

gasunie

crossing borders in energy

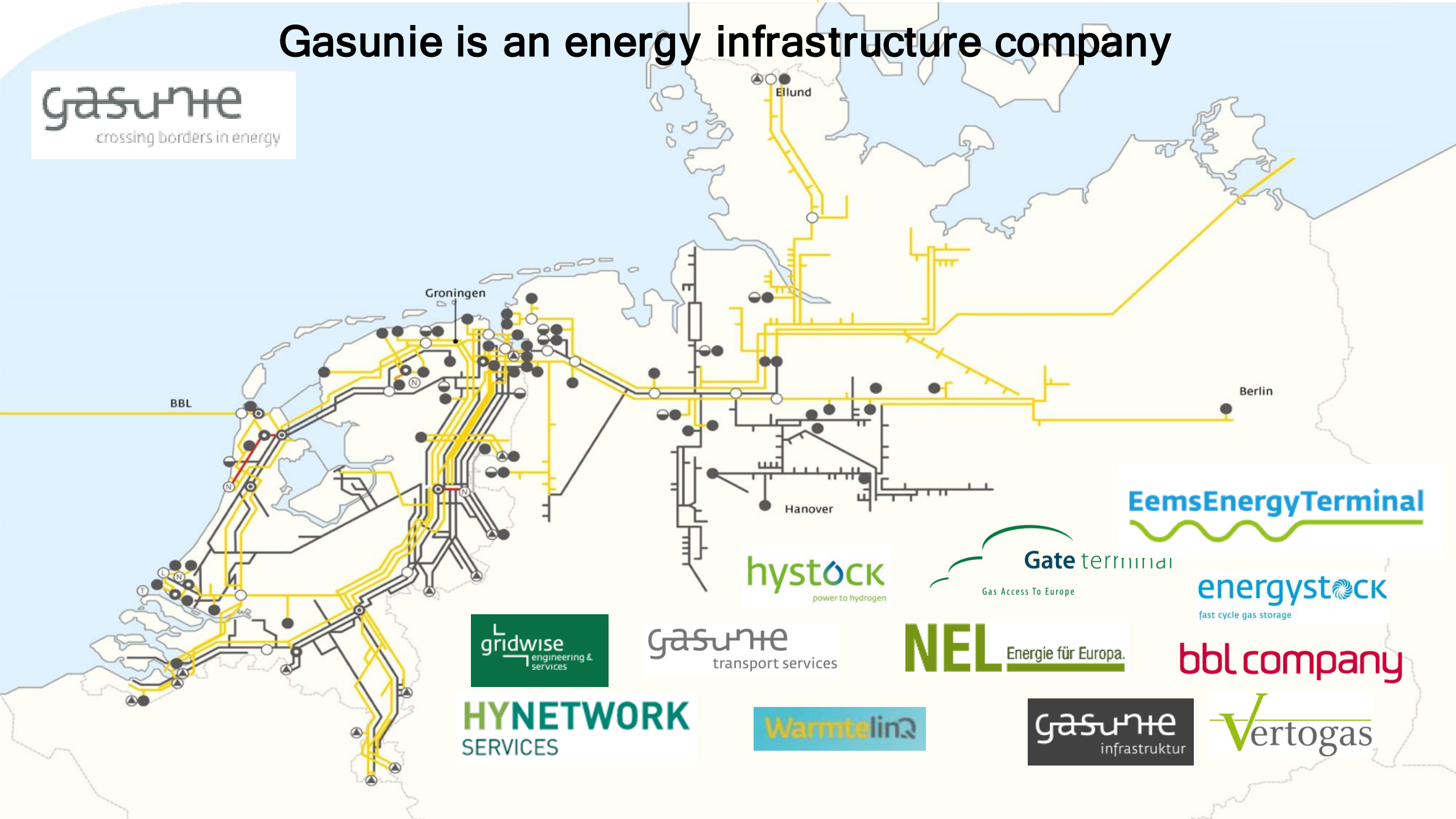
# Crossing borders with hydrogen

*Harry Smit*  
*N.V. Nederlandse Gasunie*



# Gasunie is an energy infrastructure company

gasunie  
crossing borders in energy



EmsEnergyTerminal

Gate terminal

Gas Access To Europe

energystock

fast cycle gas storage

bbl company

Vertogas

gasunie  
infrastruktur

NEL Energie für Europa.

