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National and International Hydrogen Strategies

Offshore Wind & Hydrogen

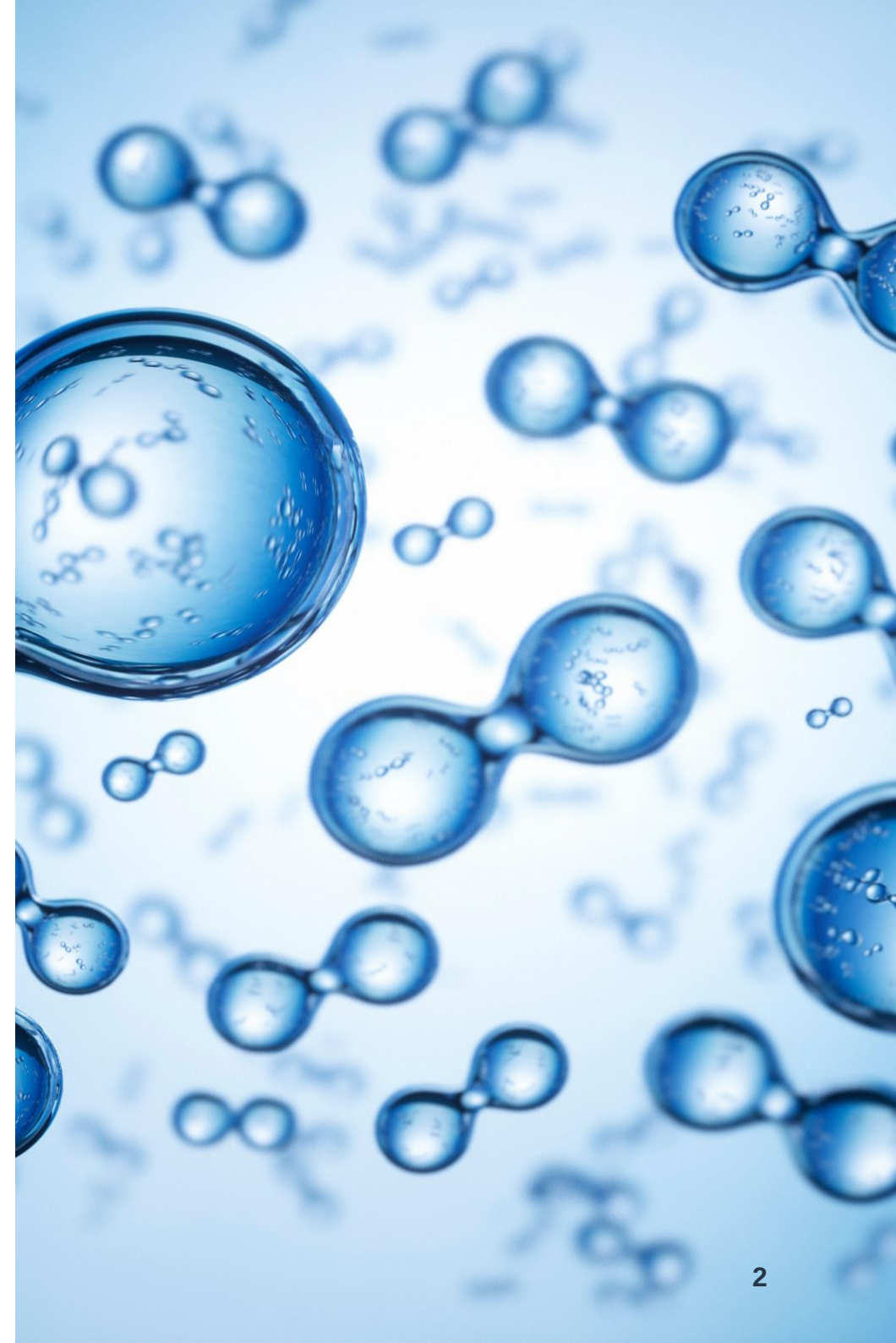
Joint Opportunities in the North Sea Region

June 2023 | Dr. Janina Pochhammer & Dr. Niels Lange

Hydrogen is not new

“I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable.”

