



EXECUTIVE SUMMARY

**NGT & NOGAT
PIPELINES CAN BE READY FOR
TRANSPORT OF HYDROGEN
BEFORE 2030**



OCTOBER 2023

EXECUTIVE SUMMARY

Study shows: NGT and NOGAT's offshore infrastructure can be repurposed for hydrogen transportation before 2030, by rerouting certain gas fields, while still providing transportation services for current and future Dutch offshore natural gas.

Dutch Hydrogen ambition to reach CO2 reduction goals

The Netherlands has ambitious offshore wind energy targets (21 GW by 2030, growing to a maximum of 70 GW by 2050) and aims to increase its production of green hydrogen substantially in the coming decades, to meet decarbonisation goals and support energy security. The Dutch government, in collaboration with sector stakeholders, is taking steps towards building a hydrogen network, both onshore and offshore.

North Sea potential important Energy Hub

The North Sea is foreseen to become an important energy hub especially after 2030. It provides opportunities for large scale offshore wind energy production, green hydrogen production and underground (carbon) storage, favourably located between several NW European countries. However, there are limitations to building new infrastructure required for these energy production ambitions in the North Sea since it consists of environmentally protected and safe areas and large shipping routes across the area.

Opportunities for existing offshore infrastructure

The North Sea has an existing network of oil and gas facilities, pipelines with international connections, which is rather extensive. This infrastructure is in many cases already conveniently located near potential offshore wind areas which makes reuse of these existing pipelines for hydrogen a preferable option. Repurposing has several other advantages such as:



A cheaper solution for society: the cost to repurpose offshore pipelines is estimated (with high uncertainty) to be ~10% of new construction costs ¹



Savings in power grid investments: when combined with offshore wind, low grid investment cost (less HVDC platforms with high investment cost) as offshore hydrogen produced will be mainly transported via existing pipelines instead of power lines



Fast roll-out of large-scale production: compared to building new pipelines, fast roll-out of large scale production and faster permitting process, including timely availability for pilot projects.



Less impact to ecology and environment: with less construction works, less impact to the environment and ecology, especially when space on North Sea coast is a limiting factor



Utilisation of know-how and experience: opportunity to utilise installation, operation, maintenance, administrative and logistics expertise of current offshore gas pipeline operators.



Storage potential: storage possibility of hydrogen in empty gas fields and/or salt caverns, which are already connected to the gas network.

[1] Specification of a European Offshore Hydrogen Backbone, DNV, February 2023 - Estimate for offshore is highly uncertain, as there are no existing references to convert offshore natural gas pipelines to hydrogen

Options for rerouting and repurposing explored

Noordgastransport (NGT) and Northern Offshore Gas Transport (NOGAT) own and operate open access offshore gas pipelines in the North Sea for about 50 years. Guidehouse and Enersea have conducted a study on behalf of NGT and NOGAT to examine the possibilities to use existing offshore gas pipelines for hydrogen transport.

Main assumptions for study

- Gas from existing and yet to be discovered gas fields still to be transported to shore
- The latest information on the planned timelines for the offshore wind areas
- H2 production forecasts based on these planned wind areas (low, mid, high scenario)

The aim of this study executed by Guidehouse in collaboration with Enersea is to develop different reuse scenarios and evaluate their feasibility.

