The role of harbours in the energy transition

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A project executed by

New Energy Coalition TNO university of groningen

De rol van havens in de energietransitie

Project information

Consortium: NEC, TNO and RUG

Advisory board: Port of Amsterdam. Port of den Helder, Groningen Seaports, Gasunie and EBN

Budget: ca. 320k (80% funded)

Start: March 2019

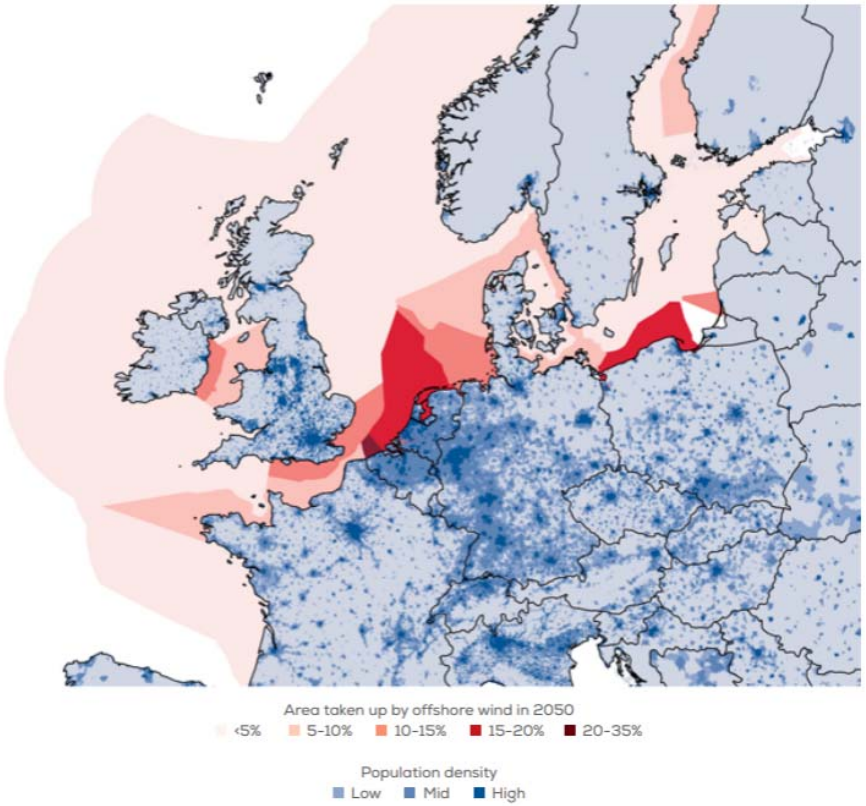
Four workpackages

- Defining future scenarios
- Develop methodological framework
- Validate outcome from optimisation
- Legal and regulatory implications

Strategic importance of port regions in development of energy networks (e.g. TEN-E) is not sufficiently acknowledged?

