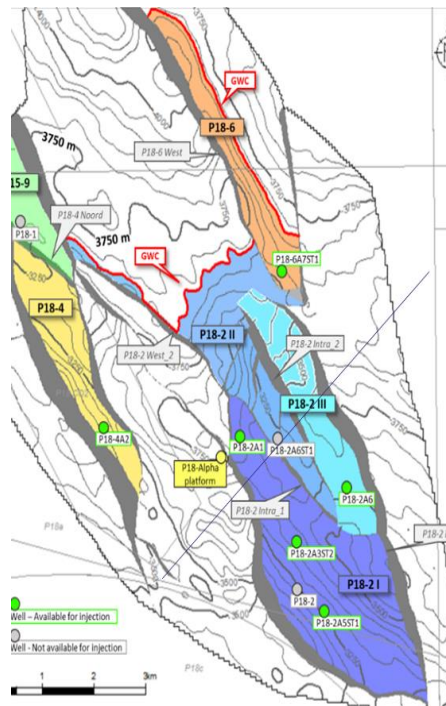
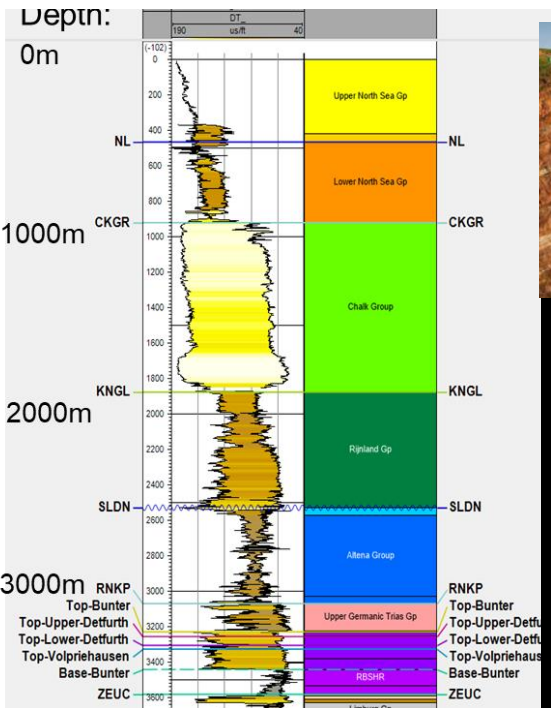
No gas production

