

Porthos project

CO₂ reduction through storage beneath the North Sea



Rotterdam **CCUS**
Porthos project

CO₂ transport and storage

Port of Rotterdam Authority, Energie Beheer Nederland B.V. (EBN) and N.V. Nederlandse Gasunie are working on the construction of a CO₂ transport and storage infrastructure between the Port of Rotterdam and depleted gas fields beneath the North Sea. The total length of the CO₂ infrastructure is around 55 km. The storage will take place in the P18 fields, 21 km off the Dutch coast.

Initiators

Port of Rotterdam Authority, EBN and Gasunie are three organisations that play an important role in the Dutch energy landscape. In this project, each external organisation offers specific experience and expertise. Port of Rotterdam Authority with its knowledge of the local situation and market, EBN with its expertise of the deep subsurface and Gasunie as gas infrastructure and transport expert.

Porthos in the Port of Rotterdam

Porthos stands for Port of Rotterdam CO₂ Transport Hub and Offshore Storage. The three initiating parties are working together to prepare this project in which CO₂ from the industry will be captured, collected in a transport pipeline and then stored in gas fields deep beneath the North Sea seabed. Some of the CO₂ can be used in the South Holland greenhouses to ensure faster plant growth.

Porthos and Europe

Porthos has been granted Project of Common Interest (PCI) status by the European Commission. A PCI project is an energy infrastructure project that has obtained preferred status on behalf of the European Commission. This also means that permit applications are more streamlined and the applications are made simultaneously as one total package of permits.



The intended Porthos pipeline route

This of course does not mean that the integration will be carried out in a less careful and well-considered way. The necessary environmental surveys will be checked in the Environmental Impact Assessment (EIA) and various procedural steps have been incorporated in which the public will be involved. These steps are intended to enhance transparency and consultation.

In addition to the Porthos project, two other PCI projects have been concluded in the Netherlands. The COBRA cable, a sustainable electricity connection between the Netherlands and Denmark and the cross-border 380 kV high voltage connection from Doetinchem (the Netherlands) to Wesel (Germany).

Cross-border infrastructure

The CO₂ infrastructure in Rotterdam can be seen as the first step in developing a CCUS hub in the Rotterdam region, which offers future possibilities for other regions to transport and store CO₂ to depleted gas fields beneath the North Sea. The European Commission has therefore granted Porthos PCI status and has awarded Porthos a subsidy.

