Responsible CO_2 storage

50 years ebn

The complexity of the Porthos project

DACE contact meeting

30 November 2023

Agenda

1. EBN

State participant in exploration and production of oil & gas

2. CCS

Developments in the Netherlands

3. Porthos

Project description

4. Complexity

Of a First Of A Kind project

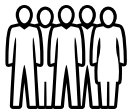
1. About EBN

- Industry partner & co-investor in E&P of natural gas and oil
- Non-operating partner (40-50%) for oil & gas companies
- Shares held by the Dutch State, represented by Ministry of Economic Affairs & Climate (MEAC)
- Statutory basis and mandate in the Mining Act

2022 results:

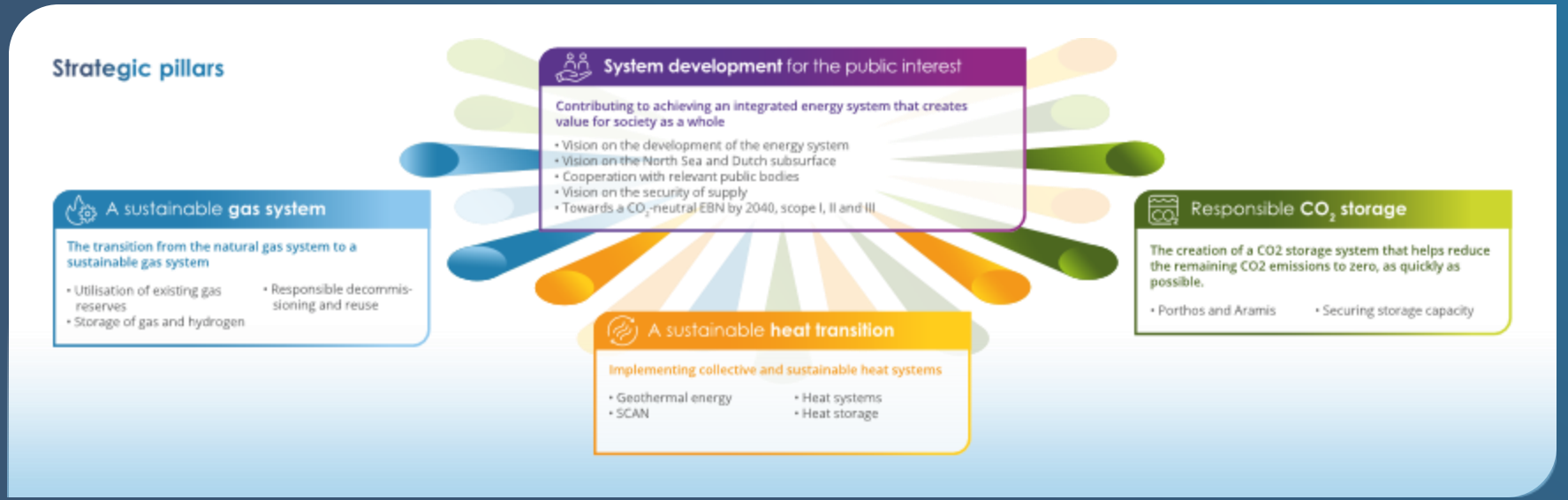
168 licenses in gas & oil

€ 4.2 Bn Net profit



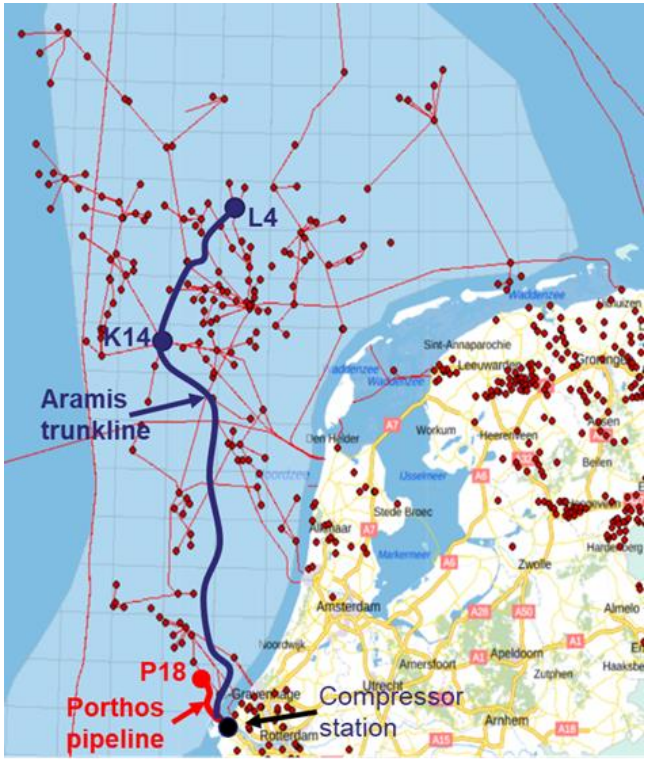
158 FTE