Daylight only operations

- Walk to work vessels
- Helicopter hoisting only

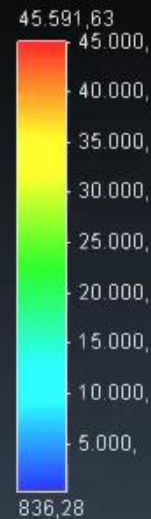
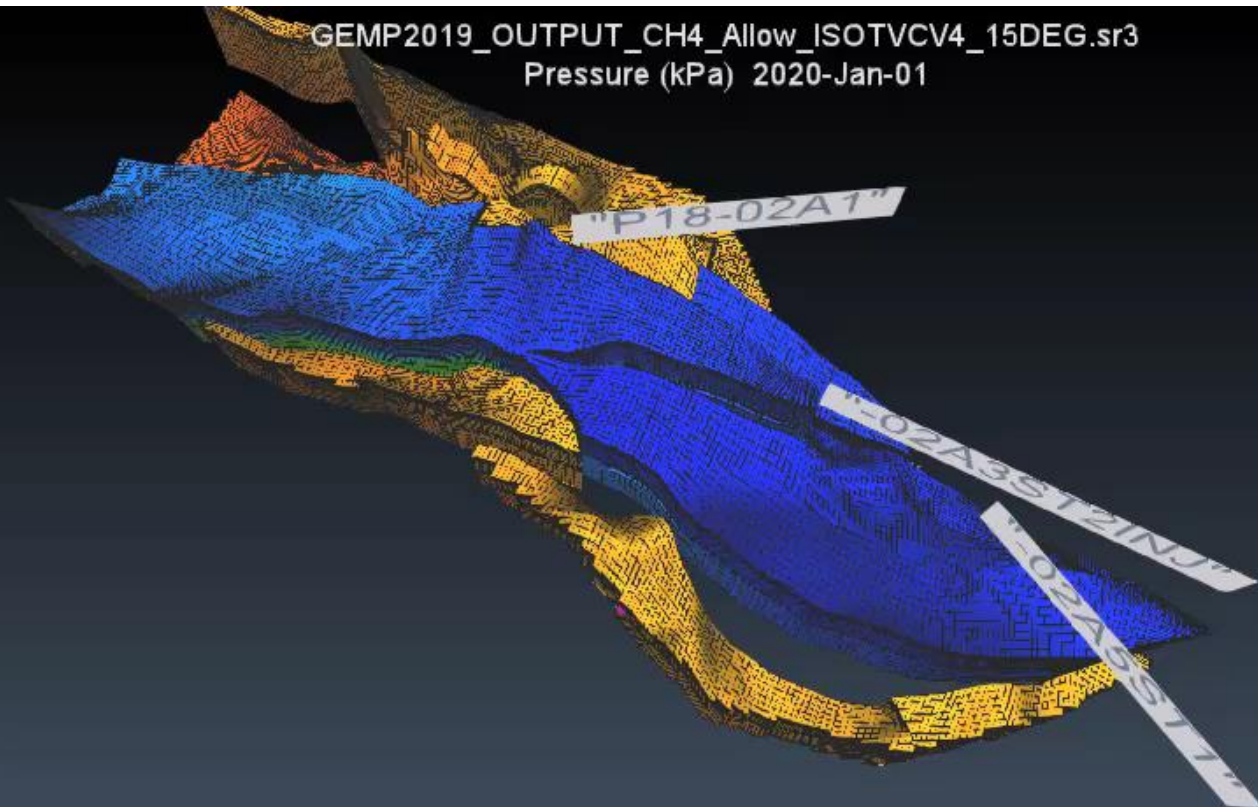


Geological setting



Reservoir pressure

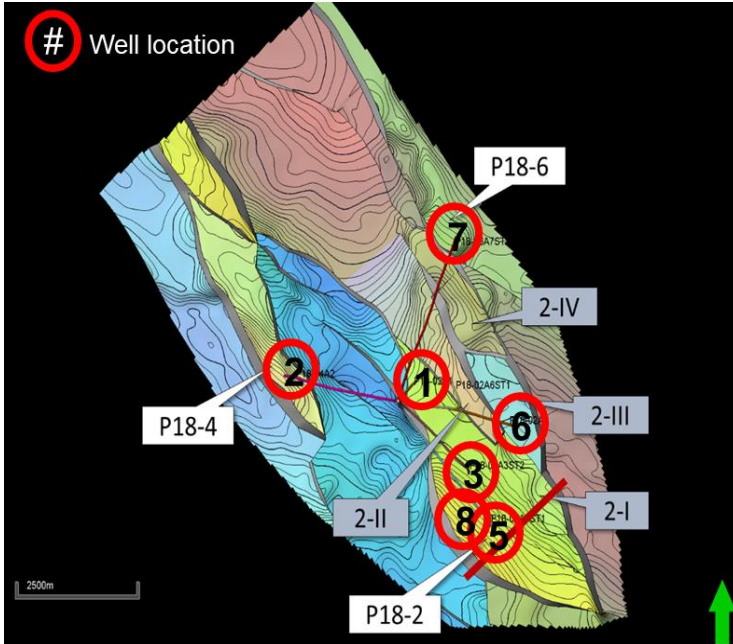
GEMP2019_OUTPUT_CH4_Allow_ISOTVCV4_15DEG.sr3
Pressure (kPa) 2020-Jan-01