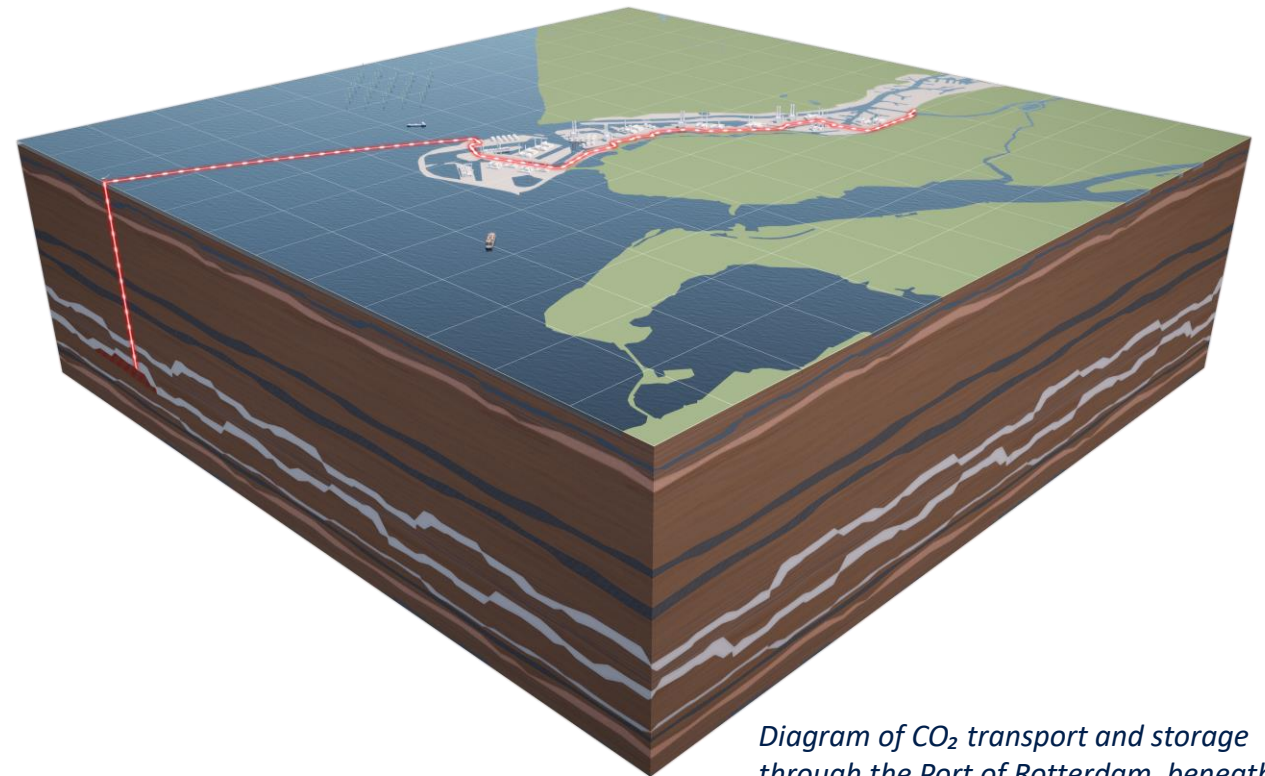


Diagram of CO₂ transport and storage through the Port of Rotterdam, beneath the North Sea seabed to a storage location 21 km off the coast

Why CCUS?

The Netherlands has clear climate targets: compared with reference year 1990 levels, there must be a 49% cut in greenhouse gas emissions by 2030 and a 95% cut by 2050. The transition from the current economy based on fossil fuels to a sustainable economy including a different raw materials' basis, will take considerable time. To achieve the climate objectives, measures will therefore be necessary to reduce CO₂ emissions in the short and medium term.

The capture of CO₂ from industries for subsequent use or storage underground (Carbon Capture Usage and Storage, or CCUS) is one of the measures being proposed to actually achieve these climate targets. The capture and underground storage of this CO₂ from industries which in the short term do not have any possibilities to switch to a fundamentally different raw

materials' economy, will prevent the increase of greenhouse gases in the atmosphere.

CCUS in Rotterdam

The Rotterdam Port area, including Moerdijk, makes a 17% contribution to the Netherlands' total CO₂ emissions. In the context of the climate policy, the port area is tasked with enhancing sustainability and achieving a low-CO₂ port. At the same time, the port must remain competitive internationally; a considerable task!

Transition paths

To achieve a reduction in CO₂ emissions in the Rotterdam Port area, transition paths have been developed that form the basis for cooperation with companies to achieve CO₂ emission reductions.

Research has shown that the capture and storage of CO₂ is a vital link in this, and an important, cost-effective measure to prevent the emission of

relatively large amounts of CO₂ into the atmosphere.



1 CLOSED CARBON CYCLE **2** BIOMASSA EN CCS **3** TECHNOLOGICAL PROGRESS

98%
CO₂ REDUCTION
2050 vs. 2015

98%
CO₂ REDUCTION
2050 vs. 2015

75%
CO₂ REDUCTION
2050 vs. 2015

Overview of scenarios with CO₂ reduction measures



Other measures in the port

Besides CCUS, work will take place in the port on fundamental innovations in production processes and chains, such as bio-based industry, renewable energy, the development of hydrogen as energy carrier and geothermal energy.