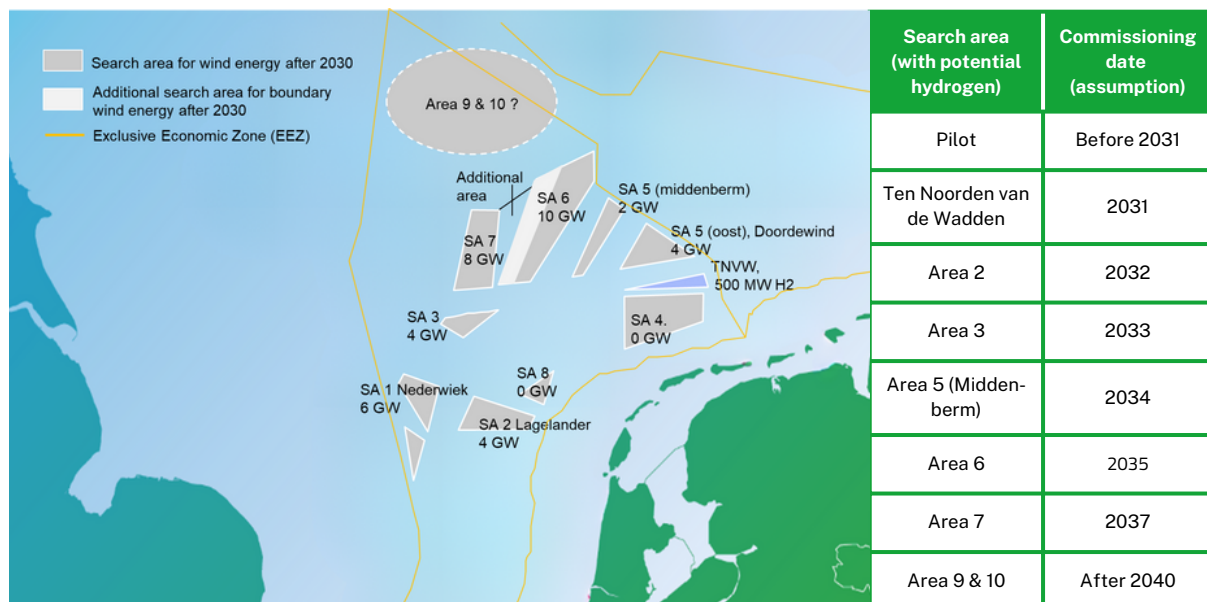


Figure 1. Offshore wind search areas in the Dutch North Sea for 2030-2040

Hydrogen transport via existing pipelines is feasible, and can be made available by 2030

Following a detailed technical evaluation and certification process; flow assurance, pipeline rerouting assessment, cost estimates and impact analysis on ecology and environment resulted in the selection of two main scenarios. In each of these scenarios, one of the main pipeline systems is converted to hydrogen, while the other system provides transport services for all the current and future gas fields in the area.

Scenario I: Repurposing the NOGAT pipeline for transporting hydrogen to Den Helder by 2030

Scenario II: Repurposing the NGT pipeline to transport hydrogen to Uithuizen by 2030

