Hydrogen Cluster Belgium, the Netherlands, and North-West Germany

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Process4 Sustainability

Cluster for climate-neutral process industries in Hesse

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Motivation

Region: Belgium, the Netherlands and northwest Germany

Potential nucleus of a European hydrogen economy

- High population density
- High economic activity
- Energy conversion, refineries
- Trade (goods and raw materials)
- Developed natural gas network

Objectives of the study

- Quantitative analysis of market ramp-up scenarios within the region until **2030**.
  - high spatial resolution at NUTS 3 level
  - Linking sources and sinks through hydrogen infrastructure
  - Impact on the region and necessary adjustments

Methodology

	Bottom-Up-analysis
Hydrogen demand	▪ Existing demand: chemical industry, refineries ▪ Emerging demand: steel industry, heavy-duty transport, public transport
Hydrogen production	▪ Low-carbon hydrogen from existing projects ▪ Hydrogen as a byproduct from chlorine-alkali electrolysis

Low demand scenario

- Lower penetration rates in industry and transport
- Production according to project pipeline

High demand scenario

- Higher penetration rates in industry and transport
- Production according to project pipeline

Development of hydrogen balances at NUTS 3 level:

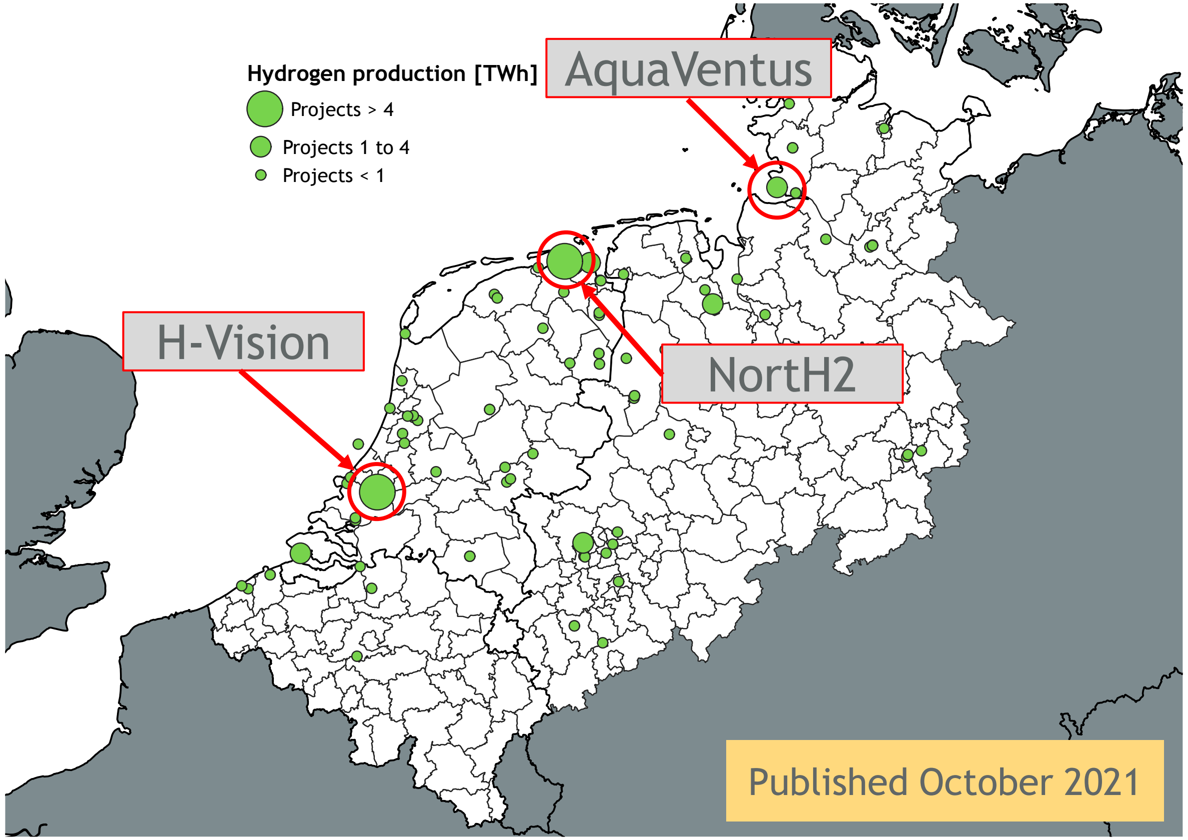
Identification of sources and sinks

Discussion of a cross-border hydrogen infrastructure to cover production deficits