1. Strategic geographic position

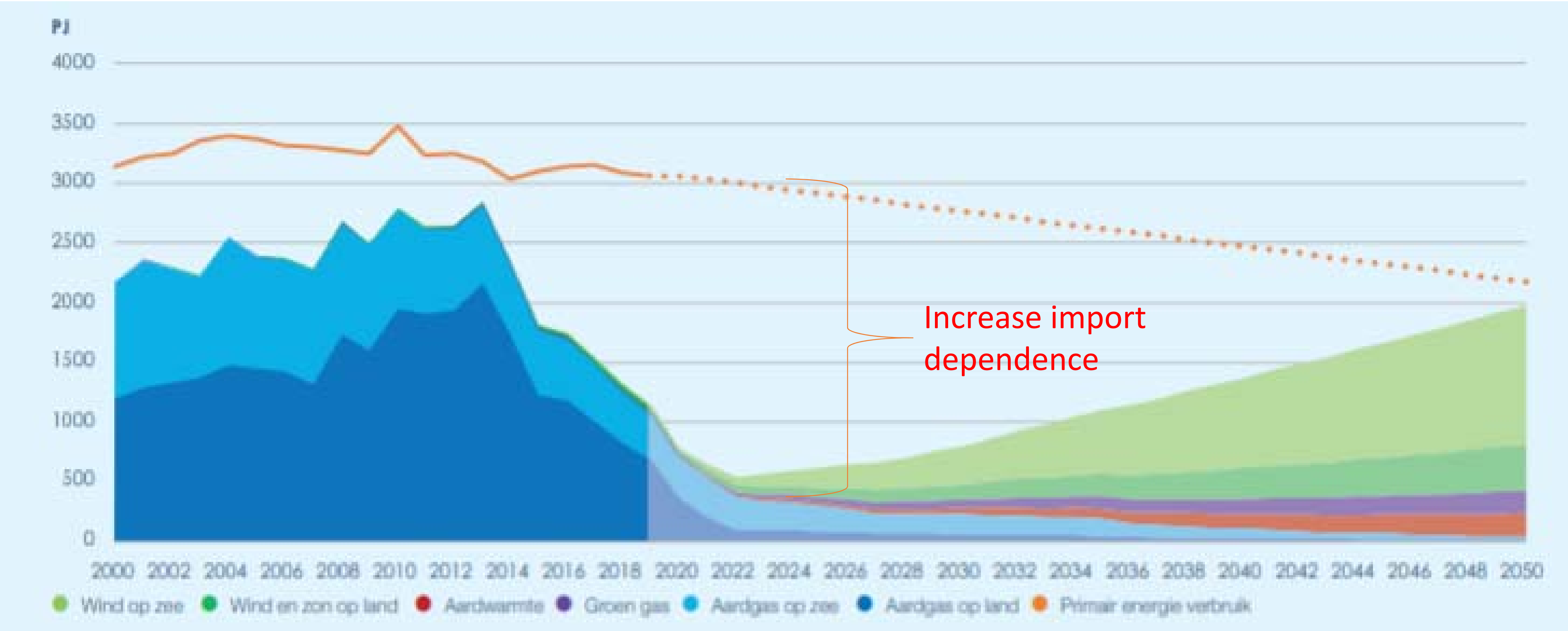
- Technology improvements (very competitive prices)
- Landfall of offshore RES becomes more and more difficult
  - limited capacity existing network
  - Passing through Waddensea (impact on nature)
  - Etc.
- Presence of existing energy infrastructure also offshore



Windeurope, 2020

2. Strategic import position

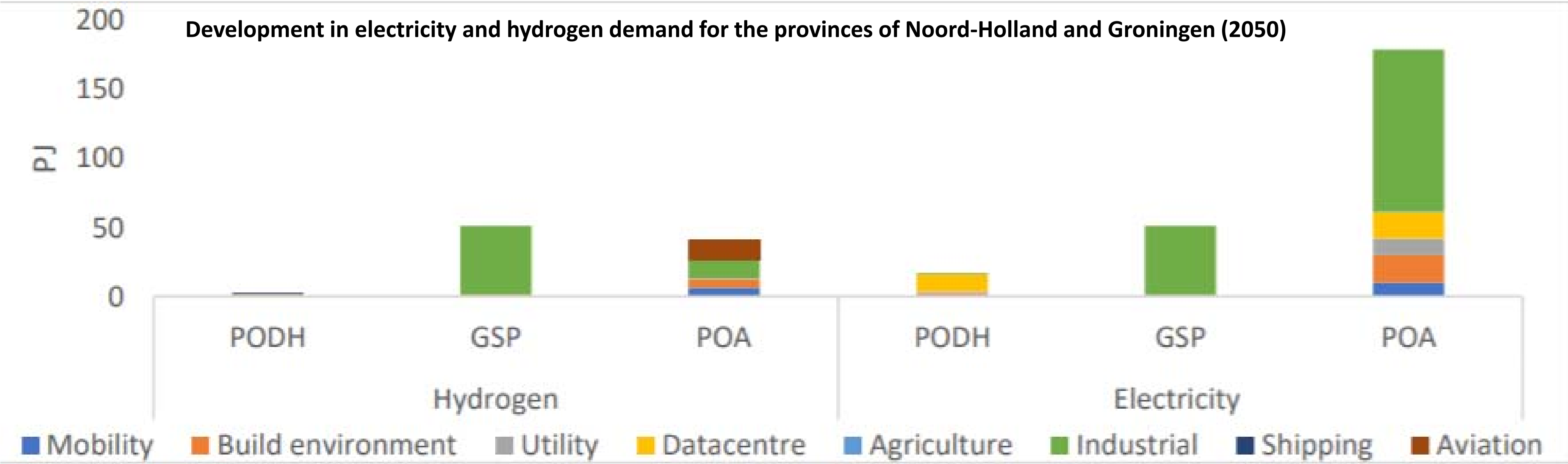
Traditionally all harbours handle large volumes of energy (kerosene, coal, natural gas, electricity)



