

Renewable Energy and Hydrogen in the Netherlands

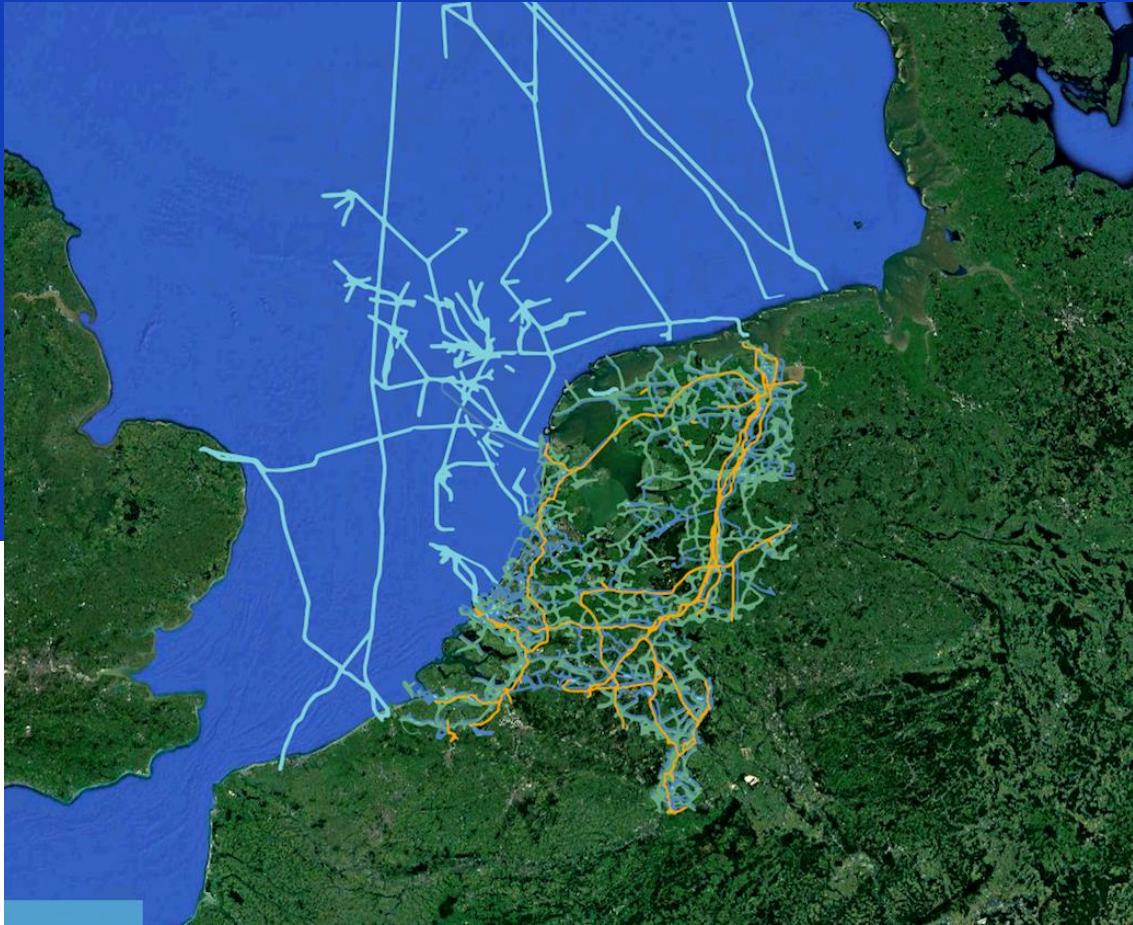
Current status overview

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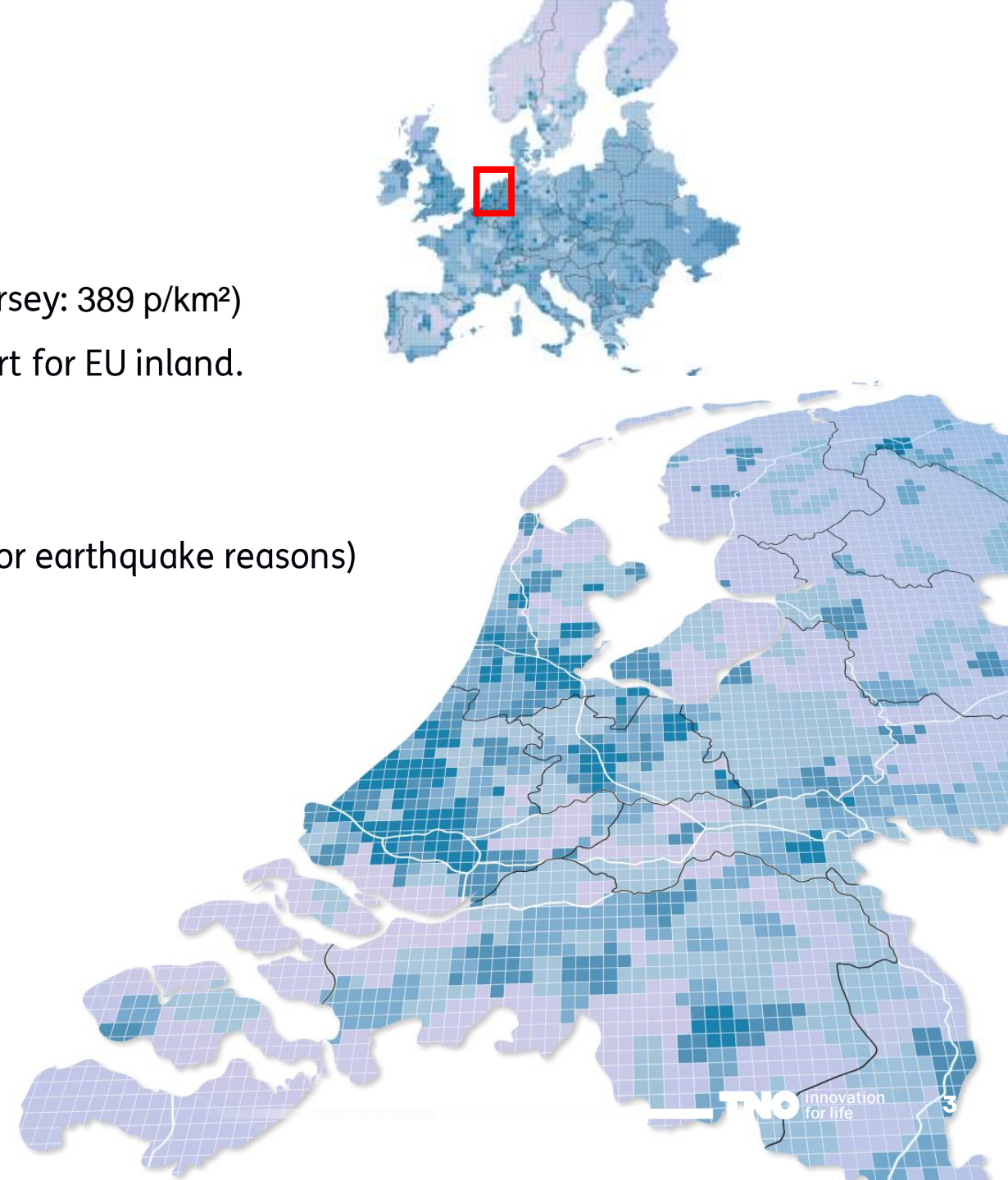
Agenda



1. Renewable energy in the Netherlands
2. Solar and Wind energy production
3. Hydrogen
4. Offshore Hydrogen
5. TNO

Renewable energy in the Netherlands

- Small and densely populated country (416 p/km²) (New Jersey: 389 p/km²)
- Heavy industry (steel, refineries, fertilizer plants etc), import for EU inland.
- Since the 60's, highly dependent on oil and gas. Yet now:
 - Less domestic production (large Groningen field closed for earthquake reasons)
 - Import restrictions from Russia
- Focus for new energy carriers:
 - Residual biomass (rely on import)
 - The North Sea
 - Offshore wind
 - Offshore solar
 - CO₂ storage



Solar and Wind energy production

Onshore solar: Recent growth of 4 GW/year (2022)

Offshore solar: 3 GWp in 2030



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Offshore solar:	3 GWp in 2030
Onshore wind:	6.5 GW in 2023
Offshore wind:	4.6 GW in 2023 21 GW in 2030, 50 GW in 2040, 70 in 2050

