



CO₂ Transport & Storage @ TNO

Developments, strategy, projects

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The Netherlands is front runner on CCS implementation

Capture

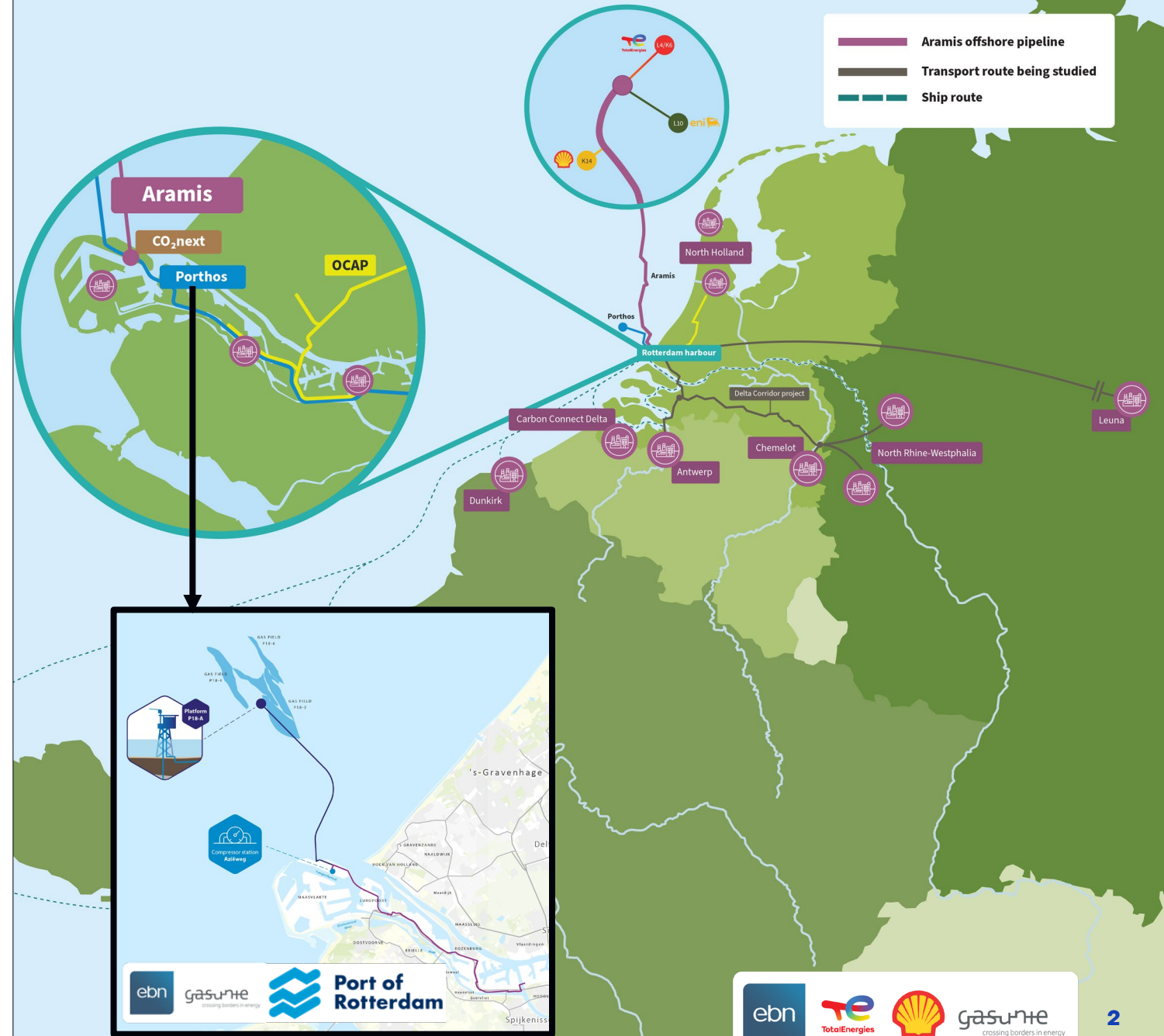
- Pilot & commercial scale CO₂ capture projects

Transport

- Gaseous: Porthos onshore pipeline and expansion of Porthos compressor station
- Liquid: Shipping via coasters and barges to a new receiving terminal (CO₂next project)
- New offshore pipeline, 22 Mtpa capacity, to storage locations (dense phase)

Storage

- Depleted gas fields, multiple operators
- Aquifers under investigation
- 2.5 Mtpa and 22 Mtpa for Porthos and Aramis, respectively



TNO is front runner on CCS R&D, information and advice in the Netherlands, EU, and beyond

R&D projects covering full value chain in different TNO groups

- Capture & reuse, transport and storage
- Broad range of research projects in the Netherlands, Europe, and internationally

Information services for underground storage capacities

- National Information Task and Mining Law: intake, processing, mapping and release of public information
- 10+ years experience in coordinating European CO₂ storage atlas projects

Policy support and advice

- Mining Law License Applications (legal task)
- Implementation of CCS Directive and National Policies
- Implementation and Support of NZIA in the Netherlands (and EU)

Various developments will impact CCS deployment in the coming years

- CCS enters an **operational phase** in the Netherlands – with Porthos and Aramis as front-running projects
- **Monitoring** will be a key aspect – with focus on research, data management, and advice
- **NZIA** implementation leads to additional obligations and legal tasks for the Netherlands (in EU context)
- EU storage targets may result in a **full utilization of accessible storage capacities** in Dutch gas fields by 2060
- Applications for new storage projects are shaping the directions of **further upscaling** in the next decades
- **Aquifer storage** considered essential for mid–long-term storage needs, with technical benefits over gas fields
- CCS upscaling presents challenges regarding **optimized CO₂ transport design** and **CO₂ quality management**
- Accessibility of offshore storage capacities **competes with other functions** in the North Sea

TNO's key focus is to support realization of the ambitious Dutch targets set for CCS

- **Monitoring and conformance assessment** – ensuring CO₂ remains securely stored and detect leakage
- **Well technology** – the technical requirements to convert existing O&G wells to CO₂ injection wells
- Workflows for demonstration of **CO₂ behavior** during transport, injection and storage
- Prediction of **long-term behavior** of stored CO₂
- **Feasibility studies** for subsurface CO₂ storage in depleted fields and aquifers
- Assessment of the **operational window** for transport and injection (flow assurance)
- Scenarios for temporal development of potential **transport networks**
- Workflows for **safe injection** operations

TNO's CCS Team is one of the leading research groups in Europe for of CO₂ transport and storage

- Preferred partner in EU-funded proposals
- Working closely with the operators and consortia in The Netherlands (and abroad)

Longer-term goals and strategy for CO₂ transport and storage @ TNO

1. Innovator

- R&D for the CCS value chain, focusing on storage and transport
- Monitoring and conformance assessment
- Utilizing research and facilities to develop & test new technologies and equipment

2. Orchestrator

- Development and management of (large) innovation programs and projects, with a focus on the European market (e.g. CETP, Horizon Europe)

3. Enabler

- Supply of data and tools to support CCS development and application in the Netherlands (and abroad)
- Work with partners to bring operational expertise to the Netherlands
- Facilities to develop and test new technologies and equipment
- Develop new data products based on NLOG database

The Netherlands



Export developed knowledge and innovation internationally



Thank you for your attention