hystock  
power to hydrogen

gasunie  
transport services

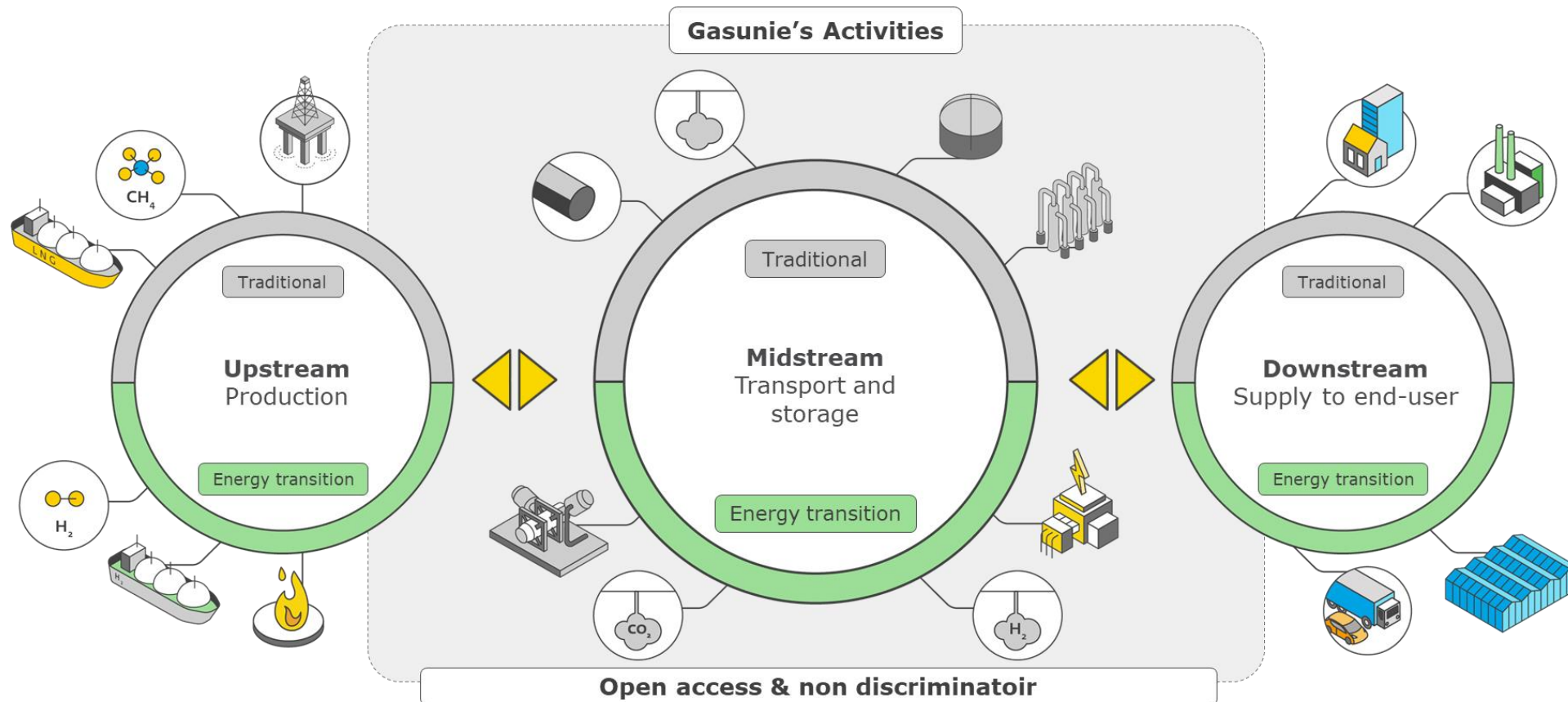
WarmteInQ

gridwise  
engineering &  
services

HYNETWORK  
SERVICES

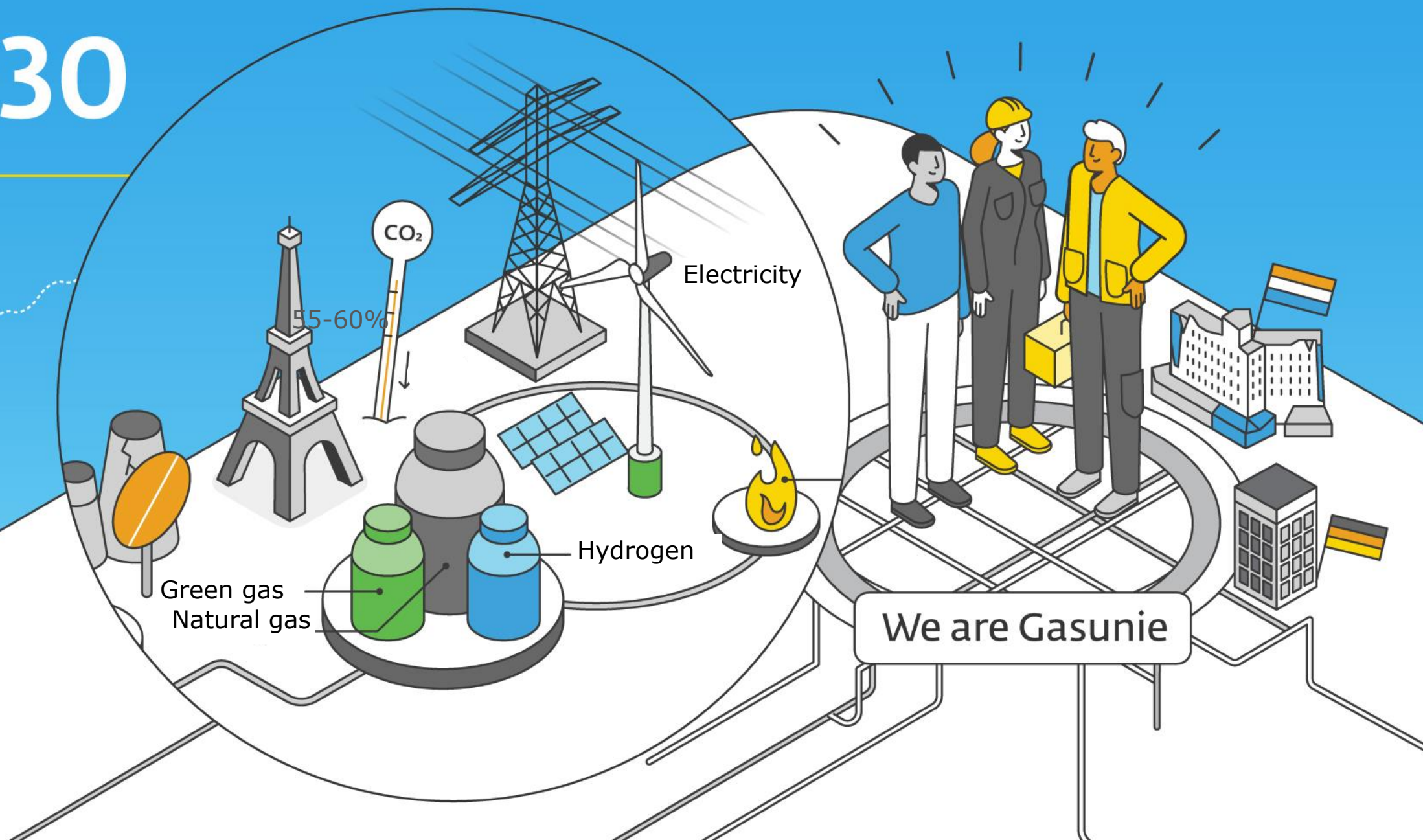
# A connecting factor in the energy value chain

Gasunie is a midstream energy infrastructure company, based on open and non-discriminatory access





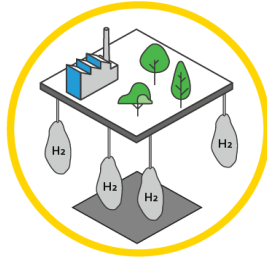
# 2030



# Hydrogen activities required to enable an (inter)national H<sub>2</sub> market



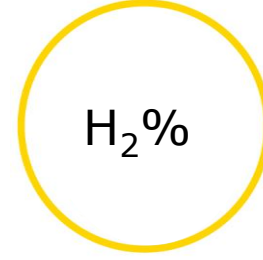
Transport



Storage



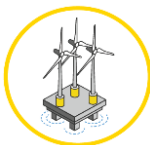
Market



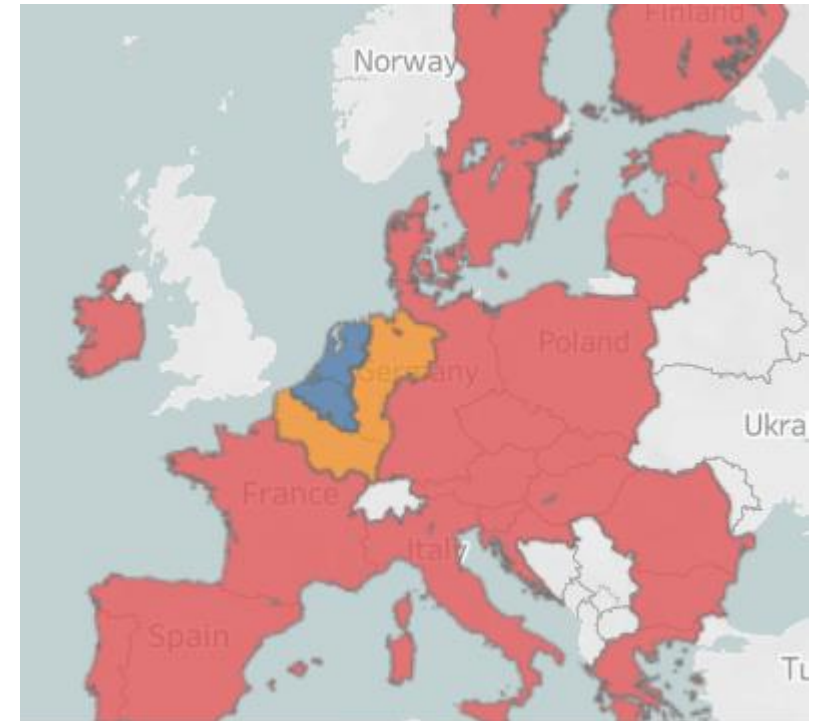
Quality



Import



Offshore

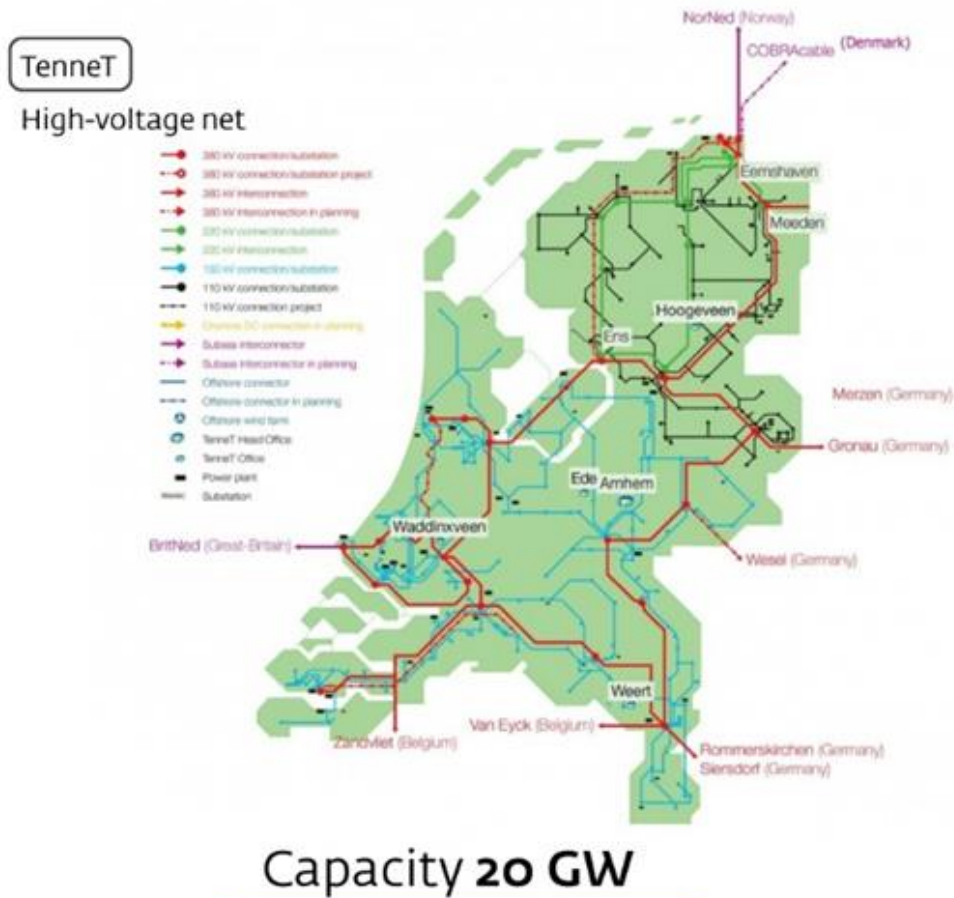


# Development of a (liquid) international hydrogen market

## Prerequisites – not exhaustive...

- ❑ Large industrial market allowing for large scale investments
  - Hydrogen utilization purposes effectively reducing CO<sub>2</sub>
  - Sufficient & competitive supply options - production & imports
- ❑ Well connected & high-capacity cross border transport systems
  - Limited to none physical or financial barriers, no congestion
- ❑ Flexibility options to respond to supply and demand fluctuations
- ❑ Market based instruments for cross border transport & balancing
- ❑ Uniform and harmonized quality specifications