EBN, 2021

3. Centres of high energy demand.

- Decarbonisation of existing industries
- New industrial processes requiring electricity or green molecules



Three research questions

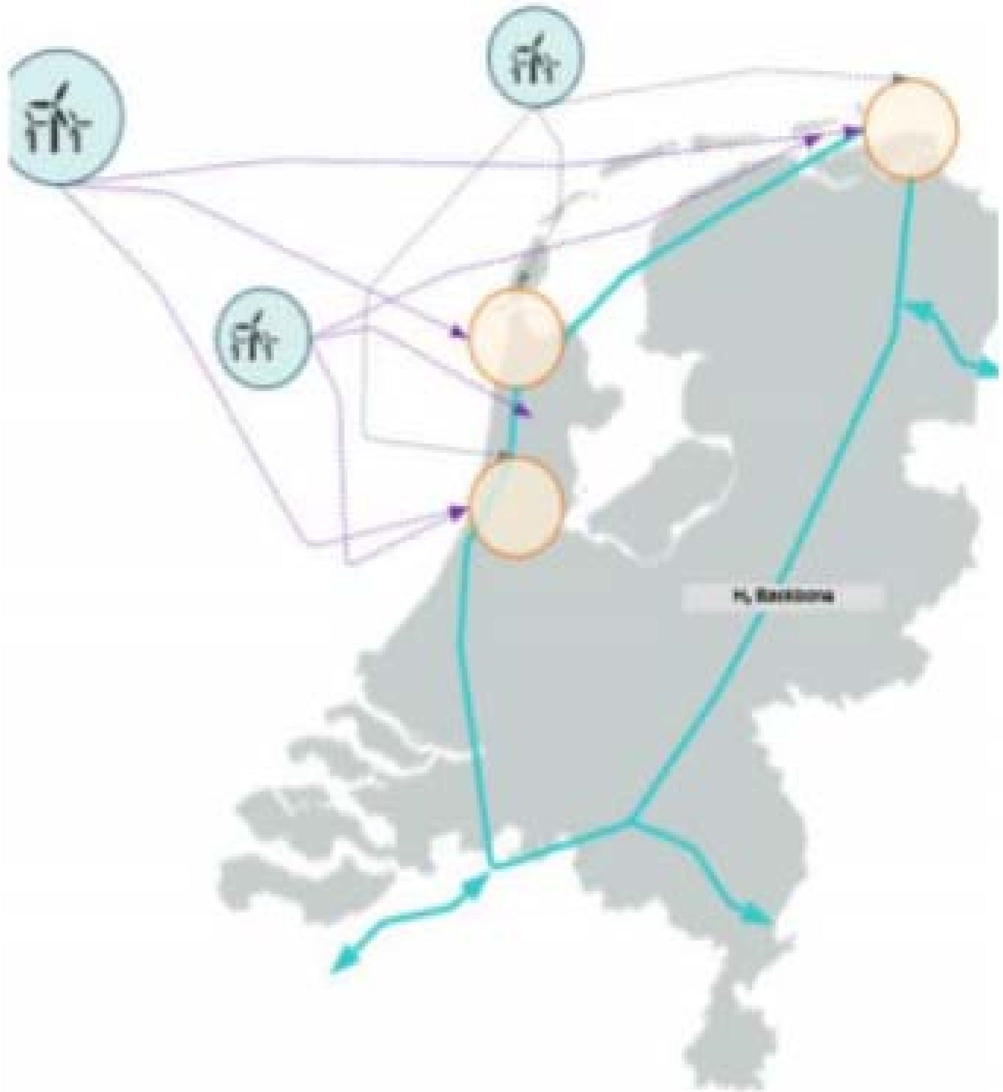
1. What **investment levels** with respect to hydrogen related energy activities correspond to the defined scenarios **collectively** describing the potential energy hub futures of the three harbour regions mentioned?