Strategy for sustainability & acceleration of the energy system



2. CCS in the Netherlands

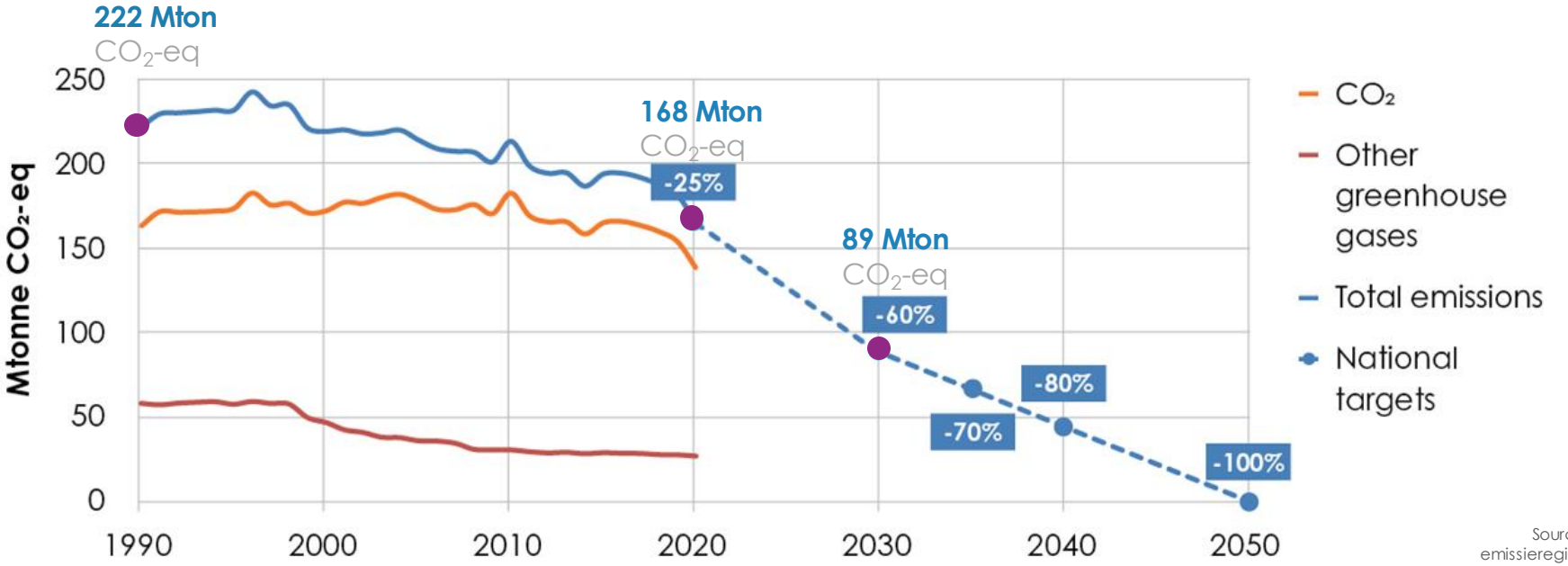
- Netherlands has a long history of offshore gas production
  - Extensive pipeline & platform infrastructure is present
  - Many gas fields are nearing end of production life
  - Fields and infrastructure can be re-used for other purposes
- Netherlands has clusters with high CO_2 emissions
  - Rotterdam port area, Chemelot
  - Require large emission reductions
- Netherlands is close to large clusters abroad
  - Antwerp port area (Belgium)
  - Nord Rhine-Westphalia (Germany)
- Netherlands well-positioned to connect emitters to storage
  - Large-scale CCS projects: Porthos and Aramis
  - Potential for aquifer storage is being studied
- EBN is partner in all CCS efforts