# Electricity & natural gas networks in the Netherlands

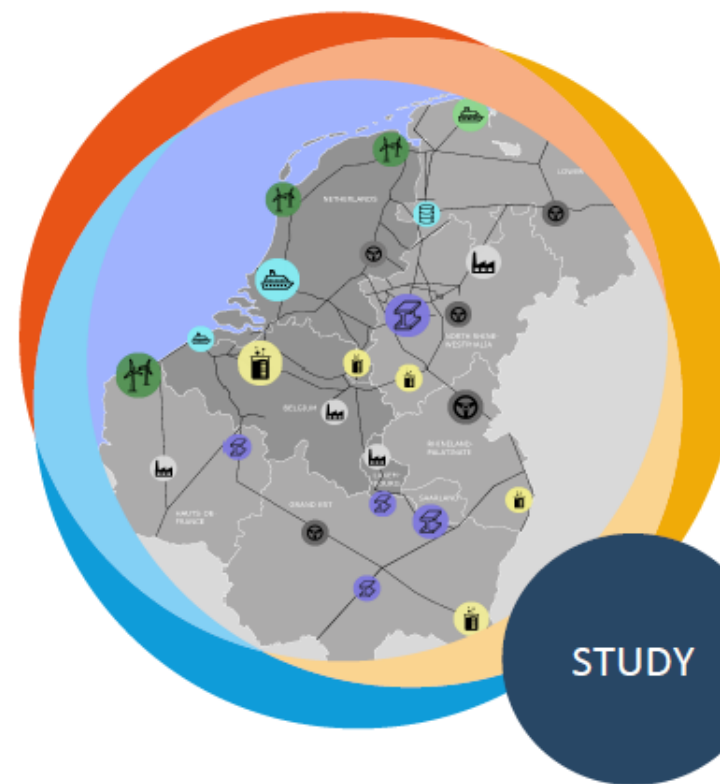
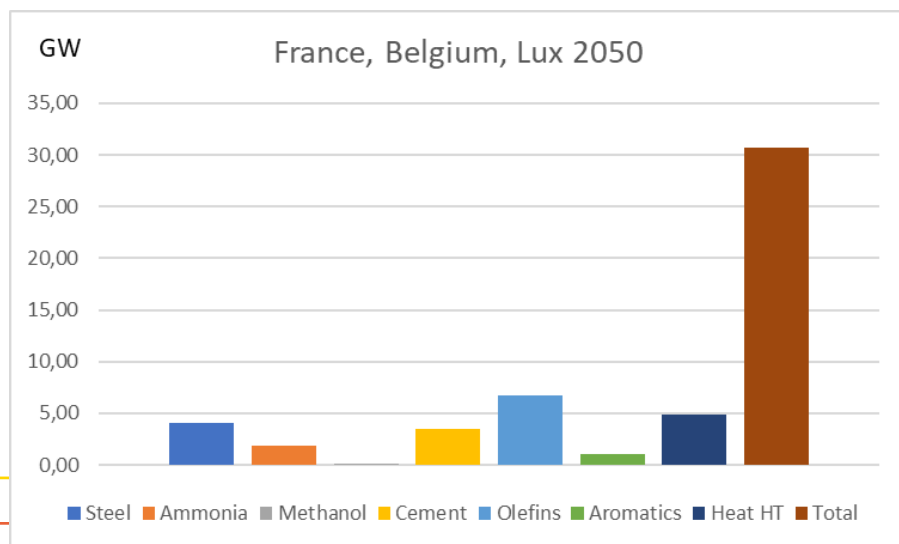
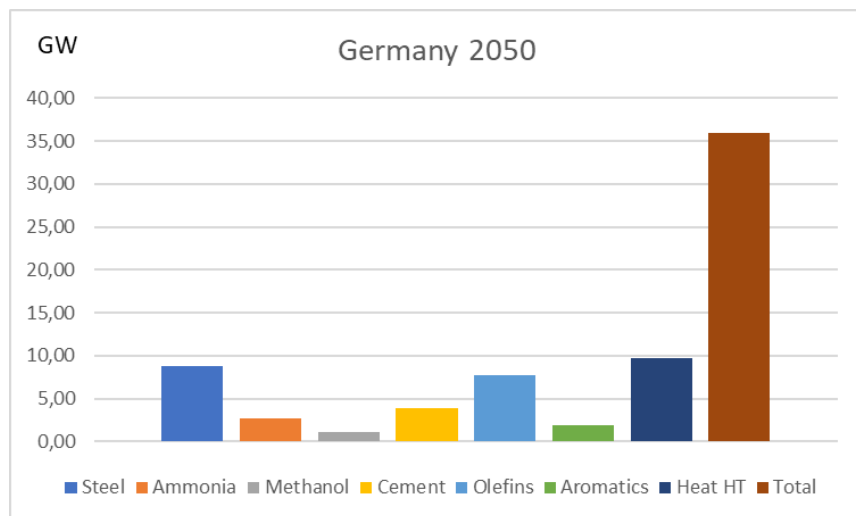


Domestic: **200 GW**

Export: **150 GW**



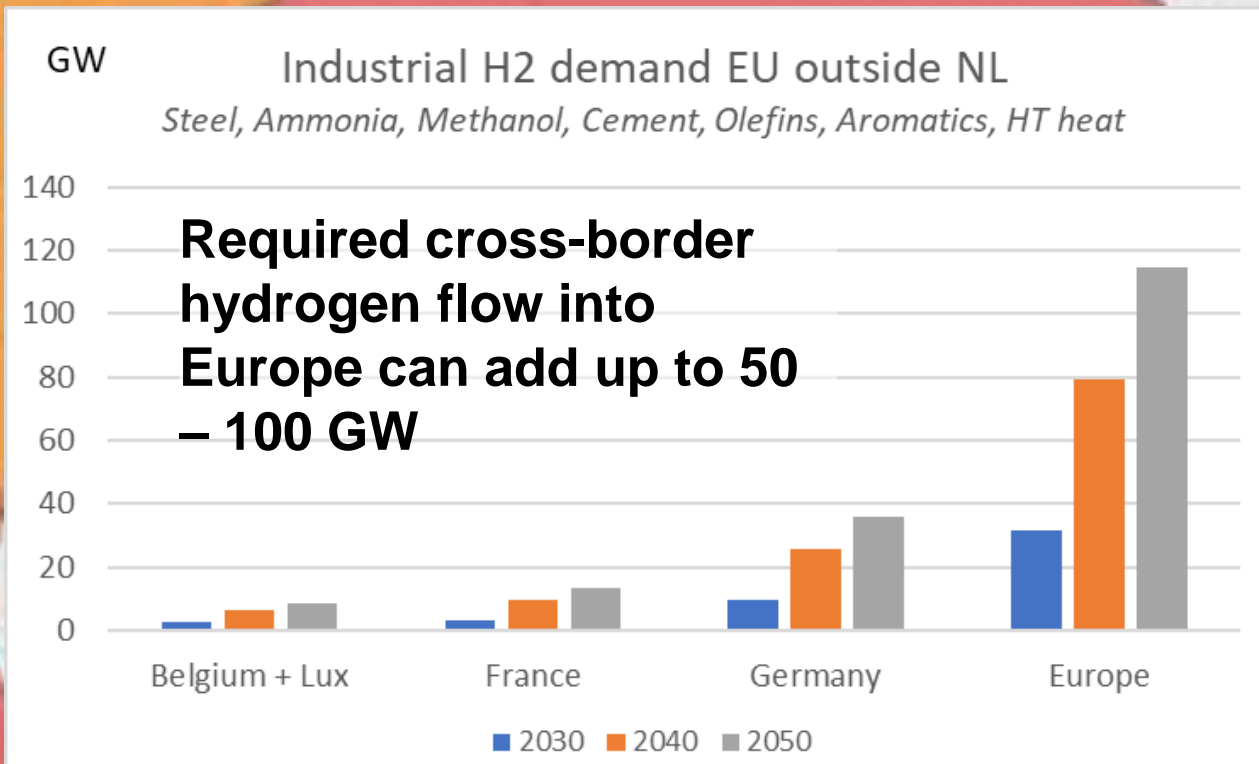
# Market potential for cross border hydrogen