2. What **opportunities for synergies** exist between the different harbour areas and how can these be realised?

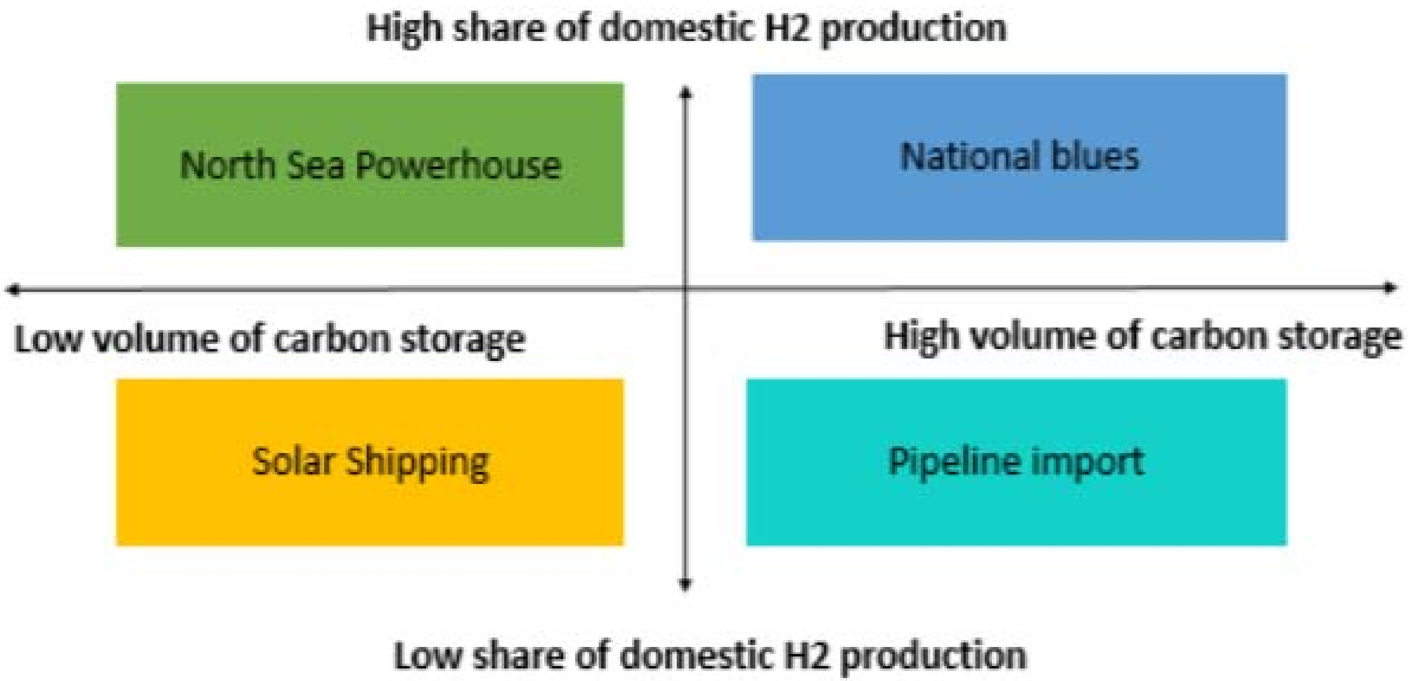
3. To what extent do the current **laws and regulations act as a hindrance** for achieving the potential roles of ports as important energy/hydrogen hubs in the future?