A strategy will be followed in the coming years in which measures will be taken that are cost-effective as well as being relatively easy to achieve. This includes CCUS, as well as the use of residual heat and steam from the port for the heating of homes, greenhouse horticulture and industry.

At the same time, experiments are already taking place and investments are being made in measures based on a new raw materials' economy.

Dutch plans and decisions

State Coordination Scheme

Porthos is a PCI project and to enable these types of projects, decisions need to be taken on the use of space and permits need to be provided. A special procedure will be used for this, the so-called State Coordination Scheme.

This scheme is intended to enable faster decisions to be taken on large European and national energy projects, without this being at the expense of careful decision-making. It will remain possible for citizens to submit their opinions during this process.

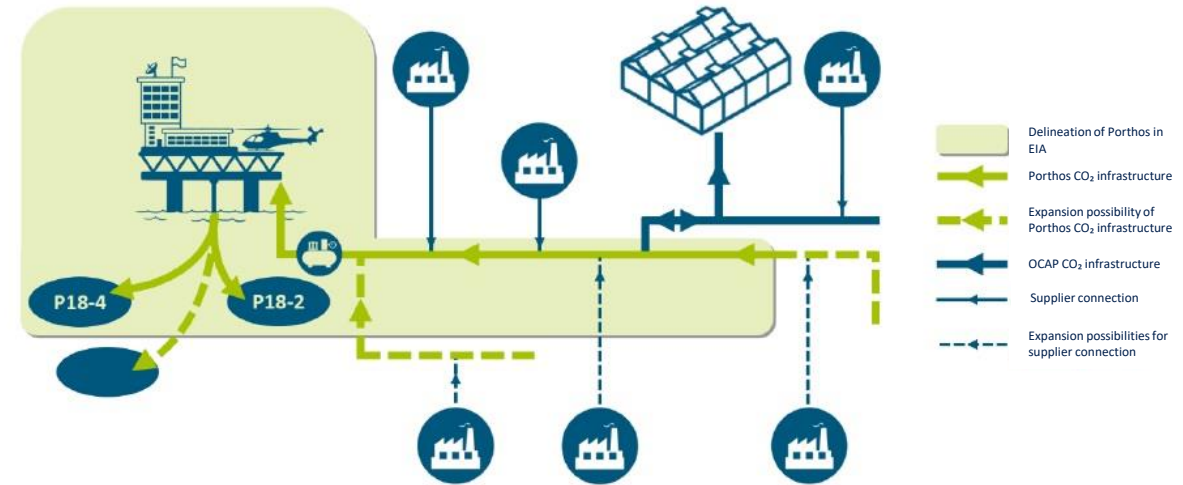
For PCIs, the law states that these must go through the State Coordination Scheme. The Ministry of Economic Affairs & Climate Policy handles this for the Porthos project. That ministry is also coordinating the permit procedure.

Integration plan

The ministers of Economic Affairs & Climate Policy and Interior & Kingdom Relations will formulate an integration plan showing the location of the CO₂ infrastructure and compressor station. It will be possible to submit opinions about the design integration plan. The EIA and the design integration plan will be made available for consultation at the same time as the other design permits.

Above: diagram of the Porthos CO₂ infrastructure through the Port Industrial Complex (HIC)

Below: photo of Maasvlakte 2 with one of the intended compressor station locations shown centre top



Environmental Impact Assessment (EIA)

The environmental effects of Porthos will be investigated and identified. These include effects on landscape, nature, soil, water and health. This applies to both the pipeline infrastructure through the port area as well as for the deep substrate of the CO₂ storage location beneath the North Sea.

The EIA will be formulated to ensure that environmental effects play a key role in consideration and decision-making with respect to the final location of, for example, the compressor station. The EIA therefore also forms the basis for the yet to be formulated integration plan (EIA Plan) as well as for the permit applications (EIA Project).