Climate objectives of the Netherlands

Ambitious targets:
- -60% in 2030
- Requires drastic reduction this decade

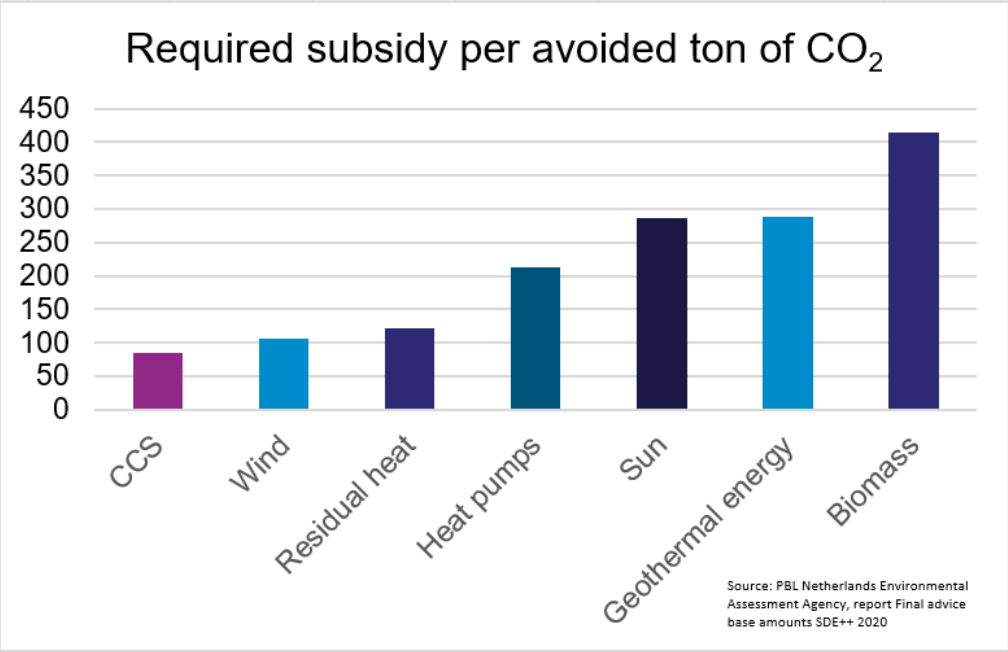
Current policies:
- -38 – -48% in 2030



Source data:
emissieregistratie.nl
Dashboardklimaatbeleid.nl

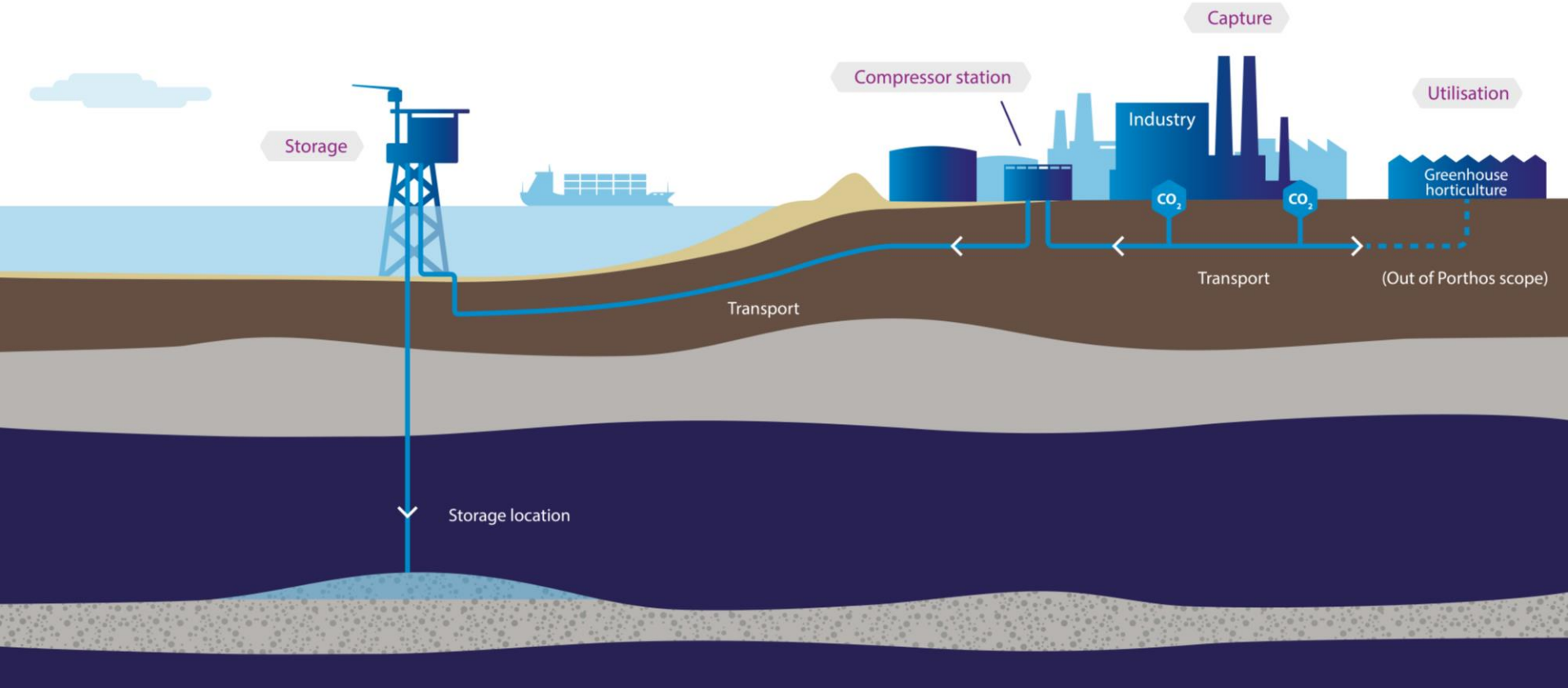
Why CC(U)S?

- Has the potential to reduce large volumes of CO_2
- 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
- On the long term: commodity for industrial use (circular)



How does CC(U)S work?

Porthos
CO_2 TRANSPORT & STORAGE



Rotterdam ideal location

- ~ 14% national CO_2 emissions
- Large industrial cluster
- Relatively small area
- Cost effective
- Storage locations offshore
- Combination with other developments in the port, e.g. hydrogen and circular

Rotterdam: a carbon neutral harbour in 3 steps

Porthos
CO_2 TRANSPORT & STORAGE

1 Efficiency and infrastructure

Residual heat will be used to heat homes, buildings and greenhouses, CO_2 will be captured and stored

→ Requires a lot of additional infrastructure, including pipelines and cables

2 New energy system

Industry will use electricity and (green) hydrogen instead of oil and gas

→ Demands a lot of and affordable electricity from sustainable sources (e.g. wind and sun)

3 New raw materials and fuel system

Fossil fuels will be replaced by biomass, recycled materials, green hydrogen and CO_2