Methodology

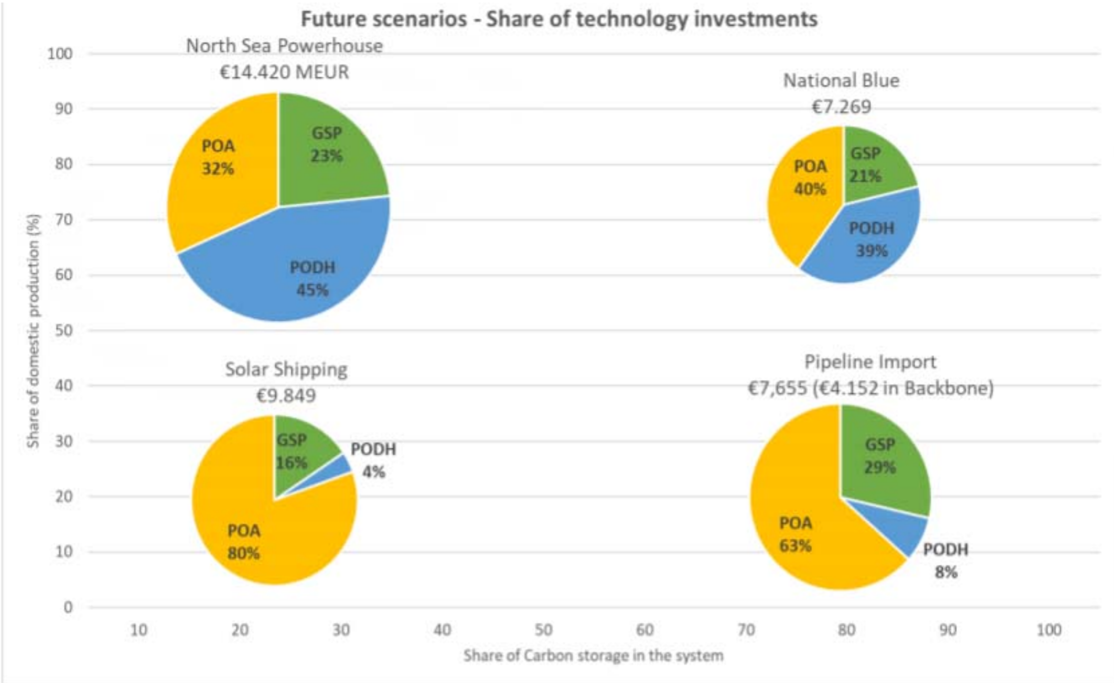
- Non linear model with cost factors calculated as Equivalent Annual Costs
- Some assumptions:
  - Direct connection possible
  - Heat demand less explored
  - Hydrogen storage dominant
  - **Unique harbour characteristics captured in locational factors**
    - Cost per m2
    - Distance (km)
    - Re-use of existing facilities



Scenarios (2050)