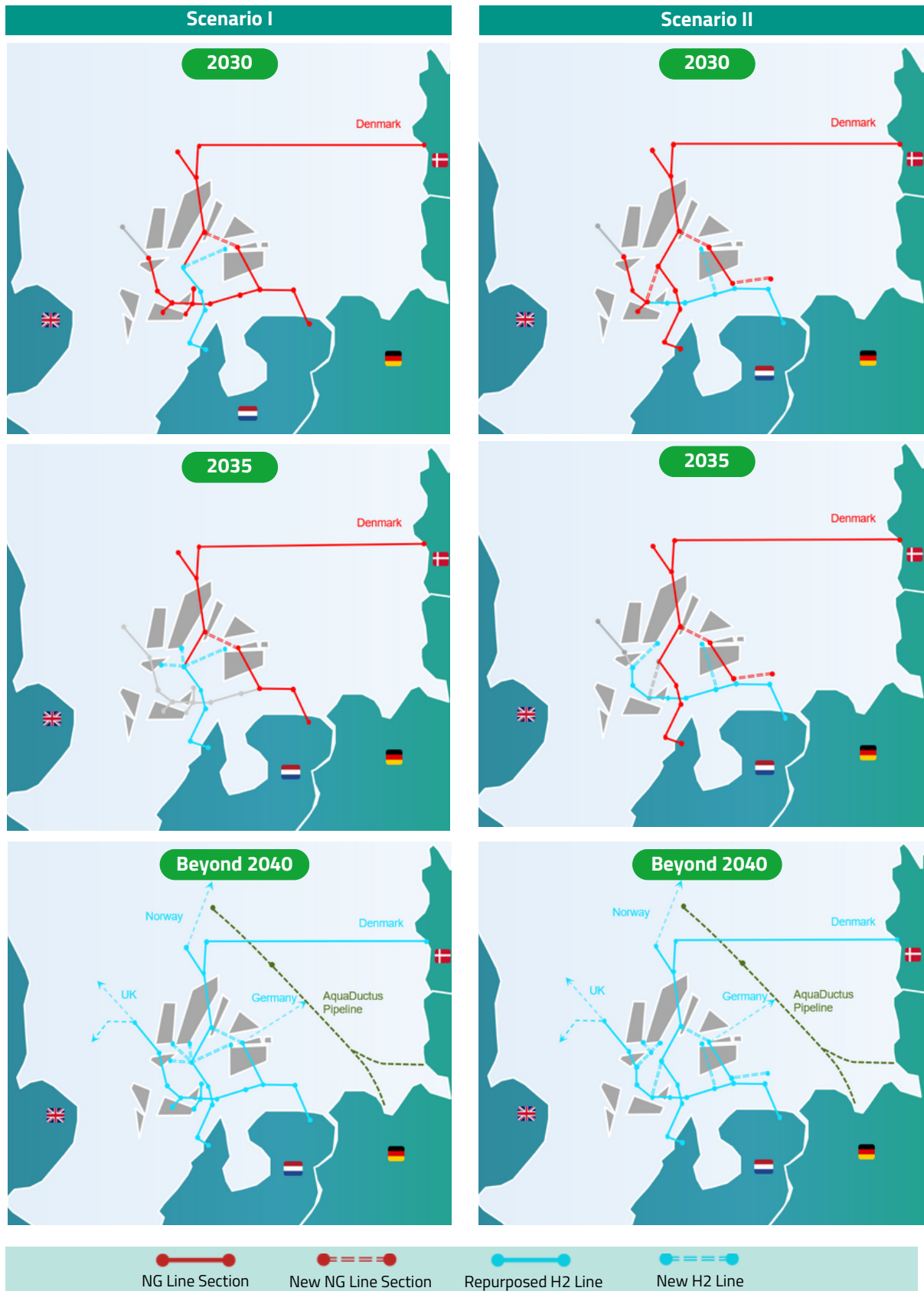


Figure 2. Selected scenarios

Fast, cheap and less impact on environment

As shown in Figure 2, the majority of the existing natural gas pipelines will be reused. This means that the creation of an offshore hydrogen network can be realised quicker and at significantly lower costs as compared to installing a new-build pipeline system. Depending on the scenario, this can mean up to a 90% reduction in cost. Repurposing also means less impact on ecology and environment in an already protected Nature reserve: The Wadden Sea.

Future proof

Both scenarios will serve existing gas producers and aim to have a redundant network available for hydrogen by 2040. After ca. 2040, both pipelines will be available to transport 14GW each of generated hydrogen. Both scenarios will also be able to facilitate blending of natural gas and hydrogen in a transition phase.

Minimal investments are needed to ensure natural gas transport and an optimal connection to planned wind areas.

International connection and storage

This future network is already connected to Denmark through the NOGAT pipeline and offers good opportunities for connection to other North Sea countries. Examples are the connection of the western part of NGT with UK pipelines or a connection with the German AquaDuctus project. Existing connected gas fields can eventually serve as storage for temporal fluctuations of offshore wind production, as well as to keep strategic reserves for hydrogen.

Outcome used as input for further regulatory developments

From the regulatory perspective, there are many uncertainties in the offshore hydrogen sector, such as:

- ▶ What will be the exact role, tasks and responsibilities for the intended TSO?
- ▶ The Hydrogen and Gas Market Decarbonisation Package will be potentially implemented by the end of this year, but still needs to be translated to the national level.

Some of these questions are being investigated in the North Sea Energy Infrastructure Plan (EIPN), on which key decisions regarding industry role, market frameworks and further legislation will be made.

The EIPN is expected to be finalised in 2024 and will provide important insight on the infrastructure requirements both for offshore wind and hydrogen. The NGT & NOGAT repurposing scenarios are considered to be important input for decision making going forward.

Contact persons

For NGT: Ron Hagen, ron.hagen@noordgastransport.nl, +31 6 52 61 1082

For NOGAT: Hans Janssen, hans.janssen@neptuneenergy.com, +31 6 39 78 0018