Discussion of further measures necessary for the expansion of a hydrogen economy

Results: hydrogen production in 2030

Planned H_2 production and locations by NUTS 3 regions

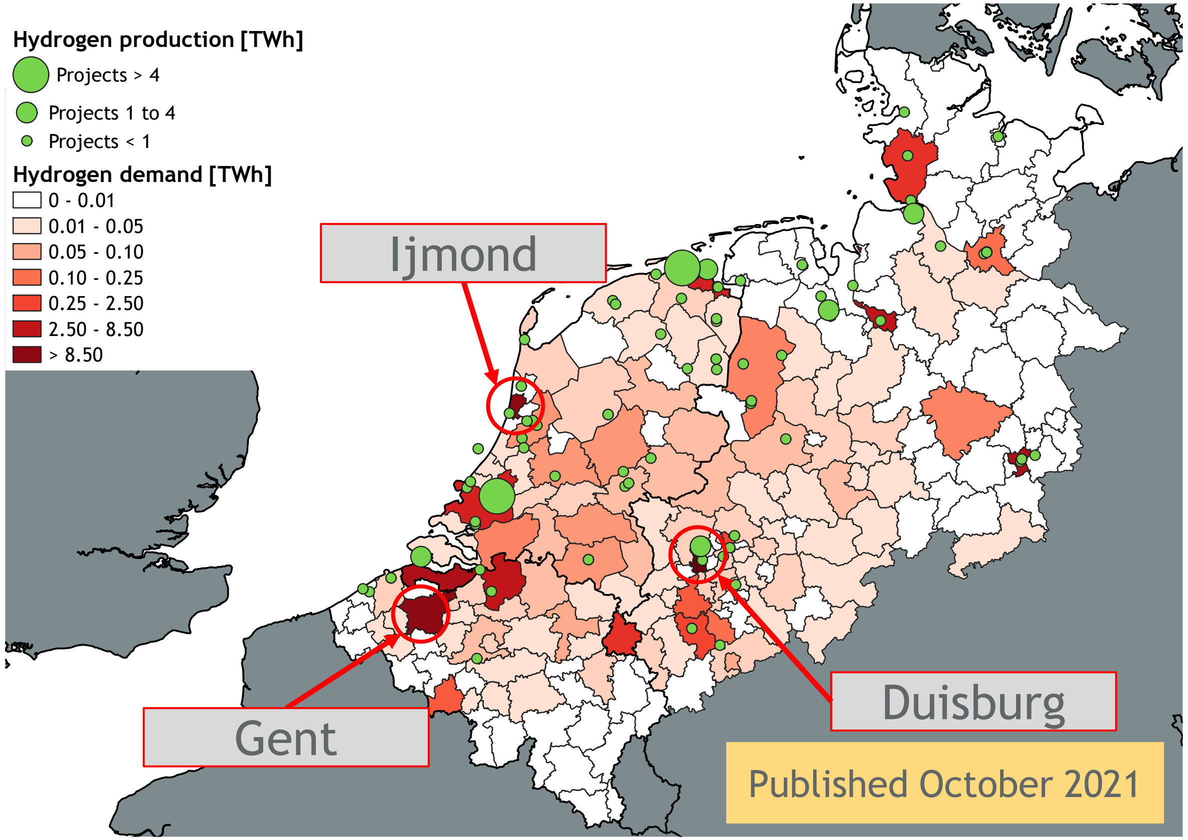


Total	39.3	TWh
green	31.1	TWh
blue	4.5	TWh
chlorine-alkali electrolysis	3.7	TWh

- Predominantly near North sea coast & large consumers
- Largest projects along North Sea coast, due to favorable RE potentials.
  - *NortH2* (Groningen province): 11.2 TWh
  - *H-Vision* (Rotterdam): 4.2 TWh
  - *AquaVentus* (Helgoland): 2.8 TWh
- Largest domestic production site (green steel)
  - *"Grüner Wasserstoff für grünen Stahl aus Duisburg"* (Duisburg): 2 TWh

Results: hydrogen demand in 2030

H_2 production and demand by NUTS 3 regions (high demand scenario)