1) Every energy mix requires a mix of harbour features



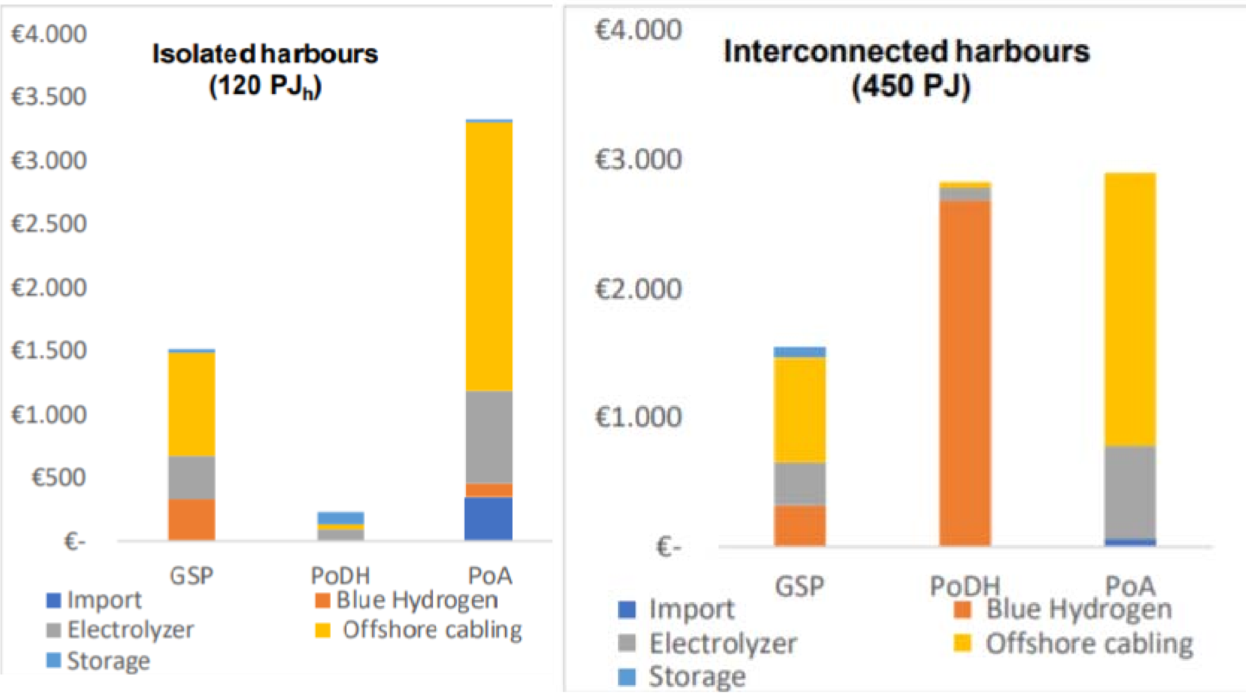
The system expenditures do not link with economic value

Investment to fulfil local electricity demand in all scenarios (2.3Beuro)

Locational factors define specialisation profile of harbours.

Economics of scale impact total system expenditures not per se the location of investment.

2. Collaboration pays off



Backbone connecting the harbours and the hinterland crucial for synergies (economics of scale)

300M€/a saved due to cooperation

Sensitivity analyses

- annual expenditures reduce in National Blue scenario with 50%
- 40% in solar shipping scenario
- 30% in North Sea powerhouse

HYDRO PORTS Waterstofontwikkelingen Noord-Nederland 2020-2040

Groningen Seaports, Port of Amsterdam en Port of Den Helder vormen samen Hydroports. Een vooruitblik op de ontwikkeling van hèt waterstofknooppunt van Europa:

2021

1. 5 MW H2 elektrolyse Amsterdamse haven gereed
2. 20-60 MW elektrolyser Chemiepark Delfzijl (Djewels)

2022

3. 1e dedicated H2-pijplijn Amsterdams havengebied

2023

4. Demonstratie synthetische kerosineabriek Amsterdamse haven
5. 100 MW elektrolyser Eemshaven (HyNetherlands)
6. Start aanleg backbone Noord-NL: Eemshaven, Delfzijl, Emmen en opslagcavernes Zuidwending.
7. Windpark Hollandse Kust Noord operationeel

2024

8. 100 MW groene H2 productie gereed
9. 10 MW battolyser Vattenfall Amsterdamse haven gereed
10. Eerste cavernes voor H2-opslag Zuidwending gereed

2025

11. Regionale H2-verbinding IJmuiden – Amsterdam
12. Blauwe waterstofproductie Den Helder
13. Windpark Hollandse kust West operationeel
14. Eerste turbine Magnumcentrale op H2

2026

15. Proeven op zee met wind naar H2 (North Sea Wind Farm)

2027

16. Noord-tracé NL Backbone Den Helder-Amsterdam in gebruik
17. Opschalen elektrolyser Eemshaven naar 0,8-1 MW

2028

18. Alle drie turbines Magnumcentrale op H2 (=stroom voor ruim 2 mln huishoudens)

2029

19. Productie synthetische methanol Amsterdamse haven

2030

20. Pilot import H2 over zee naar haven Amsterdam
21. H2-leiding IJmuiden Ver naar Den Helder
22. Wind Power Hub: eilanden met H2 uit wind, via leiding naar land

2035

23. Grootschalige productie synthetische kerosine haven Amsterdam

2040

24. Grootschalige import H2 over zee
25. H2-leiding van Doggersbankgebied naar Den Helder

Thank you

Report will be public by end of April

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