## CROSS-BORDER HYDROGEN VALUE CHAIN IN THE BENELUX AND ITS NEIGHBOURING REGIONS

\* Study conducted by WaterstofNet on behalf of the Benelux-Secretariat

# The study considers hydrogen use for the hard to abate industries



# Effective hydrogen utilization options (unavoidable, hard to abate)

Recent study by “WaterstofNet” shows

- ❑ Huge potential industrial hydrogen market in the EU for greening steel, ammonia, methanol, refineries, heat, cement
- ❑ Projected supply / demand result in potential export from NL
  - As of 2030 5 – 10 GW NL -> GE, FR, EU
  - As of 2050 50 - 100 GW NL -> DE, FR, EU
- ❑ Future cross border flows will depend on supply / demand developments
  - imports, north sea production, cost development, EU industry politics

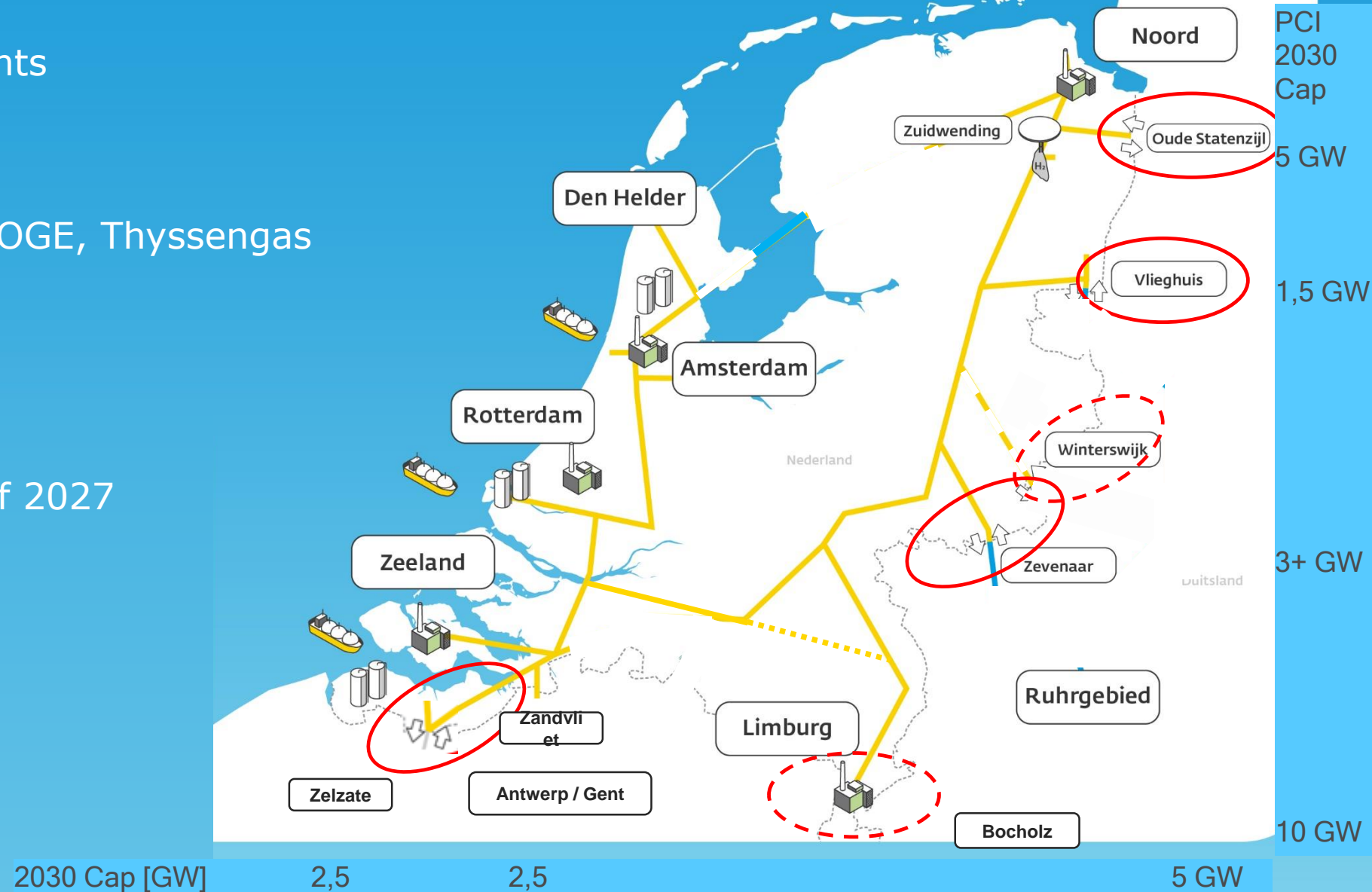
⇒ Gasunie can anticipate by successively expanding infrastructure “for future growth”

*\*Note: Potential demand for mobility (ships, trains, buses, trucks, aviation, cars...) is not taken into account.*

# Transport 2030 - Cross border Hydrogen Interconnection Points

## Cross border developments

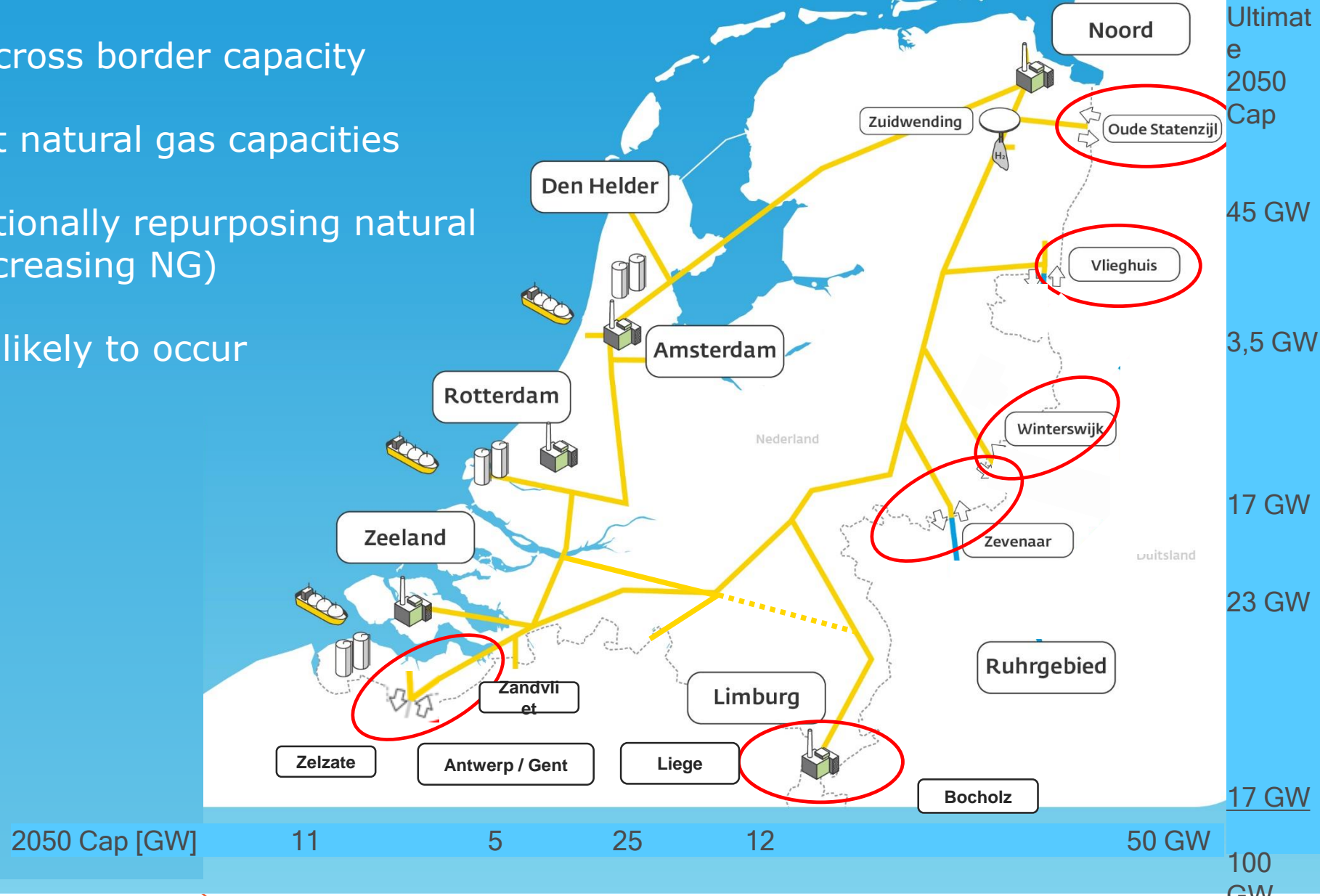
- PCI umbrella
- Germany: Hyperlink, OGE, Thyssengas  
2030 goal - 10 GW
- Belgium: Fluxys  
2030 goal - 5 GW
- First connections as of 2027