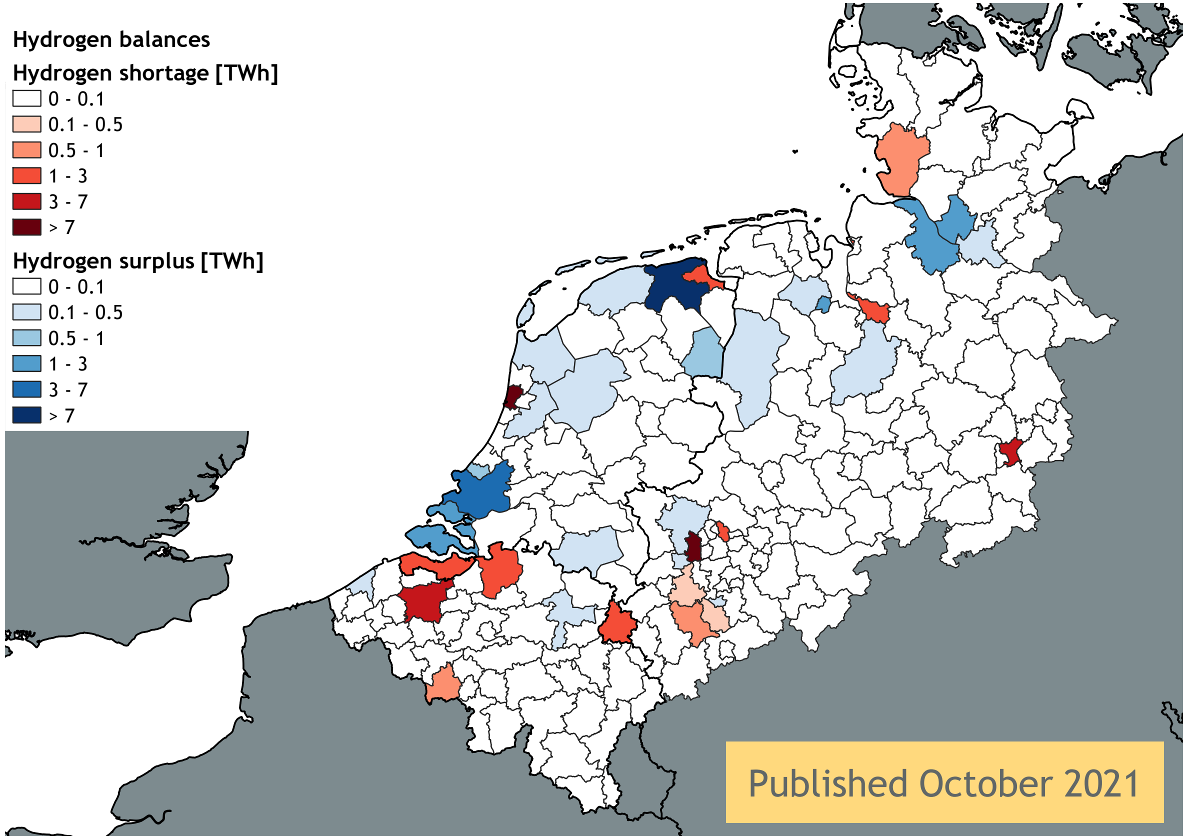


Low carbon hydrogen demand	50.2	TWh
Belgium	11.7	TWh
The Netherlands	14.6	TWh
North-west Germany	23.9	TWh

- High demand mainly in regions with
  - steel and chemical industries
  - highly populated centers
- Regions with highest demand: Duisburg, Ijmond, and Gent
- Highest demand besides steel:
  - Methanol: 1,7 TWh (Delfzijl, NL)
  - Ammonia: 2,8 TWh (Zeeuws Vlaanderen, NL)
  - Refinery: 1,6 TWh (Rotterdam, NL)

Results: hydrogen balances in 2030

Hydrogen balance by NUTS 3 regions
(high demand scenario)