Z/X: 4.4:1
Total Blocks: 374.374
Active Blocks: 193.251

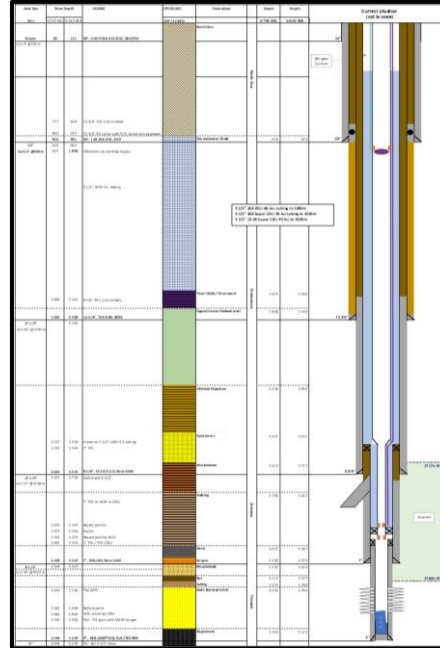


P18 Wells Campaign



P18-2 & 4 fields are the main target:

- 4 Injectors; 2A1, 4A2, 2A3, 2A5
- 1 well optional; 6A7
- 1 Decom: well P18-2 (8) off-platform