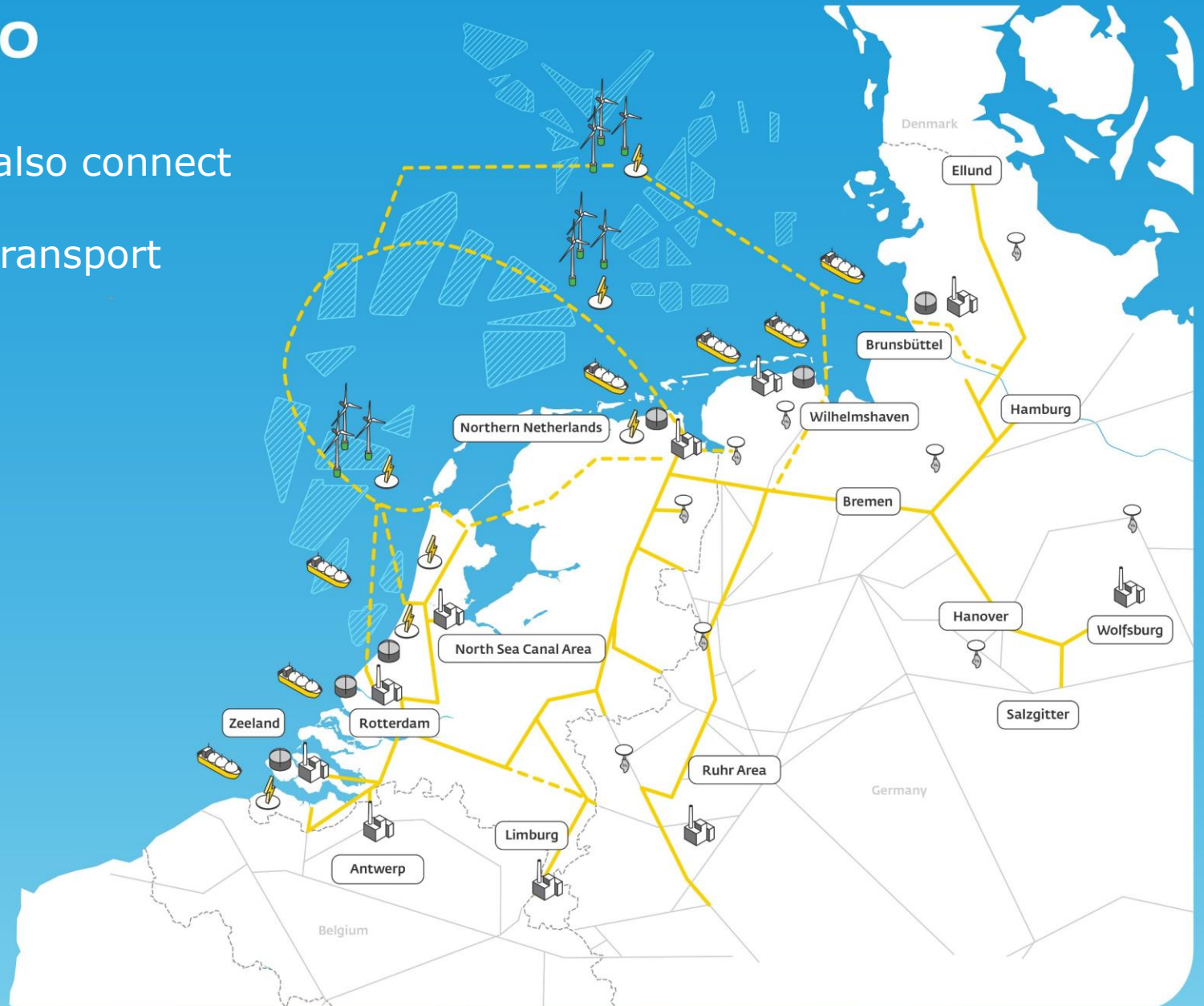
# Transport 2050 - Cross border Hydrogen Interconnection Points

- Huge future potential cross border capacity
- Comparable to present natural gas capacities
- Made possible by additionally repurposing natural gas pipelines (with decreasing NG)
- Future congestion not likely to occur



# Hydrogen network 2030

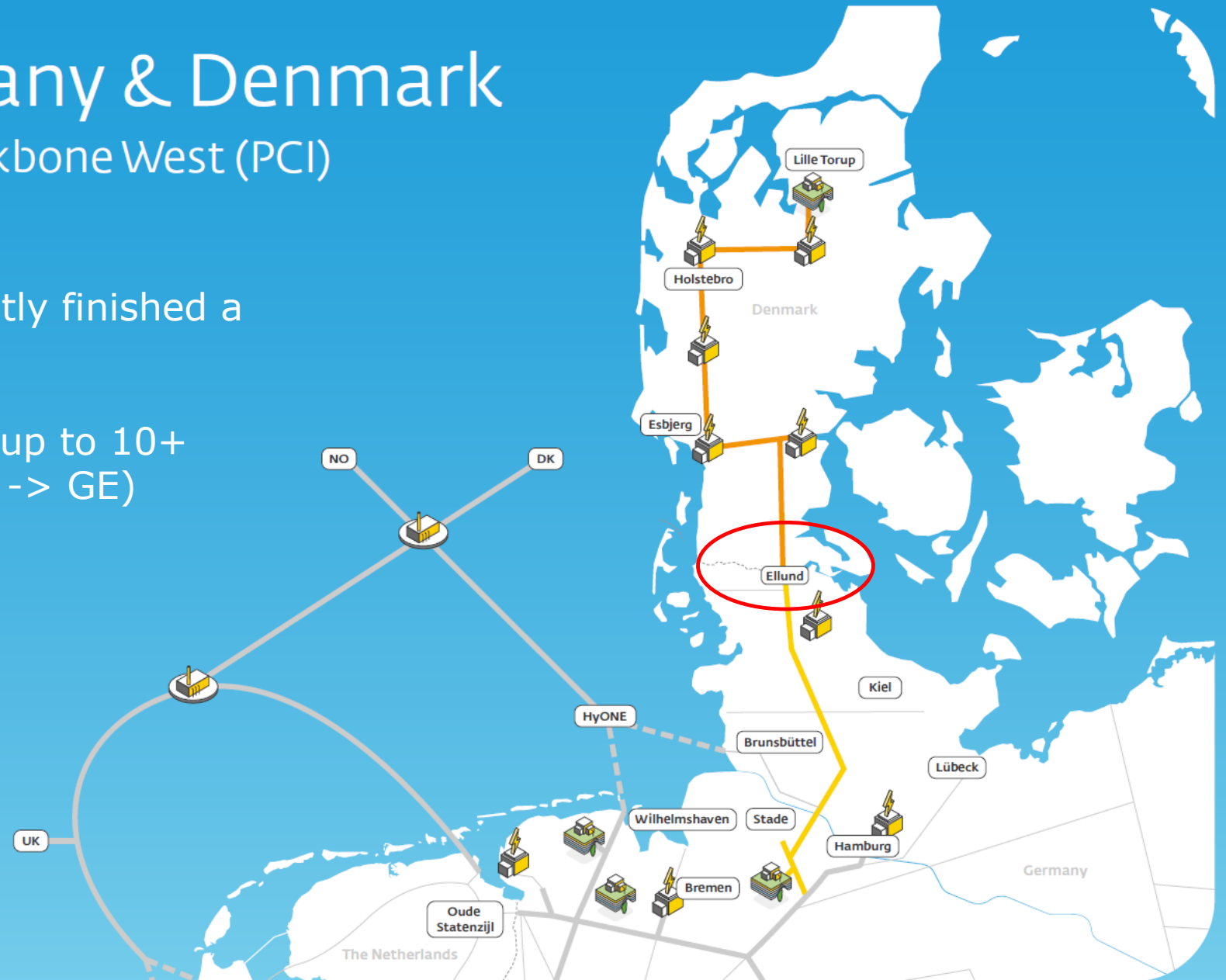
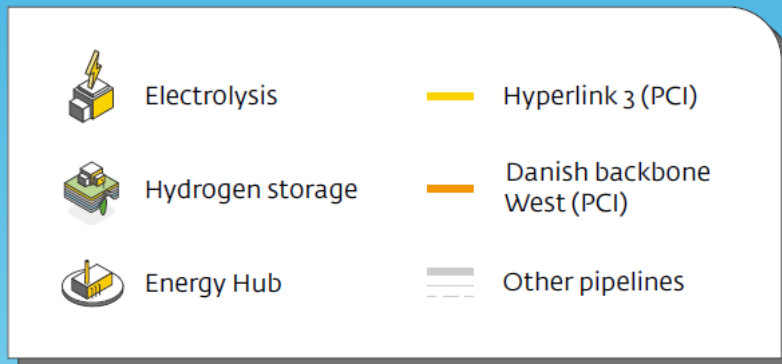
- Gasunie's NL and GE network will also connect to Denmark
- Extending cross border hydrogen transport further into EU