Jules Verne, The Mysterious Island (1874/75)



Where we stand



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*We are on the Highway to Climate Hell
with our foot on the accelerator.*

Antonio Guterres, UN General Secretary

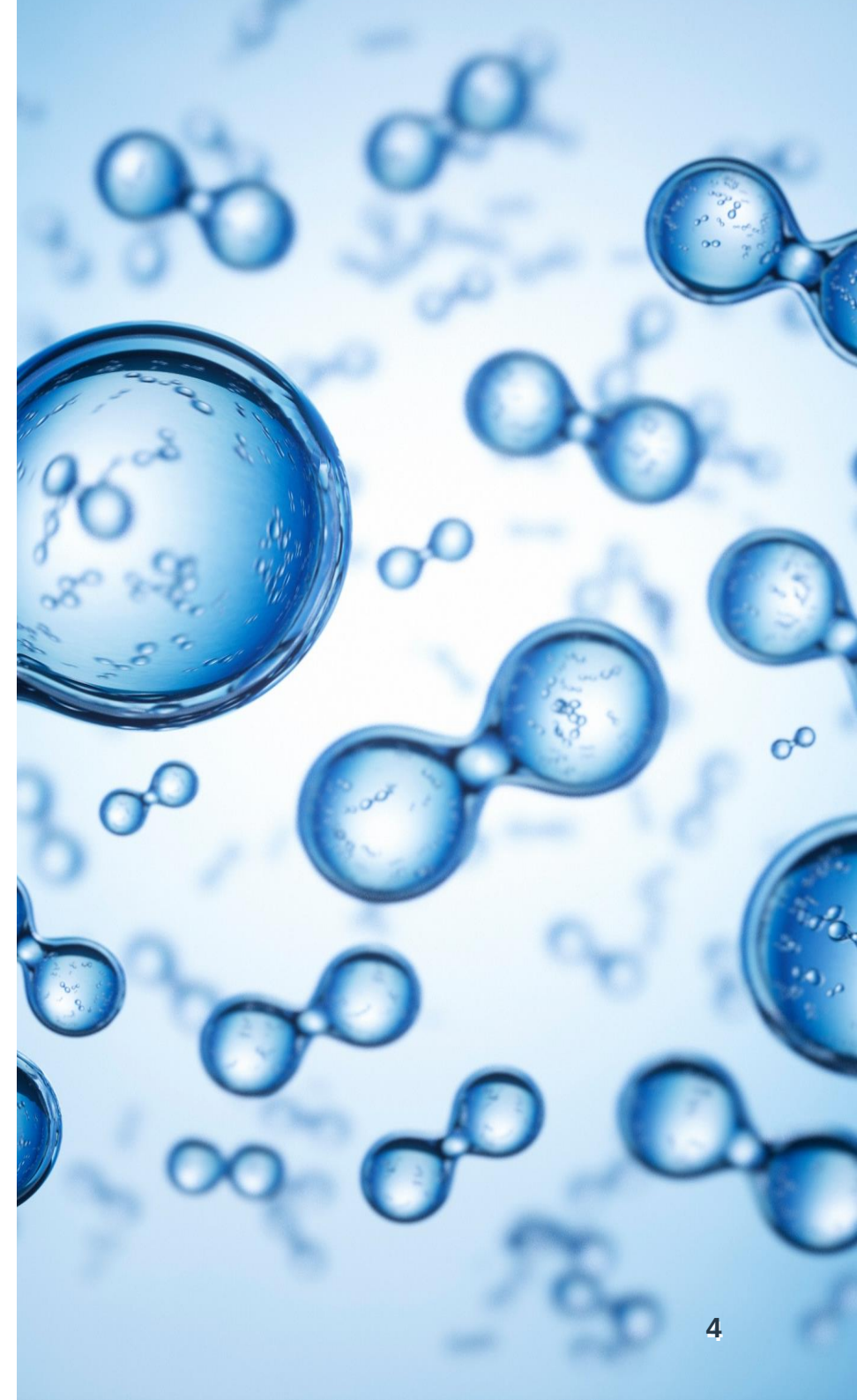
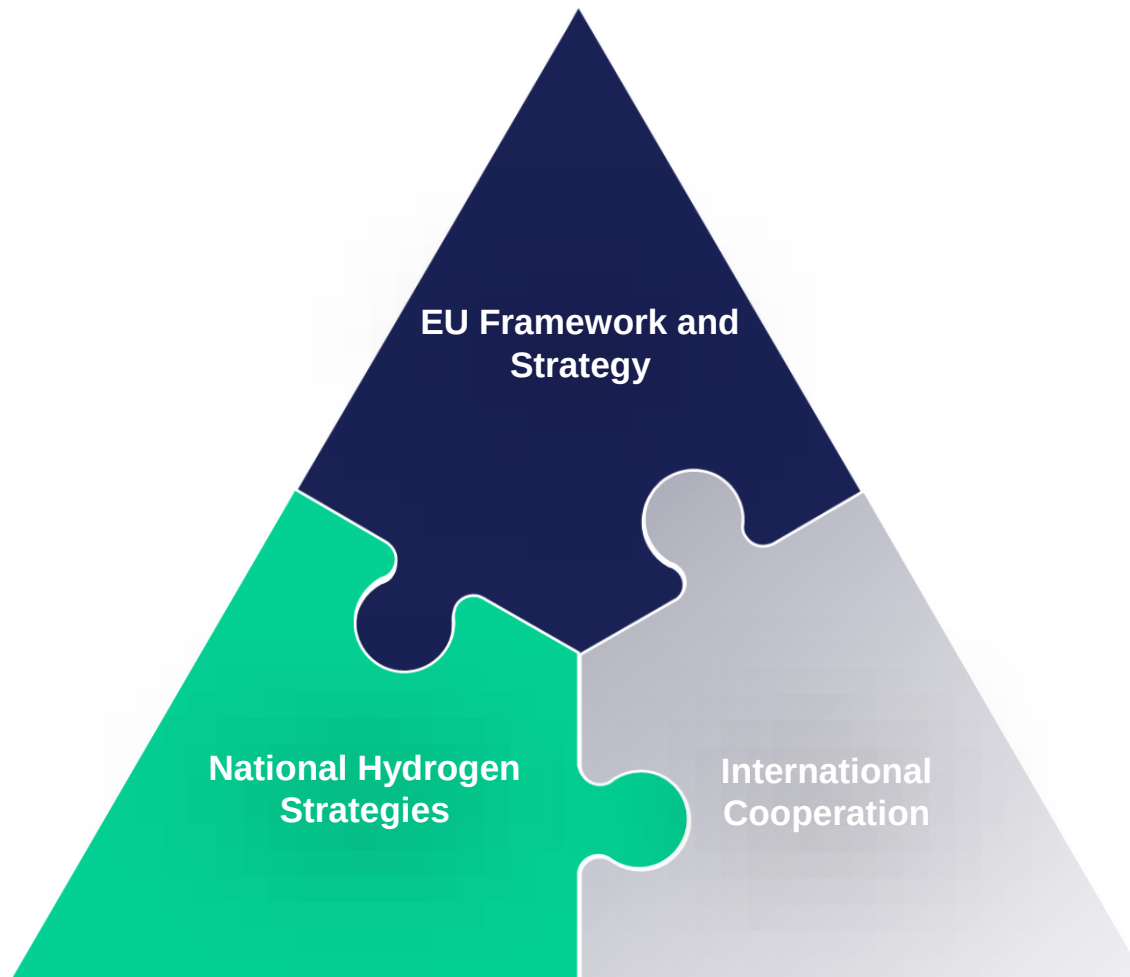