Windenergie op zee

met kabelroutes van het net op zee



Solar and Wind energy production

Onshore solar: Recent growth of 4 GW/year (2022)

Offshore solar: 3 GWp in 2030

Onshore wind: 6.5 GW in 2023

Offshore wind: 4.6 GW in 2023

21 GW in 2030, 50 GW in 2040, 70 in 2050

Most recent tender: Hollandse Kust West, 2x0.7GW, incl. system integration:

Current tender: IJmuiden Ver – 2x2 GW, incl focus on system integration:

- Investments in offshore solar energy – up to 50 MWp
- Investments in new electricity demand (with geographical scope) operational at times of high OWF output, up to 1 GW
- operational in 2028/2029

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Hydrogen

Onshore

- 7 IPCEI projects (1,15 GW) (currently 1 FID voor 0.2 GW)
- 2 projects in SDE++; 2 x 25 MW by H2Volt.
- H2Hollandia (Solar + electrolysis: 5 MW).
- HYGRO project (direct coupling between wind turbine and electrolyzer, complete value chain).

Offshore

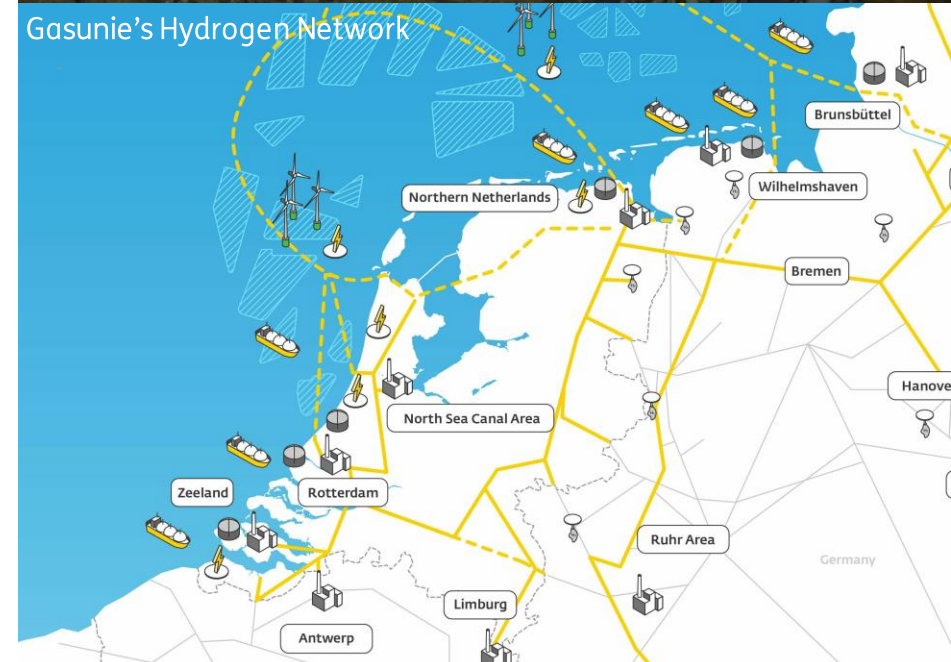
- <100 MW (2028)
- 500 MW (2031)
- Smaller pilots (Poshydon)