Development of **CCS infrastructure**

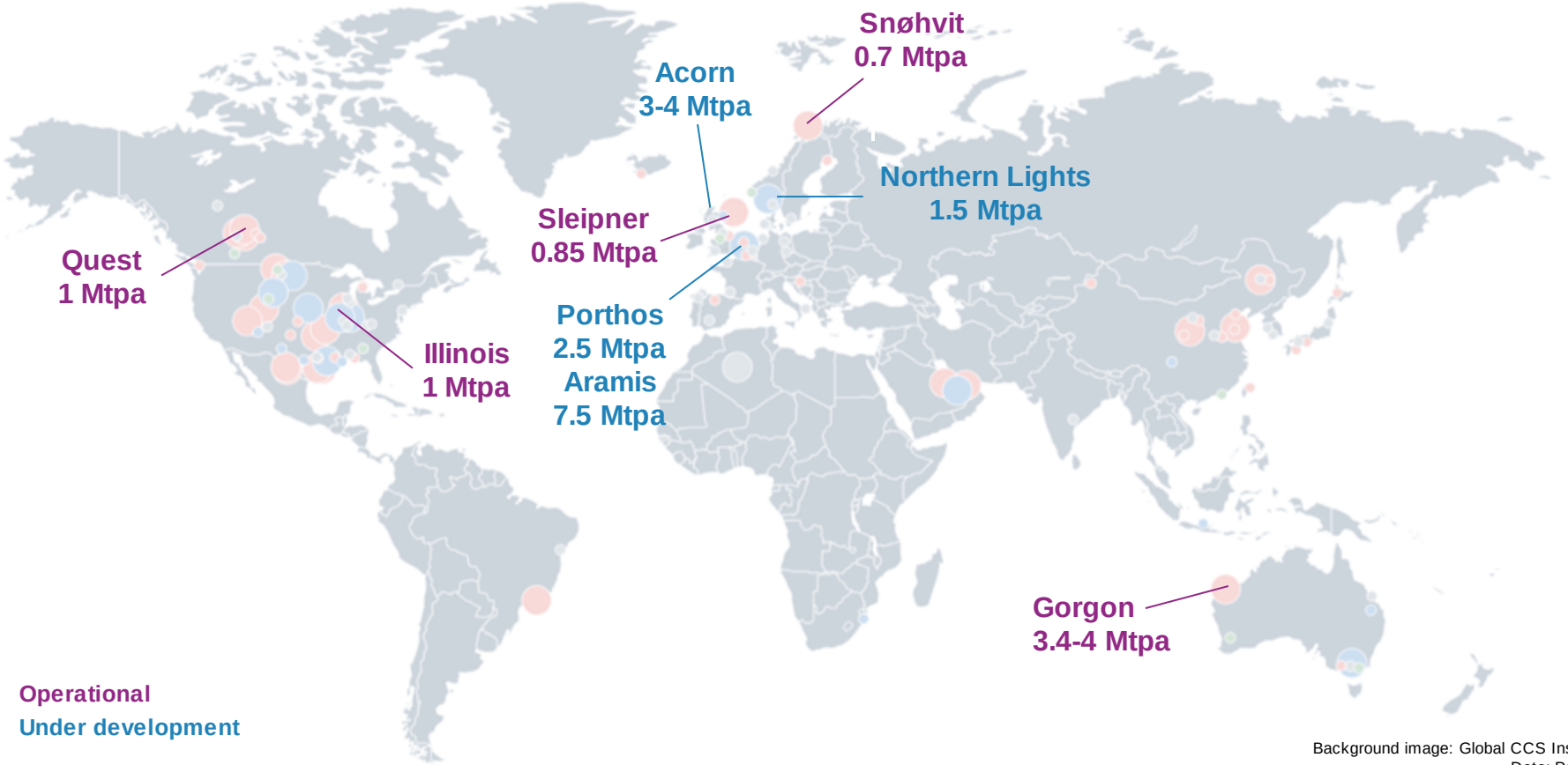
ebn **Energising** the transition

Aramis project overview

- 200 km offshore open access transport system
- Project partners: EBN, Gasunie, Shell, TotalEnergies
- Project injection rate:
  - Start-up: minimum 7.5 Mtpa from day one in 3 stores
  - Later expansion to 22 Mtpa
- CO_2 feed stream from multiple sources
- CO_2 stream is transported to offshore gas fields
  - Stores are not operated by Aramis
  - Often at low starting pressure (20 – 50 bar)
  - Start-up stores: Shell (K14), TotalEnergies (L4) and Neptune Energy (L10)
  - Potential expansion: e.g. Neptune Energy, Shell, TotalEnergies, Wintershall, others
- Planned start of injection: 2028

CC(U)S projects in the world

Porthos
CO_2 TRANSPORT & STORAGE



- Operational
- Under development

Background image: Global CCS Institute
Data: Porthos

3. Porthos: FID milestone 18 October 2023

Start construction in 2024, start CO_2 injection in 2026

Porthos steering committee members sign FID
FLTR: Pierre Bartholomeus (Gasunie), Berte Simons (EBN), Jeroen Steens (Port of Rotterdam Authority)