Cross-border effects

Porthos is focusing on the capture of CO₂ from industry in the Rotterdam Port area. The storage will take place offshore, well within the Dutch sector of the North Sea. The Porthos project will, therefore, have no consequences for activities in the British sector of the North Sea. In the future, the CO₂ infrastructure may also be used to store CO₂ beneath the North Sea from other port areas, such as Antwerp or the German Ruhr area. This is not included in the scope of the current EIA.

Porthos is one of the first CCS projects in Europe. The knowledge and experience gained in this project can be used for other projects within or outside Europe. Cooperation between various CCS projects can also lead to standardisation and cost reduction.

Consultation and appeal

The EIA, the design integration plan and all design decisions on the permit applications will be made available for public consultation by the Ministry of Economic Affairs & Climate Policy. Everyone can submit their opinions about this. These points of view will be incorporated when formulating the final decision, which will also be made available for inspection and against which an appeal can be made to the Council of State via the Justice Department. The realisation, the start of project construction, will commence once the decisions about this project have been finalised or once the permits have come into effect.

Permits and exemptions under the State Coordination Scheme



CO₂ storage permit (Mining Act)



Environment permit, construction and environment (Wabo)



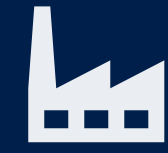
Water permit (Water Act)



Nature permit/exemptions (Nature Conservation Act)



Public Works (Management of Engineering Structures) Act (WbR) permit



Construction and management

The environmental effects for the transport section on land occur mainly during the construction phase. During this phase, various earthworks will take place in the pipeline corridor. Groundwater extraction, noise, dust and the presence of soil contaminants should be taken into account.

Nature and the environment will also undergo disruption. These effects will be identified along the route in advance. The effects on the environment will also be identified with respect to drilling beneath waterways. For the part of the pipeline that is to be laid beneath the seabed, a construction method will be used that has minimum effect on sea life.

Expectations with respect to the archaeological values of the ground along the route will also be checked in advance.

External safety

External safety risks will be identified on forehand. The pipeline and the compressor station should in any event satisfy all statutory safety standards.

The system will also be continuously monitored, so that any incidents are noticed quickly.

This will be supervised by the government (SodM and NEa). In a subsequent phase of the project, more will be known with respect to the commercial operator of this CO₂ transport and storage infrastructure.

How will a route be selected?

In the development of a final route, various criteria will be considered. The basic principles include:

- Technical feasibility and risks of the route, including the avoidance of archaeological shipwrecks, landfill sites and unstable grounds.
- Where possible and useful the CO₂ infrastructure will be bundled with other infrastructure. By doing so, the space taken up on land and at sea will be reduced and future restrictions can be prevented.
- Protection of sensitive areas, such as vulnerable nature.
- Restriction of hindrance for other area users, including shipping, leisure craft and fishing.
- Safety and reducing hindrance to people, both on land as well as at sea.

Consultations

Consultation with all stakeholders is extremely important in the construction of this CO₂ pipeline. That is why Porthos will enter into dialogue with all stakeholders prior to the announcement of the final route, so that Porthos can gain a good impression of the future planned physical developments as well as of what is likely to play a role and where. Porthos will continue to do this, also during the construction phase as potential hindrance due to roadworks and diversions will be highest in this phase.

Route alternatives

Based on surveys and consultations, two route alternatives for Porthos have been incorporated in the draft Memorandum on Scope and Level of Detail (MSLD); a northerly and a southerly option. The EIA examines the environmental impact of both routes.

Porthos will also examine whether there are measures with which negative effects can be reduced or prevented. This also includes taking measures that enables Porthos to achieve positive effects for people and nature.

Research

Various important environmental themes will be investigated and the results of these will be described in the EIA. Both routes only relate to Dutch territory, which is why the EIA

also provides insight into the environmental effects of the pipeline route on land and at sea, the compressor station and the storage location for the Netherlands.

Some effects will only be temporary (for example during the construction of the pipeline), others will be permanent (for example the heating of the ground as a consequence of the CO₂ pipeline). Whether there are consequences and if so, to what extent, will be described in the EIA.