Well Design

- New completions
- DTS / DAS monitoring
- Developed SSSV's

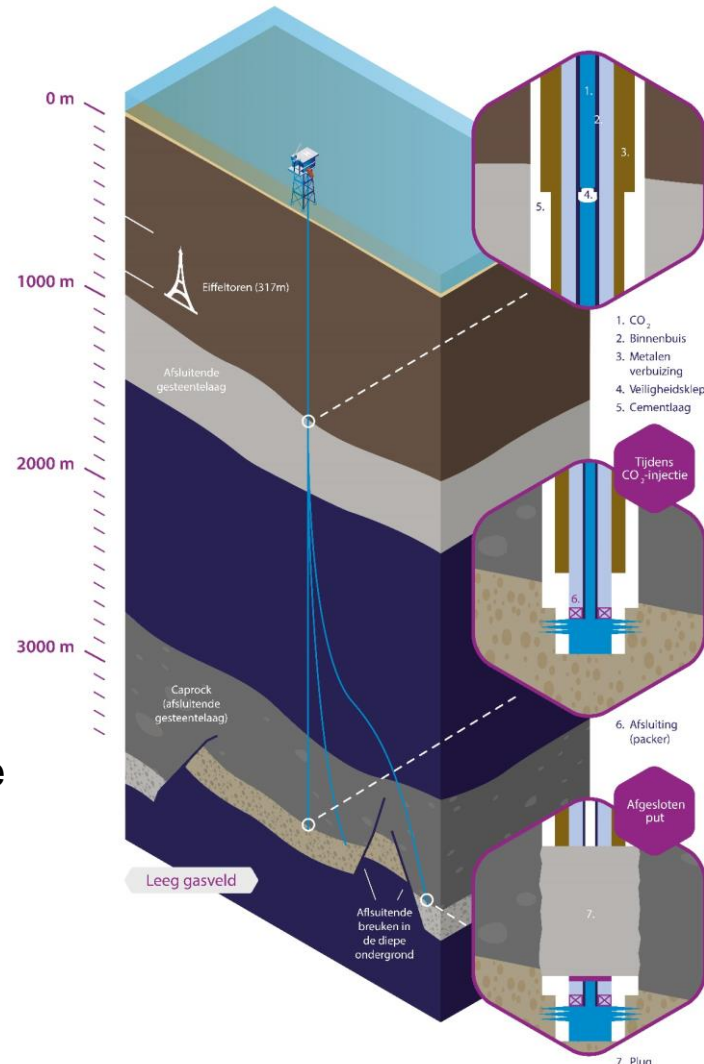


2021 Pre-FID Work Over

- De-risking the project
- Decom of multi-lateral 2A6

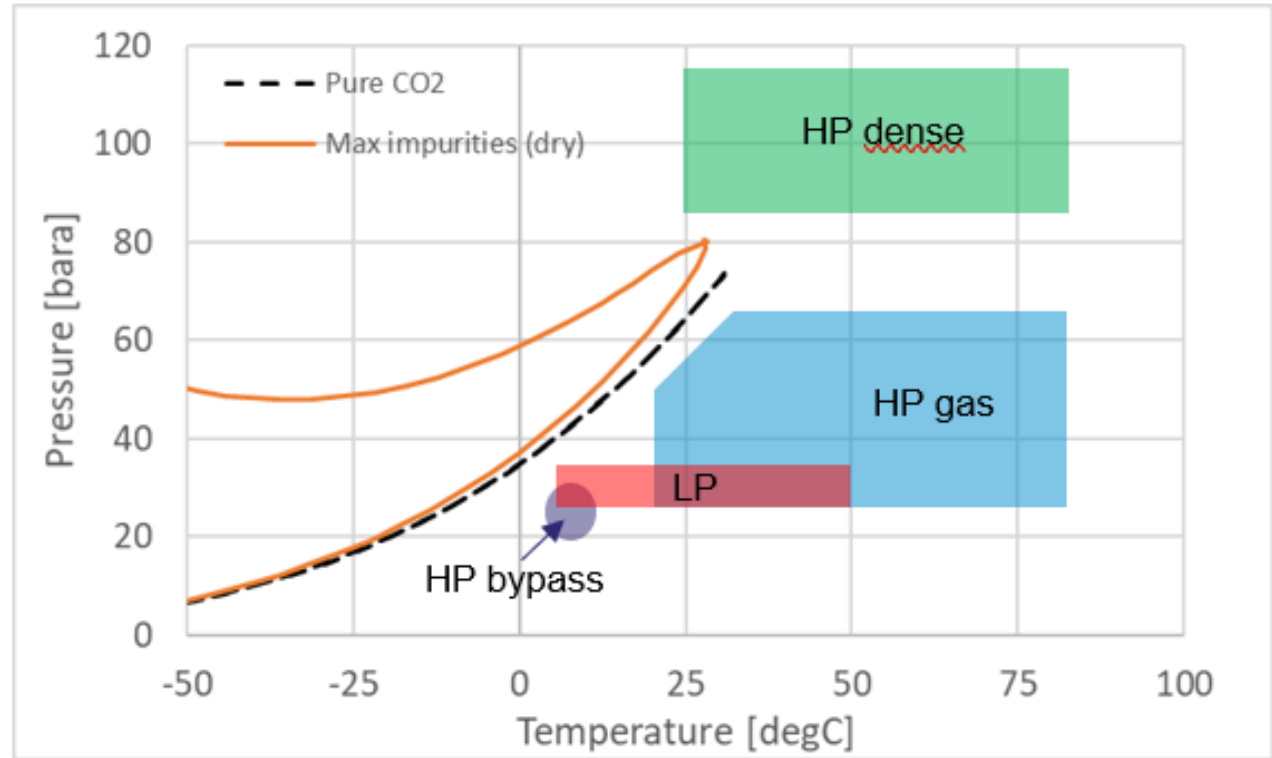
Well Abandonment

After the injection the reservoir will be closed off with a **Full-bore Formation Plug** in the caprock above the reservoir