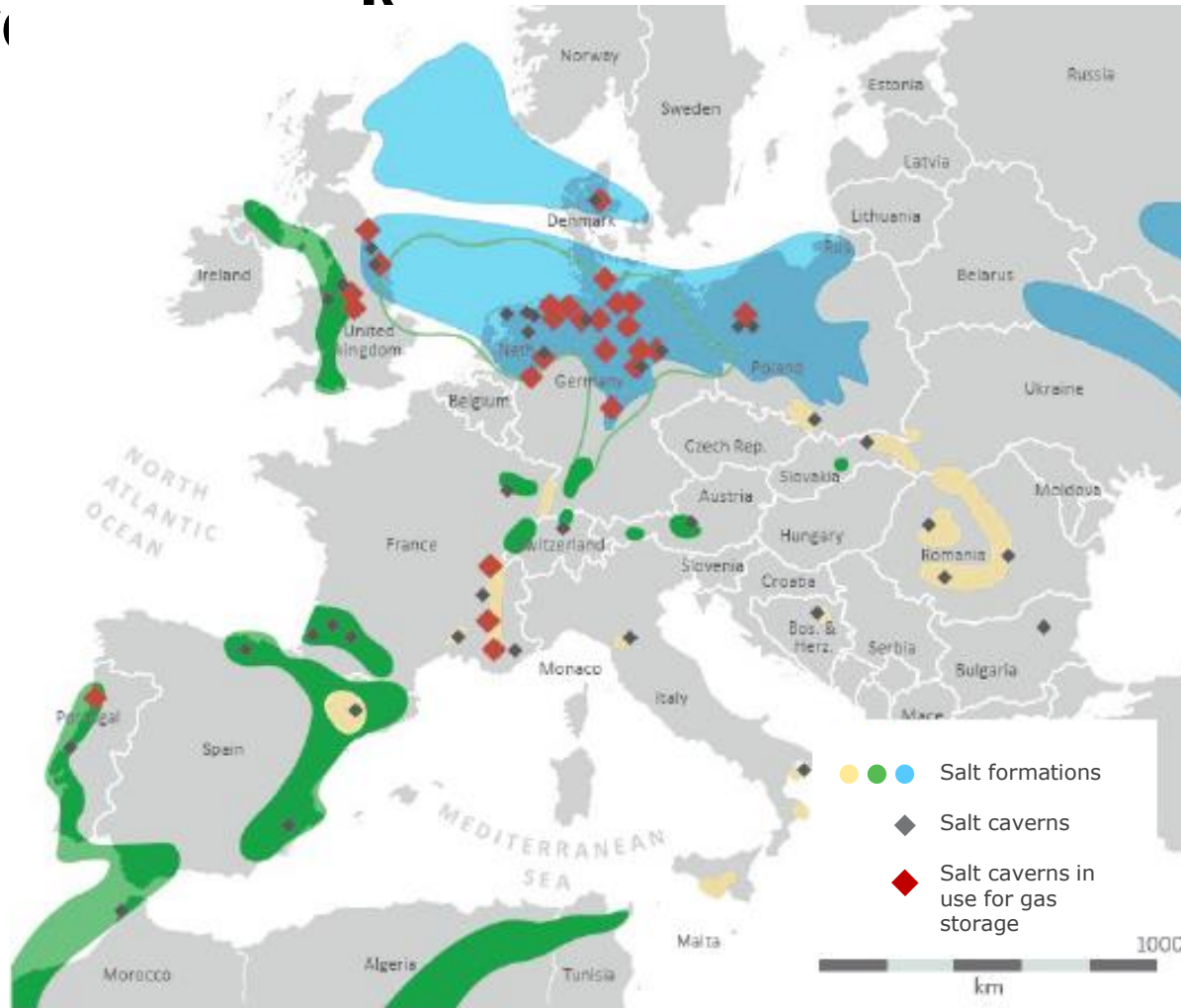
# H<sub>2</sub> Network Germany & Denmark

## Hyperlink 3 (PCI) + Danish backbone West (PCI)

- Gasunie & Energinet DK recently finished a joint market assessment
- Cross border capacity can rise up to 10+ GW at Ellund border point (DK -> GE)



# Flexibility: Salt caverns suitable for H2 storage (new or re)



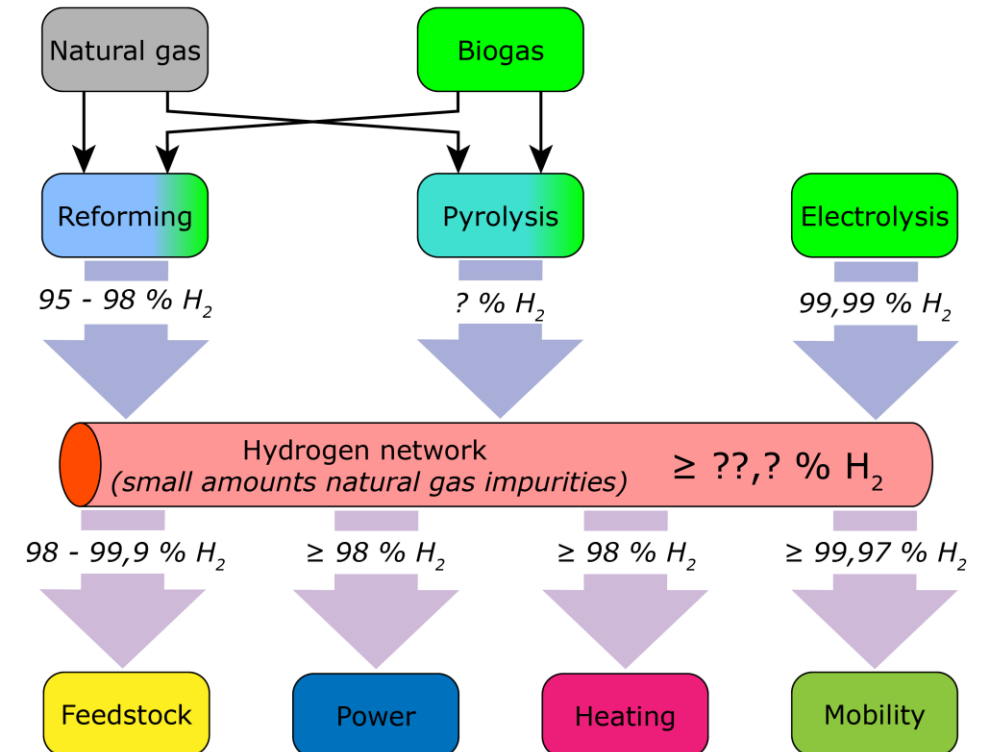
- Reasoning:
  - Intermittency
- Europe
  - What opportunities / possibilities
- The role of Gasunie
  - HyStock, cooperations
- Depleted fields
  - Much to be assessed