Who is doing what?

The ministers of Economic Affairs & Climate Policy and Interior & Kingdom Relations are determining the exact route of the connection and will coordinate the procedure and permit application. Porthos will support this with a project team of researchers and specialists and will provide all technical and content information about the project. Porthos is responsible for constructing the connection.

From proposed to final route

One route will be selected, based on the comparison of the surveyed route alternatives. The ministers of Economic Affairs & Climate Policy and Interior & Kingdom Relations will incorporate this route in the design integration plan, after which the consultation process will start. This will ultimately lead to the route on land (up to approximately 1 km from the coast) in the final integration plan.



Examples of possible environmental effects

Environmental theme *Examples of the effects to be surveyed*

Nature

- Possible loss of growth of algae as a consequence of seawater turbidity.
- The potential subsequent effects on the environment and nature, including preserving the Natura2000 objectives.
- Any disturbance to land-breeding, nursing, resting or foraging birds and small mammals due to the presence of noise and vibrations caused during construction. Examples of this include earthmoving, foundation works and construction activities.

Archaeology

- Loss of archaeological assets (if present) through earthmoving.

Landscape

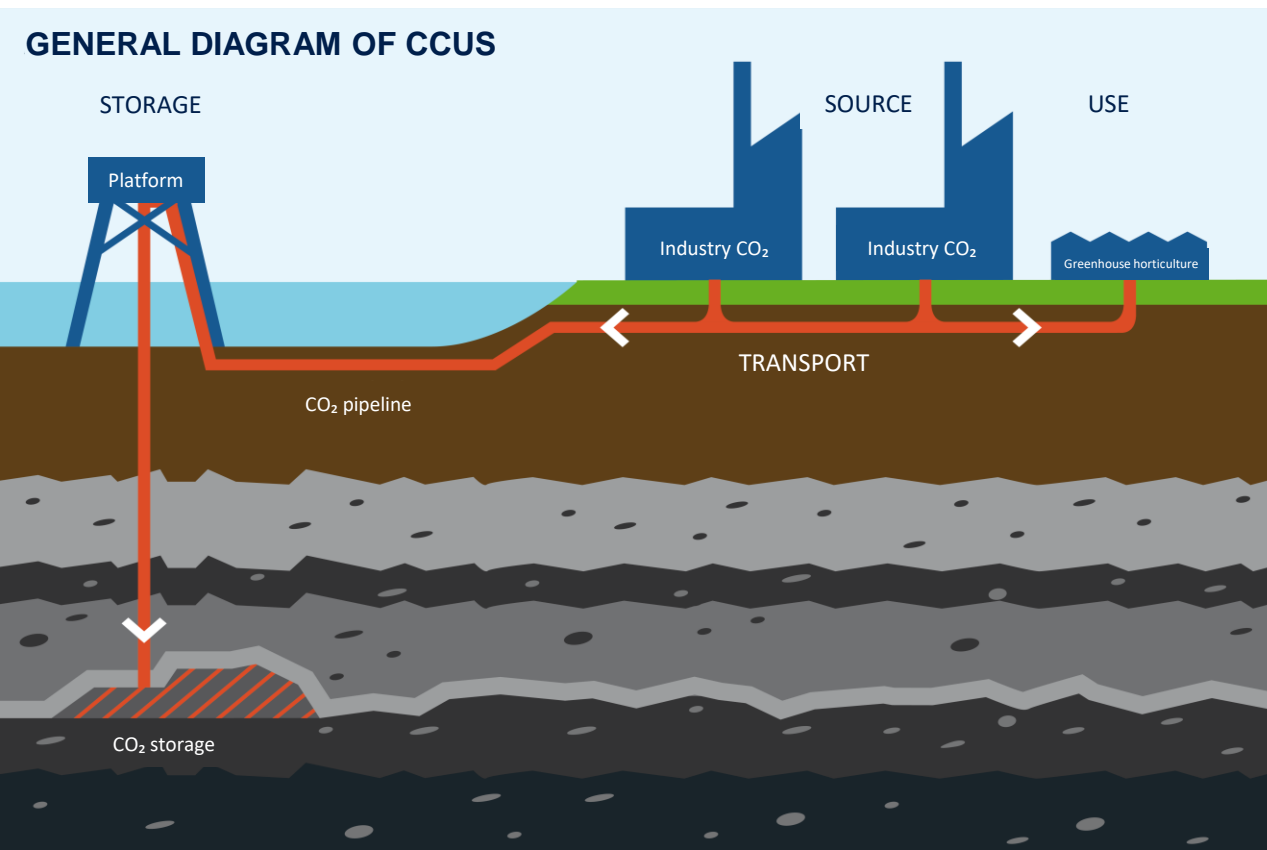
- Landscape effects through the presence of a vessel with construction material (particularly at sea) but also the addition of a compressor station on Maasvlakte 2.