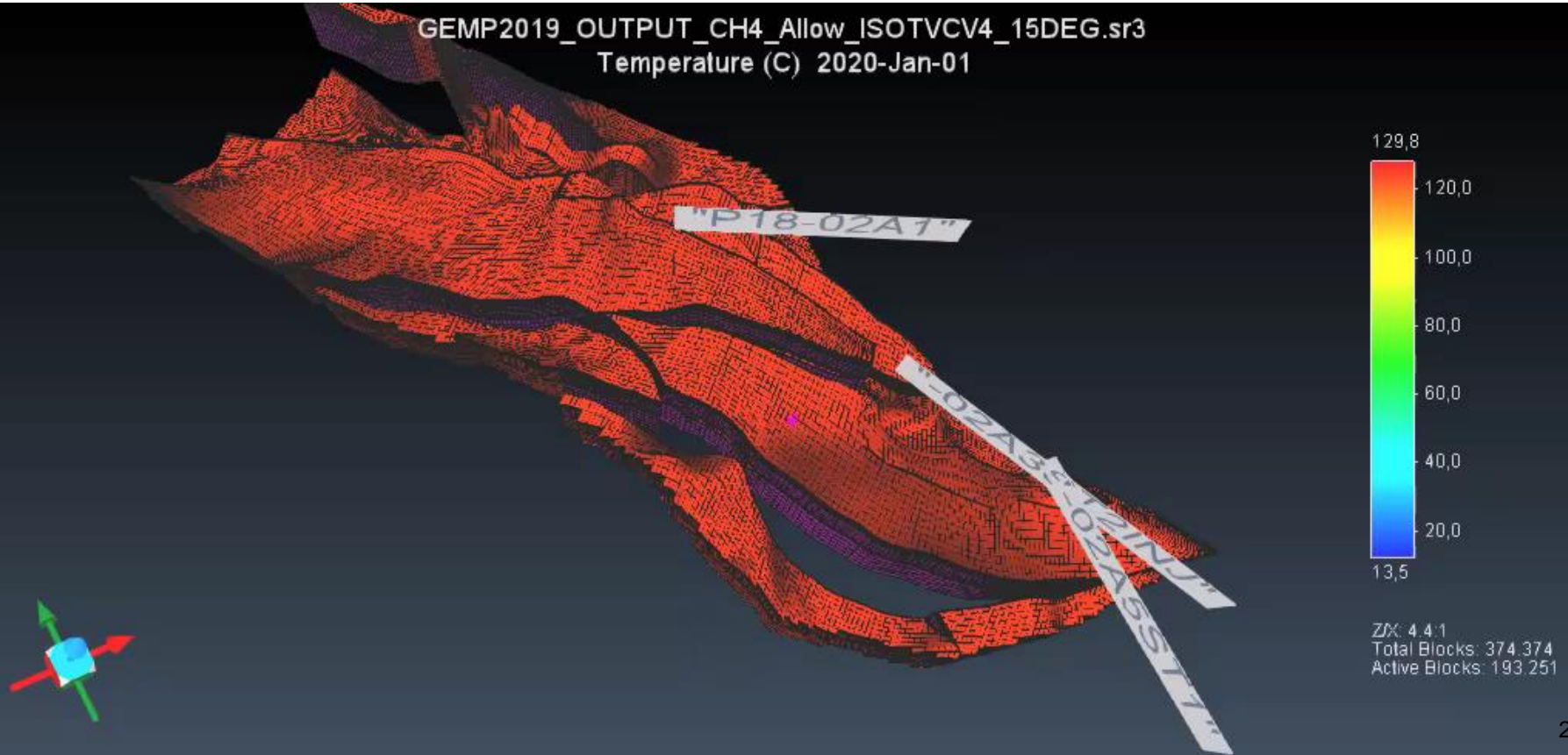
CO₂ phase behaviour

- <50 Bar reservoir pressure: Start injection in gas phase
- > 50 Bar reservoir pressure: Supercritical injection
- Composition >95 mol% CO₂