Consumers

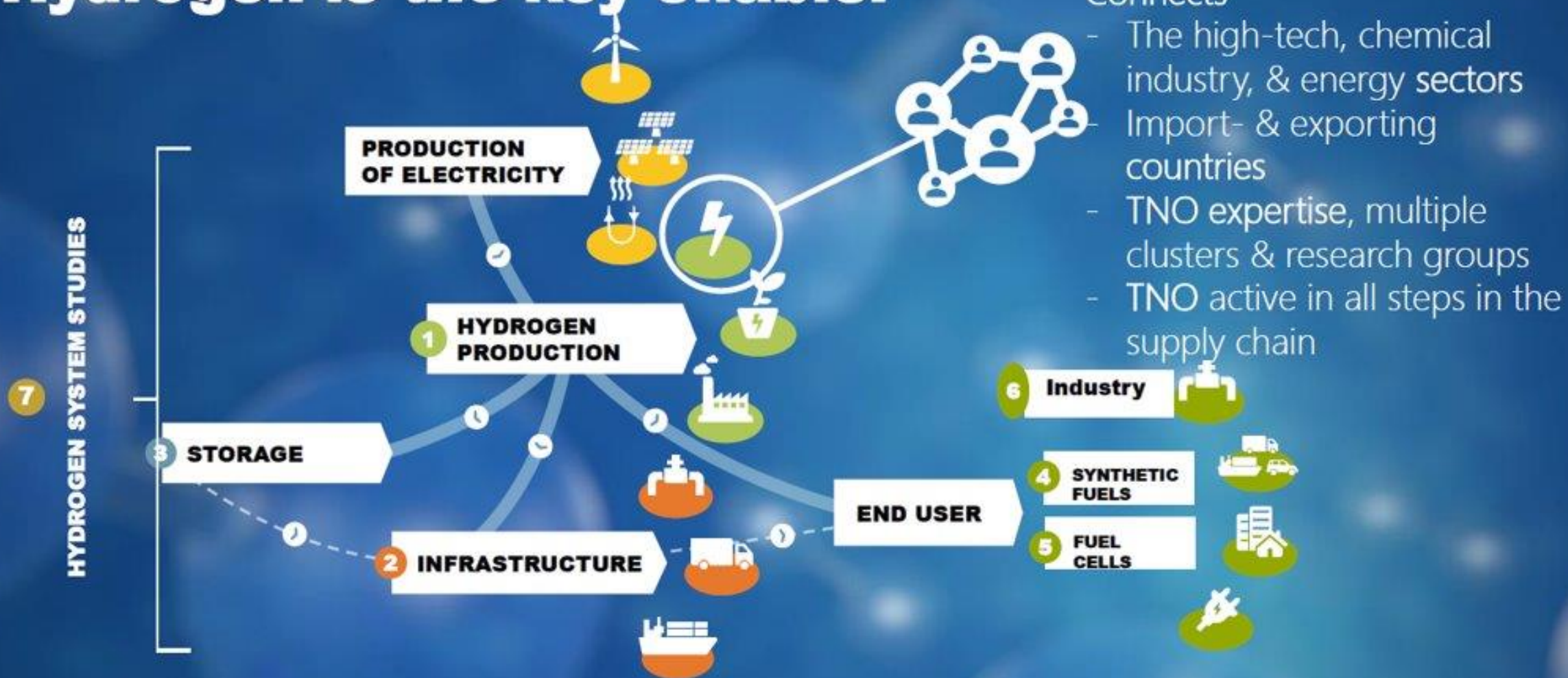
- Refineries (Shell, BP, Exxon)
- Fertilizer plants (OCI, YARA)
- Tata Steel (DRI)

Transport and Storage

- Hydrogen backbone
- (Zuidwending, 4 salt caverns)



> Hydrogen is *the* key enabler



TNO and H2 system integration

Technology development (examples):

- Faraday Lab – Electrolyzer scale up, with industriële partners
- SwitchLab – small scale system integration demonstrator lab - Wind / solar / Hydrogen / batteries

Pilots and multi-stakeholder projects (examples):

- Poshydron (offshore H2 production)
- North Sea Energy (offshore system integration)
- Offshore Solar (floating solar in sea conditions)
- Energy system modelling (energy based / physics based)
- Storage (H2 in salt caverns and reservoirs, but also NG and CO2)

Knowledge sharing platforms (together with Dutch Ministry):

- HEROW (offshore hydrogen production)
- SHIP NL (hydrogen import)





We need to work on this jointly

Bridge the gaps between the world wide hydrogen ambitions and the current state of play.

Contact

- TNO website
 - [Innovation for life | TNO](#)
 - [System transition: to a CO2-free energy system | TNO](#)
- Project websites
 - [Poshydon | Green Hydrogen Energy](#)
 - [North Sea Energy \(north-sea-energy.eu\)](#)
 - [HEROW \(topsectorenergie.nl\)](#) (offshore hydrogen production knowledge sharing platform)
- Lennert Buijs
 - [Lennert Buijs | LinkedIn](#)