Shipping security and use of functions

- Hindrance, risk or restrictions for example to shipping and other water traffic, fishing industry, exposed cables and pipelines, conducting fire service activities and daytime recreation.

Technology

The transport and storage system comprises a pipeline on land, the compressor station, a pipeline at sea and the storage of CO₂ deep below the North Sea.



Shore-based pipeline

- Capacity: 5 Mton per year for 40 bar
- Material: carbon steel pipe
- Length: 33 km
- Diameter: 90 or 108 cm
- Pressure: between 15 and 40 bar
- Temperature: approximately 15 °C
- Situation: gaseous CO₂

Compressor station

- Plot of approximately 6 hectares
- Electricity supply
- Cooling systems
- Measuring and monitoring systems
- Control room and control systems

Sea-based pipeline

- Material: insulated carbon steel pipe
- Length: 21 km
- Diameter: max. 60 cm
- Pressure: max. 120 bar
- Temperature: between 30 °C and 80 °C
- Situation: gaseous CO₂ with the properties of a liquid

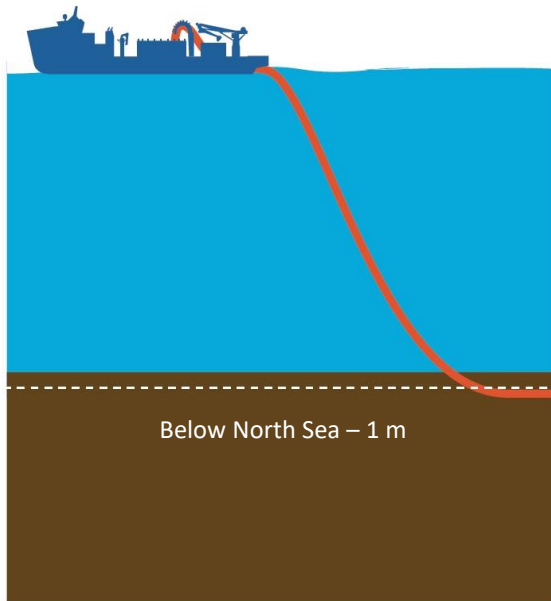
Storage

- Depth of gas fields between 3.175 and 3.455 metres
- Maximum storage capacity of fields approximately 37 Mton

Construction of a CO₂ infrastructure

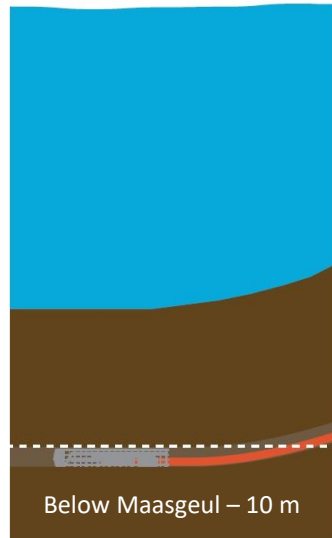
Construction method on land

The pipeline will be laid in the existing pipeline corridor and will be buried section by section. When traversing the various channels, the pipelines will be buried in the substrate.