Porthos
CO₂ TRANSPORT & STORAGE

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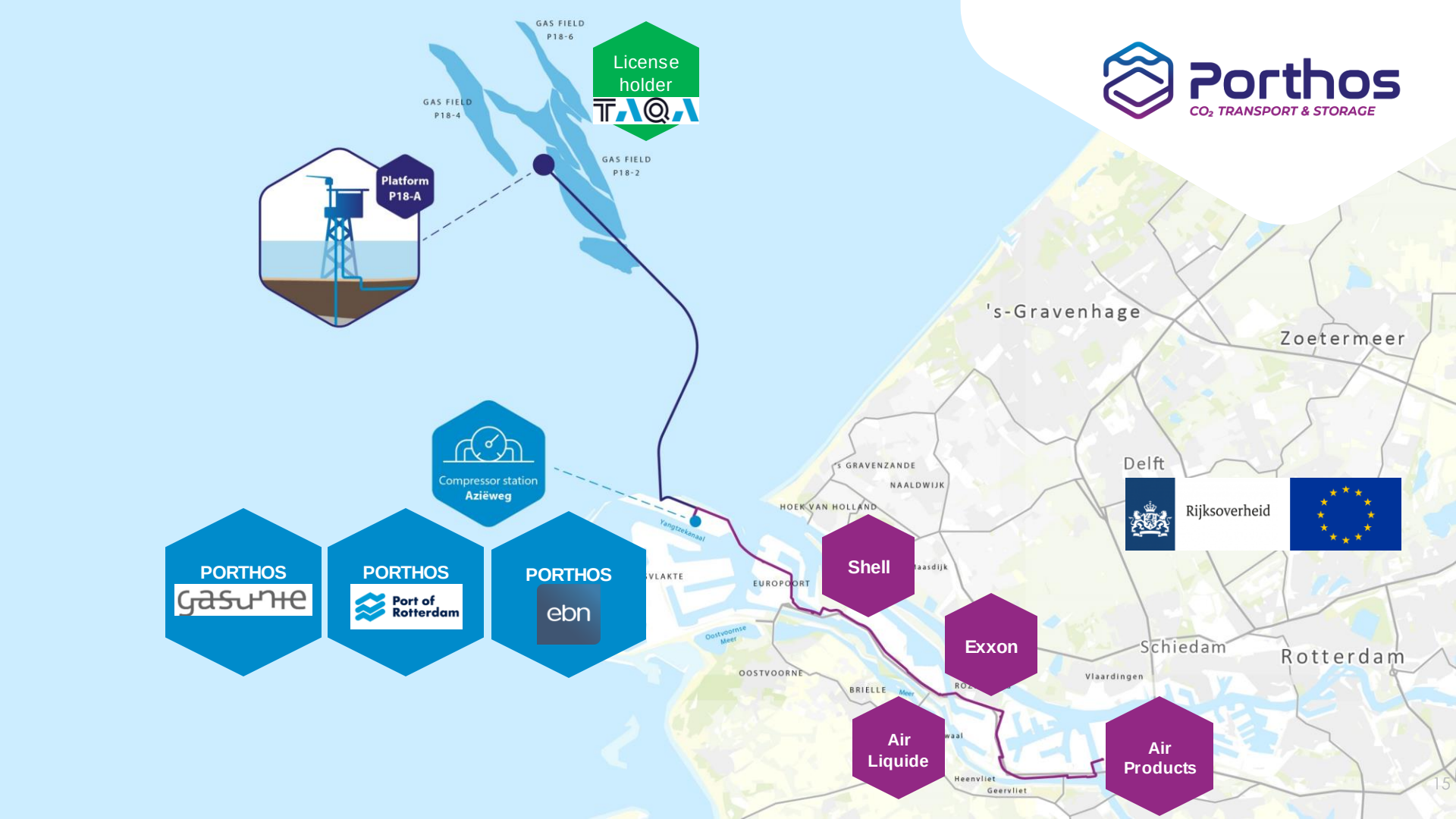
18 October 2023

First CO_2 storage project in the Netherlands is launched

Porthos has taken a final investment decision to develop the first major CO_2 transport and storage system in the Netherlands. In 2024 construction will begin in Rotterdam, with the Porthos system expected to be operational by 2026. The Porthos infrastructure requires an investment of €1.3 billion. With the final investment decision reached, Porthos will now award contracts required to realise the project.