Thermal modeling

GEMP2019_OUTPUT_CH4_Allow_ISOTVCV4_15DEG.sr3
Temperature (C) 2020-Jan-01

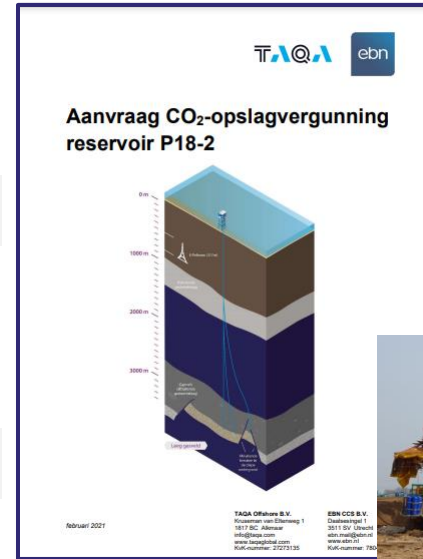


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What's next

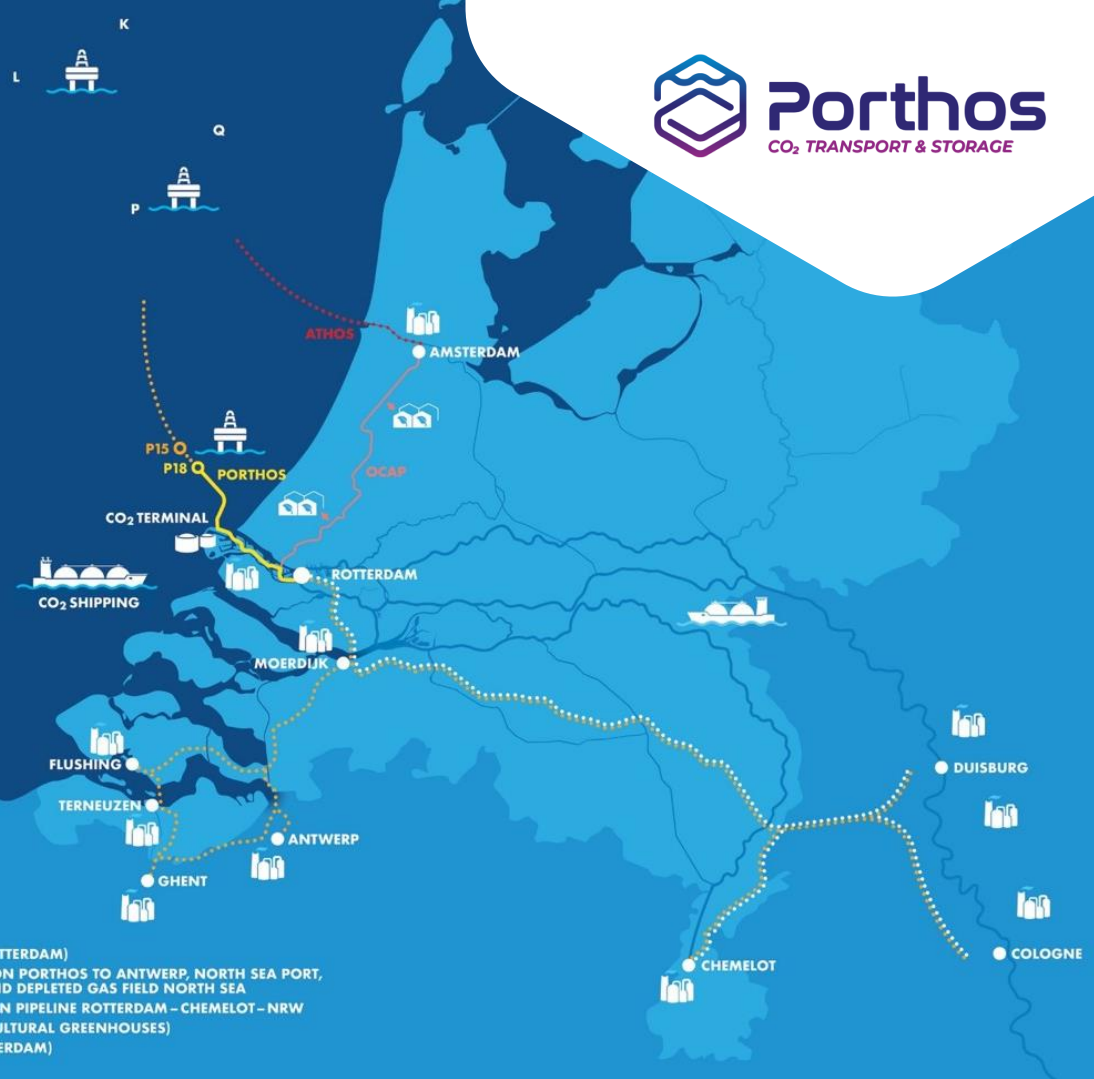
Porthos look ahead

- 2021**
 - FEED studies
 - Permit applications
 - Contracts with customers
- 2022**
 - Final Investment Decision (FID)
- 2022-2023**
 - Construction of the system
- 2024**
 - System operational



Development of CCS in the Netherlands

- Aramis project announced – connected to Porthos
- Climate ambitions European Union: Fit for 55 → effect on Dutch climate ambitions and CCS?
- SDE++ subsidy → more funding available for CCS from 2022



Thank you!