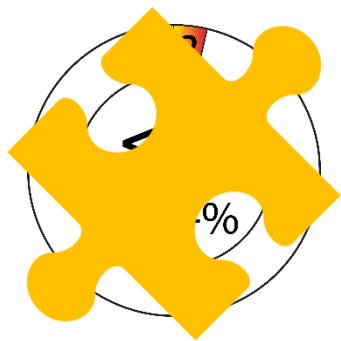
# Hydrogen / EU quality harmonisation

6  
H<sub>2</sub>%

- **Ambition and goal**  
A European standard
- **Approach**  
National and international approaches  
Existing NG fora
- **The role of Gasunie / MEA**



## (Inter)national developments



- In line with (international) hydrogen specifications
  - ISO 14687:2019 – H<sub>2</sub> fuel quality - Product specification
  - UK PAS 4444:2020 – H<sub>2</sub>-fired gas appliances guide
  - DE DVGW G260:2021 – Gasbeschaffenheit
  - EU EASEE-gas CBP:2021 – Hydrogen Quality Specification
  - NL Kwaliteitseisen voor waterstof t.b.v. het transportnet (preliminary)
  - BE Fluxys – H<sub>2</sub>/CO<sub>2</sub> Quality Specification
  - CEN – Draft Technical Specification (under development)
- Actual proposal (98% / 99,5%) under consultation by MEA



# Modeling transport & balancing based on market mechanisms



Market modelling & pricing from the start of the local network development

- ☐ Price mechanisms as soon as possible
- ☐ No cross-border barriers (physical, virtual)
- ☐ Enable cross border transport & balancing
- ☐ Enable EU market development

HyXchange is developing models and performing pilots to realize proper price setting



# Developing a European hydrogen infrastructure

## Emerging European Hydrogen Backbone in 2030

- H<sub>2</sub> pipelines by conversion of existing natural gas pipelines (repurposed)
- UK 2030 pipelines depends on pending selection of hydrogen clusters
- Newly constructed H<sub>2</sub> pipelines
- Export/Import H<sub>2</sub> pipelines (repurposed)
- Subsea H<sub>2</sub> pipelines (repurposed or new)
- Countries within scope of study
- Countries beyond scope of study
- ▲ Potential H<sub>2</sub> storage: Salt cavern
- Potential H<sub>2</sub> storage: Aquifer
- ◆ Potential H<sub>2</sub> storage: Depleted field
- Energy island for offshore H<sub>2</sub> production
- ★ City, for orientation purposes







# Developing a European hydrogen infrastructure

Growing network covering  
more countries in  
**2035**

- H<sub>2</sub> pipelines by conversion of existing natural gas pipelines (repurposed)
- Newly constructed H<sub>2</sub> pipelines
- Export/Import H<sub>2</sub> pipelines (repurposed)
- Subsea H<sub>2</sub> pipelines (repurposed or new)
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# Developing a European hydrogen infrastructure

Mature European Hydrogen  
Backbone can be created by  
**2040**

- H<sub>2</sub> pipelines by conversion of existing natural gas pipelines (repurposed)
- Newly constructed H<sub>2</sub> pipelines
- Export/Import H<sub>2</sub> pipelines (repurposed)
- Subsea H<sub>2</sub> pipelines (repurposed or new)
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# Thank you for your attention!

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Only together we can get the future energy system going!