Porthos
CO₂ TRANSPORT & STORAGE
GAS FIELD P18-6
GAS FIELD P18-4
GAS FIELD P18-2
License holder
TAQA
Platform P18-A
Compressor station Aziëweg
PORTHOS
gasunie
PORTHOS
Port of Rotterdam
PORTHOS
ebn
Shell
Exxon
Air Liquide
Air Products
Rijksoverheid
's-Gravenhage
Zoetermeer
Delft
Schiedam
Rotterdam
Vlaardingen
's GRAVENZANDE
NAALDWIJK
HOEK VAN HOLLAND
EUROPOORT
OOSTVOORNE
BRIELLE
Yangtzekanaal
Oostvoornse Meer
Heenvliet
Geervliet

The first CCS project in the EU

Porthos
CO_2 TRANSPORT & STORAGE

- Porthos will start constructing the first large-scale CO_2 transport and storage infrastructure in the European Union
- CCS will finally contribute to reducing CO_2 emissions
- All eyes on Porthos and a lot of interest in CCS, based on info requests
- Paving the way for other CCS projects, possible cooperation with Aramis

Preliminary planning for construction

January 2024	Start of construction works
First half of 2024	Crossing the sea wall (drilling)
First half of 2024 – end of 2025	Onshore pipeline
First half of 2024 – early 2026	Compressor station
First half of 2024 – end of 2025	Cooling water intake building
End of 2024 – early 2025	Platform modifications
End of 2024 – second half of 2025	Wells modifications
Mid-2025 – end of 2025	Offshore pipeline
Early 2026	Commissioning and start-up
2026	**Porthos system operational**

Transport: onshore pipeline

- In the Rotterdam port area
- In existing pipeline corridor

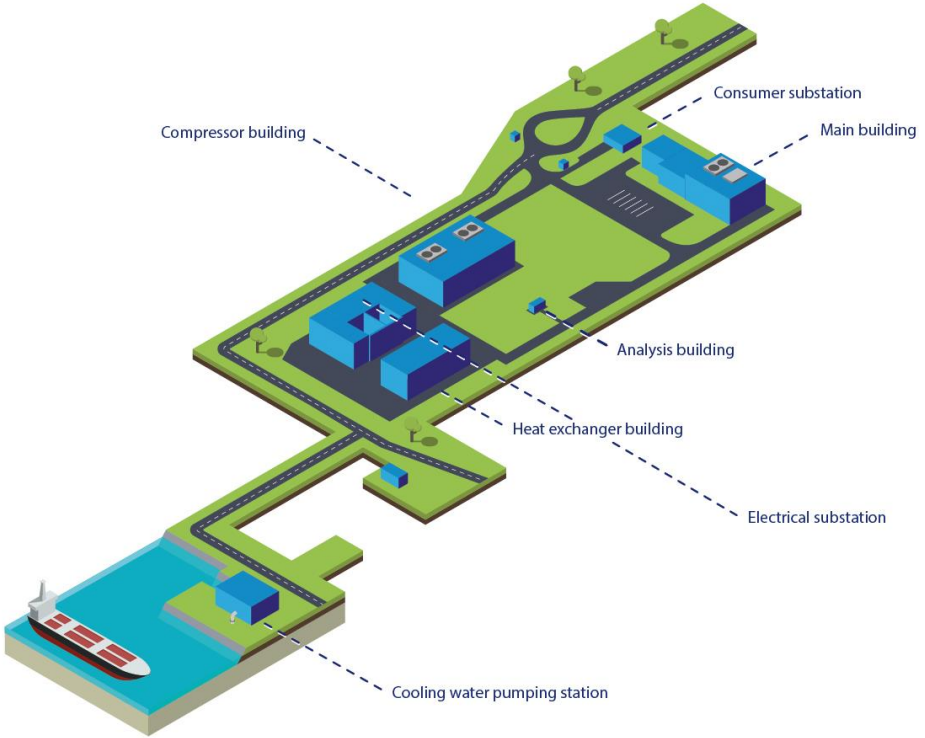
- Length: ~ 30 km
- Diameter: 108 cm

Transport: compressor station

- Location: Aziëweg
- Plot: ~ 2 hectare

Facilities:

- Compressors
- Electricity
- Cooling installations
- Measure and control systems



Transport: offshore pipeline

- From the compressor station, beneath the North Sea seabed to platform P18-A

- Length: ~ 22 km
- Diameter: 40 cm

Storage

- From the platform to the P18 gas fields
- Re-use of existing platform and wells
- Natural closing through sealing layers