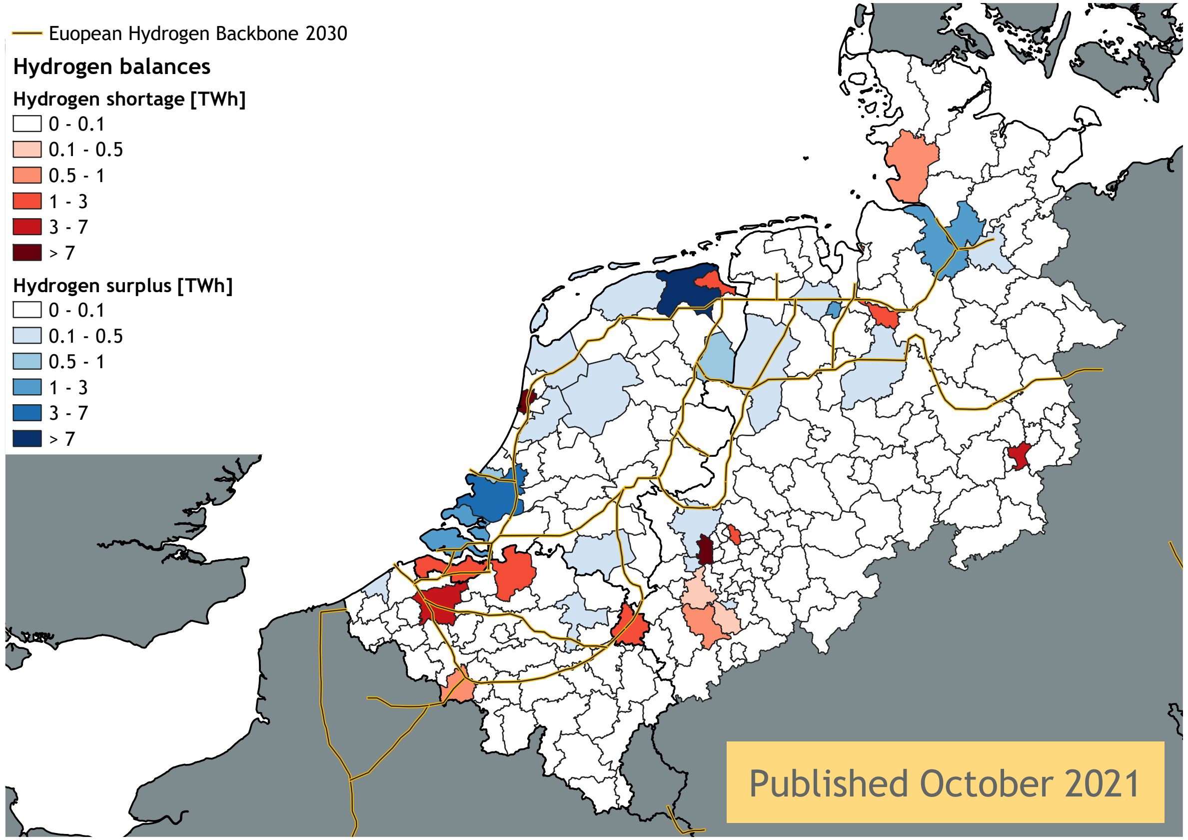
Low demand scenario	High demand scenario
Production surplus: 14 TWh	Production shortage: 11 TWh

- Regional imbalances are a result of
  - Concentrated demand of large industrial plants
  - Spatial distance of industry and RE potential

- Supply surpluses occur in RE-favorable locations (often near the coast), e.g.
  - Groningen: 15.5 TWh
  - Groot-Rijnmoond: 3.8 TWh
  - Pinneberg: 2.8 TWh

Results: hydrogen infrastructure in 2030

Potential hydrogen network 2030 at NUTS 3 level



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Future H_2 network

- Mainly conversion of existing gas network
- Use of existing pipeline interconnection between ports and industrial sites

Drivers of infrastructure expansion

- Regional **imbalances must be compensated** to supply the industries
- Expansion of the transnational hydrogen network is initially **driven by large-scale consumers** from industry

Encountering uncertainties

- Few producers feed small quantities of H_2 at the beginning, **uncertainties in financing by few users**
- Discontinuous production requires **storage to ensure supply**

Implications - close the hydrogen gap

Specific measures

- Development of storage capacities
- H_2 supply depends on actual implementation of projects
  - Prevent uncertainties by promoting projects
  - Provide incentives for additional hydrogen production
- Promote strategies and networks for H2 imports into the region

Overarching measures

- Reducing uncertainties
  - Clear transnational regulations could strengthen cross-regional cooperation
  - Support for projects is needed in the short term, but should not distort the developing market
- Research as a pillar of transformation
  - Many open questions still require further research
  - Building public databases and statistics facilitates research

EWI (2021) Hydrogen cluster Belgium, the Netherlands, and North-Western Germany – A projection and analysis of demand and production until 2030

CONTACT DETAILS

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