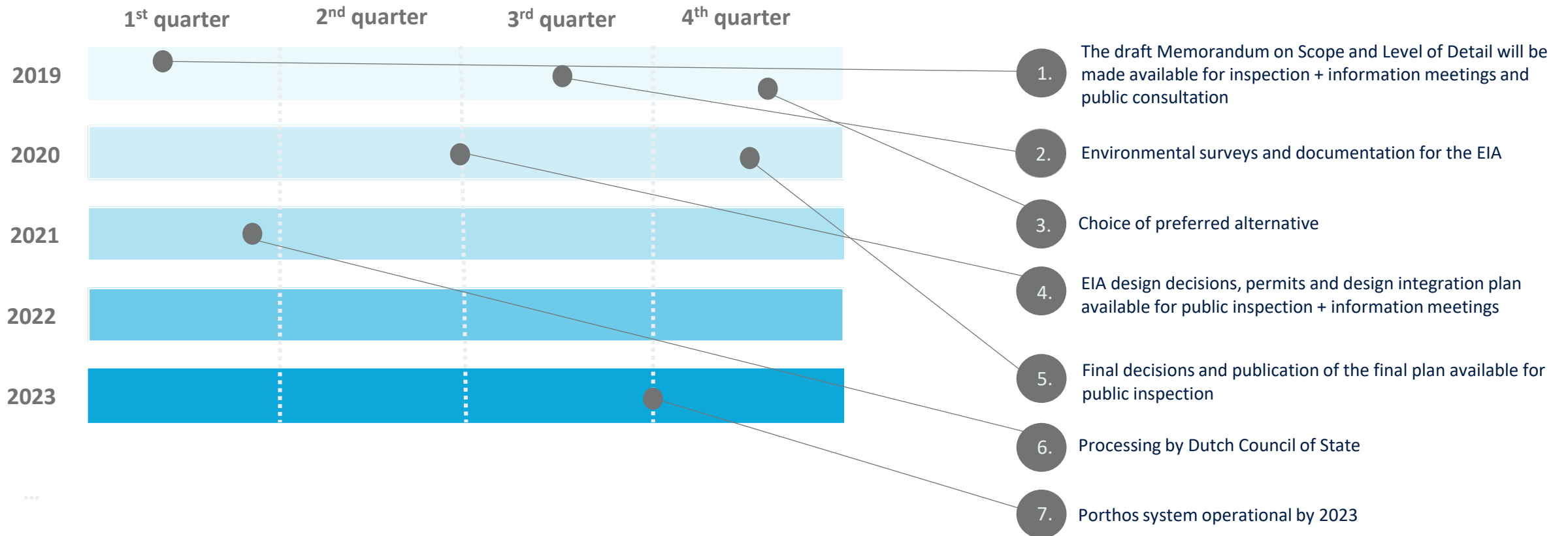


Construction method at sea

At sea, the pipelines will be buried in the seabed at a depth of at least 1 metre by a construction and pipelay vessel. These will be buried much deeper in the Maasgeul, at a depth of at least 10 metres. The pipelines will be laid at a safe distance from other cables and pipelines.



Schedule



www.rotterdamccus.nl/en

Website of the Porthos initiators including information about CCUS in general, the project, news and schedule of activities.

If you have any questions or comments, please feel free to contact us at info@rotterdamccus.nl.

www.bureau-energieprojecten.nl

Dutch government website containing information about the procedures, permits and consultation possibilities (in Dutch only).

www.ec.europa.eu

European Commission website containing information about the Projects of Common Interest (PCI).



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Port of Rotterdam Authority, Energie Beheer Nederland B.V. (EBN) and N.V. Nederlandse Gasunie are partners in the Porthos project. Together they are developing a CO₂ infrastructure in the Port of Rotterdam, with storage in depleted gas fields beneath the North Sea.

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