- ~ 20 km off the coast
- Depth: between 3.175 and 3.455 meter

- Capacity: ~ 37 Mton
- ~ 2.5 Mton CO_2 per year

Storage

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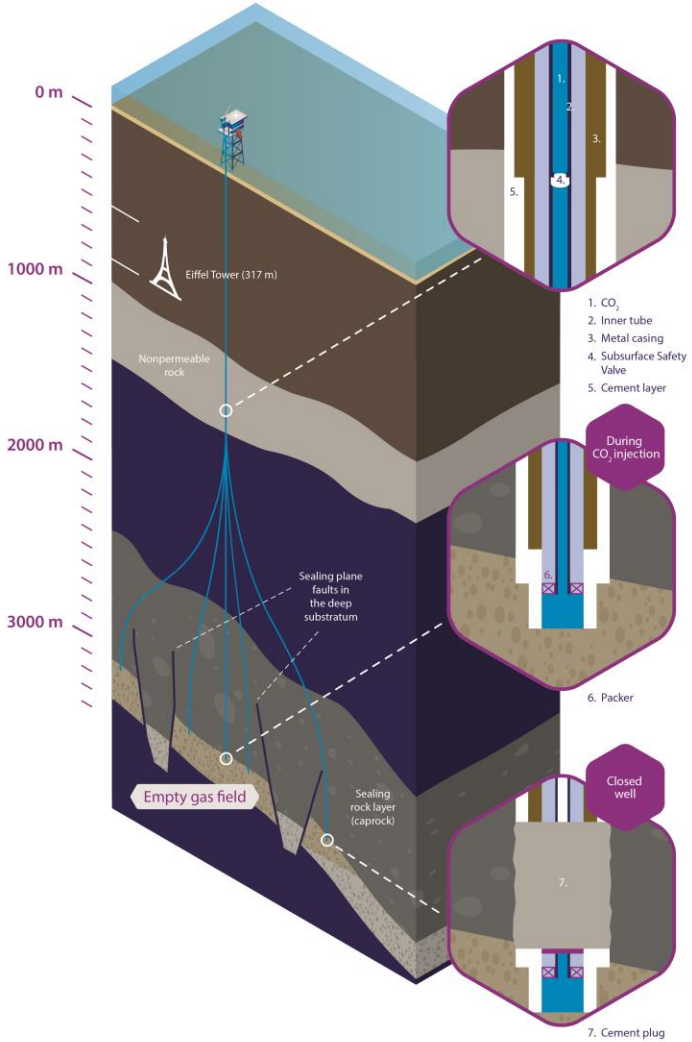
CO_2 TRANSPORT & STORAGE



4. Complexity of a FOAK project

Porthos
CO_2 TRANSPORT & STORAGE

Financial
- Funding gap
- Future proof system
- Dutch subsidy scheme SDE++

Legal/Regulatory and Permits
- Long term liability
- NOx
- Safety

Commercial
- Contracts with 4 customers
- 7 FIDs needed
- Risks and liabilities

Stakeholders and Communication
- History
- Political and societal support
- Building relationships

Delays ….. and ultimately …. Positive ruling by the Council of State

November 2021:
NGO MOB appeals against nature permits Porthos (nitrogen issue)

November 2022:
Construction exemption lapses in ruling Council of State

August 2023:
Council of State rules positively on ecological assessment Porthos

De Telegraaf
Raad van State geeft groen licht voor CO2-opslagproject Porthos

NOS
Raad van State keurt project voor opslag CO2 in Noordzee goed

CO2-opslag Rotterdamse haven mag doorgaan, klimaatdoelen niet in gevaar

REUTERS
Dutch court rules huge carbon capture project can go ahead

deVolkskrant
Raad van State: klimaatproject Porthos mag doorgaan

rtl nieuws
Omstreden CO2-opslagproject Porthos mag doorgaan

Pending the ruling…

Preparations for construction have started

- Further delays have been prevented and preparations for construction have been started, thanks to government guarantee scheme
    - Increased prices due to COVID and war in Ukraine
    - Pressure on the business case
    - JV shareholders with different risk perception
    - Long lead items ordered
    - Contractors and suppliers contracted
    - Accommodated future scope in the design (MOCs)
    - Alignment kept with Porthos' customers
    - Preparations for construction started

Conclusion: FOAK = maximum effort & endurance

Energy transition projects are often FOAKs

Porthos steering committee members sign FID
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Responsible CO_2 storage

Thank you for your attention