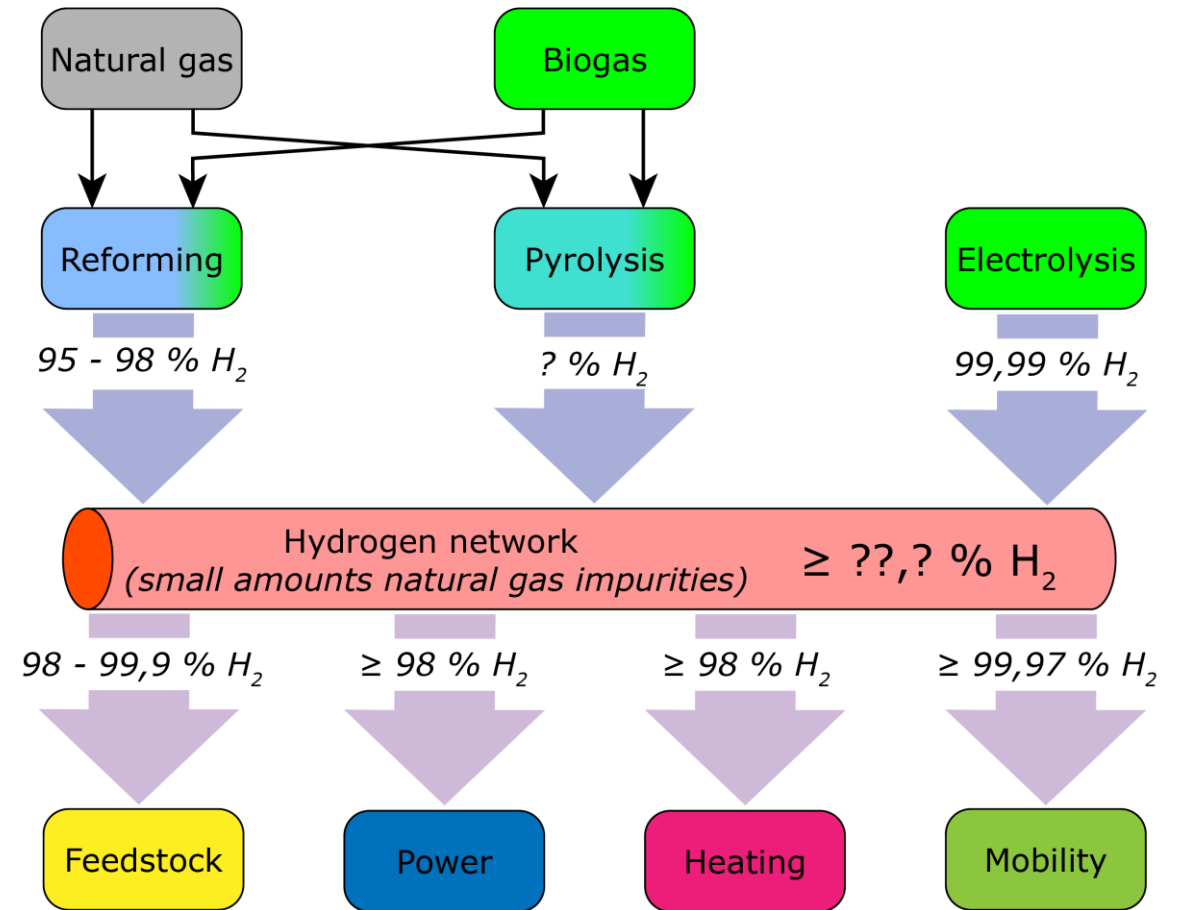


# Hydrogen / EU quality harmonisation

Ambition

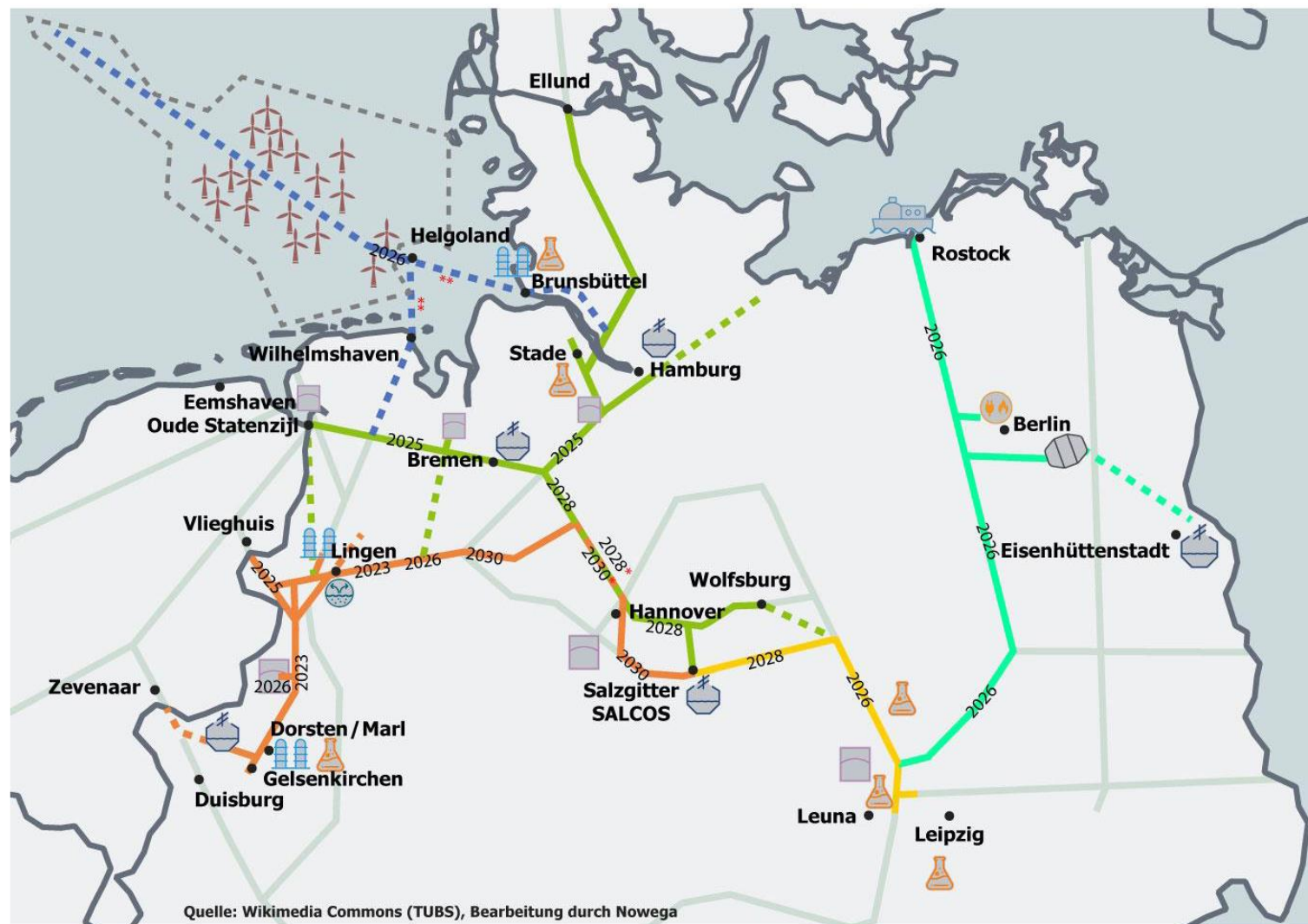
Approach (CEN, national)

The role of Gasunie / Ministry of EA





# Northern Germany further detailed, preliminary lookout



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## EU proposal for regulation\* dd. March 2023 - green gases

- This Regulation aims also to set up a regulatory framework that enables and incentivizes all market participants to take the transitional role of fossil gas into account while planning their activities to avoid lock-in effects and ensure gradual and timely phase-out of fossil gas notably in all relevant industrial sectors and for heating purposes
- An open and competitive EU market with unhindered cross-border trade has important benefits for competition, affordability, and security of supply
- It should be possible to set rules regarding cross-subsidies or financial transfers between regulated assets bases for individual or for categories of operators active within a given Member State

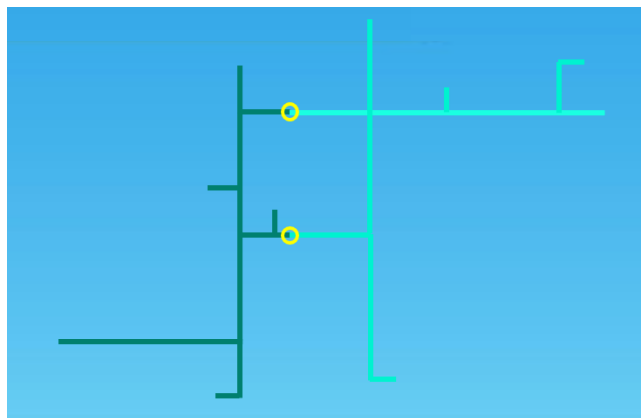
*\* Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the internal markets for renewable and natural gases and for hydrogen (recast)*

# Options for reducing / abandoning financial barriers at EU internal borders

## Classic “Market integration”

- Develop one market area
- Align fully on balancing
- Reduce or skip border tariffs
- Re-divide “lost revenues”
- EU concept regulation allows for (limited) cross subsidization with NG in developing H2 phase

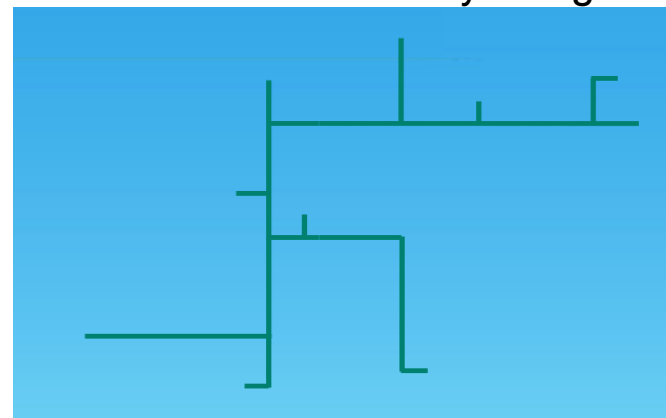
Can save costs by using mutually available infra



## Network “sharing”

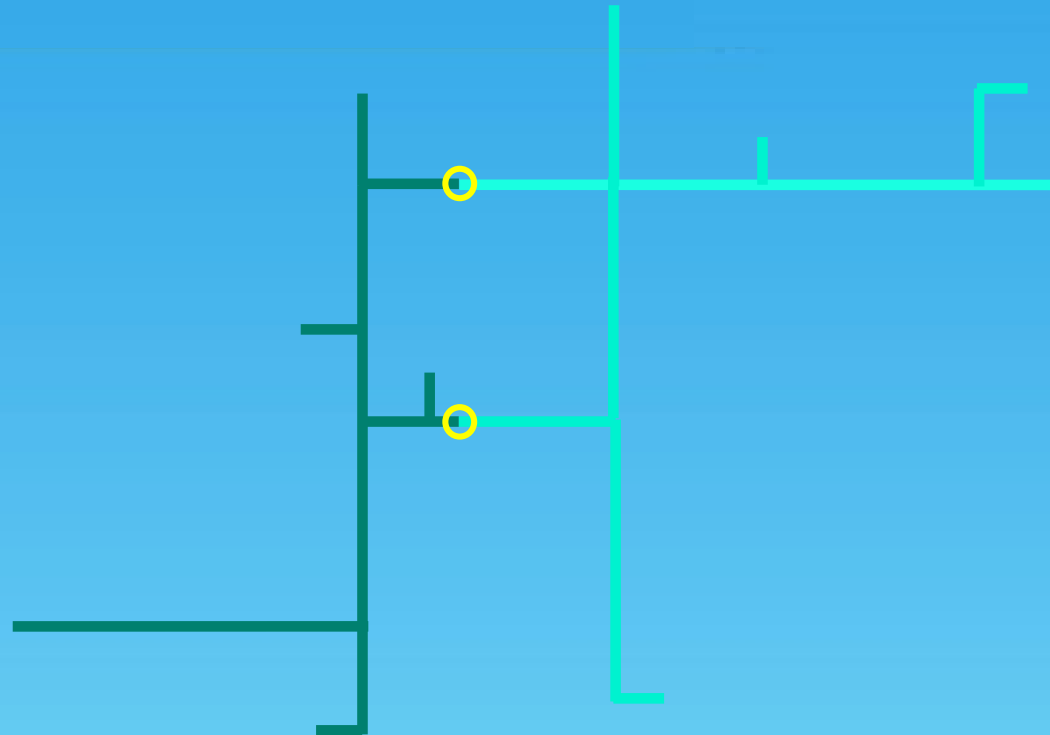
- Make cross border pipeline - routes available for Neighboring Network Operators
- NNO's agree upon mutual compensation
- Does not necessarily require “one market area”
- Operational agreement

Can save costs by using mutually available



# HNS & Hyperlink 2027/2028

*Build-up phase - separate networks*



# HNS & Hyperlink 2027/2028

*Build-up phase - separate networks*