*The global fossil fuel crisis must be a
game changer. So let us not take the
'highway to hell' but let's earn the
clean ticket to heaven.*

Ursula von der Leyen, President of the European
Commission



Pieces of Hydrogen Strategies



EU Hydrogen Strategy

"Next Generation EU should invest in Hydrogen."

Ursula von der Leyen

Phase I: 2020 -2025

- | **6 GW** green hydrogen electrolyzers (=1 million tonnes of green hydrogen)
- | Replacement of existing (harmful) hydrogen production
- | Regulation for green hydrogen markets
- | Planning of hydrogen infrastructure

Phase II: 2025-2030

- | **40 GW** green hydrogen electrolyzers (=10 million tonnes of green hydrogen)
- | Green hydrogen becomes relatively more competitive
- | Opening up of areas of application in industry and mobility
- | Planning of a Europe-wide pipeline network

Phase III: 2030-2050

- | Use of around **25% of the EU's renewable electricity to produce green hydrogen**
- | Necessary technologies will have reached market maturity

Pillars of EU Hydrogen Strategy

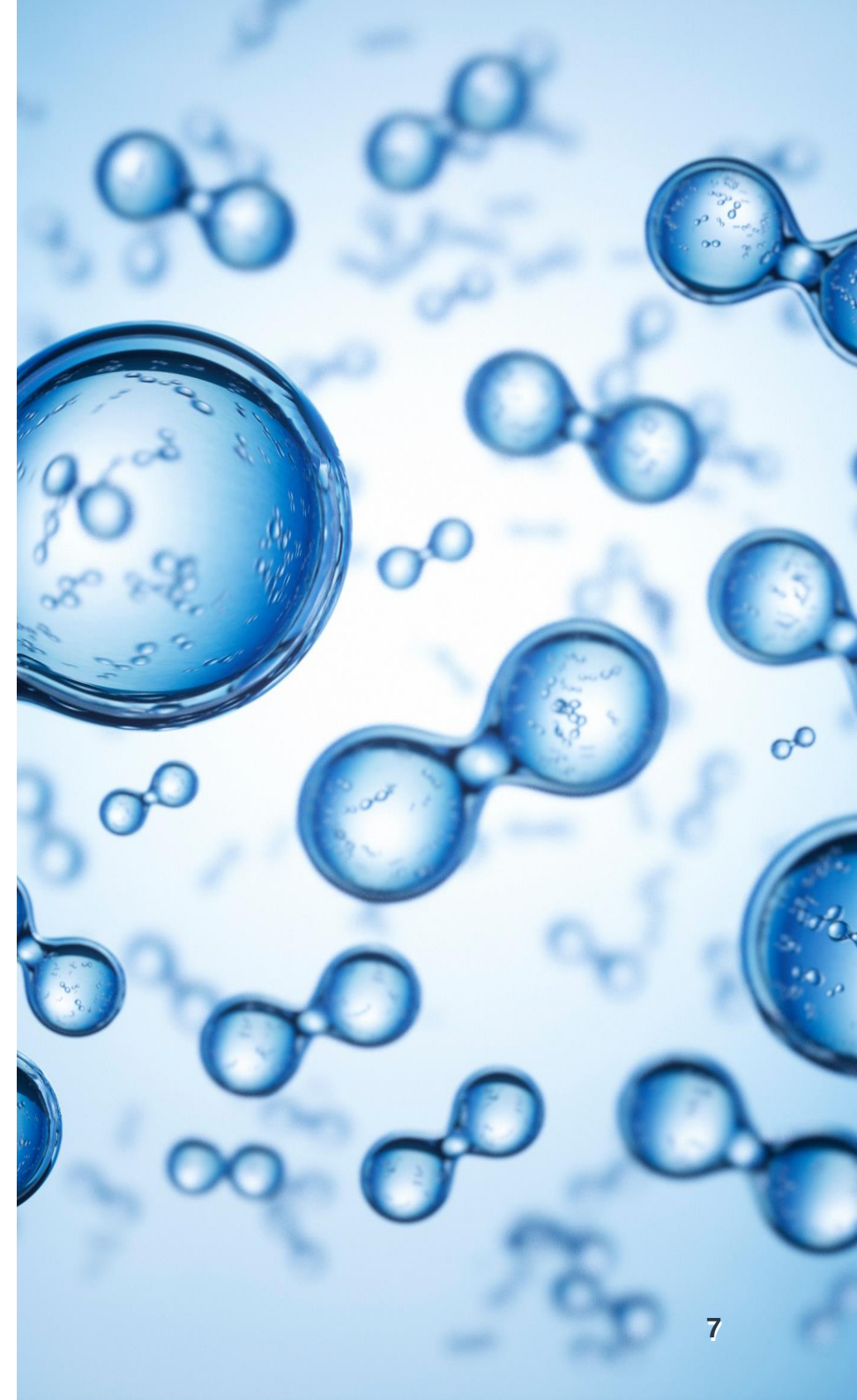
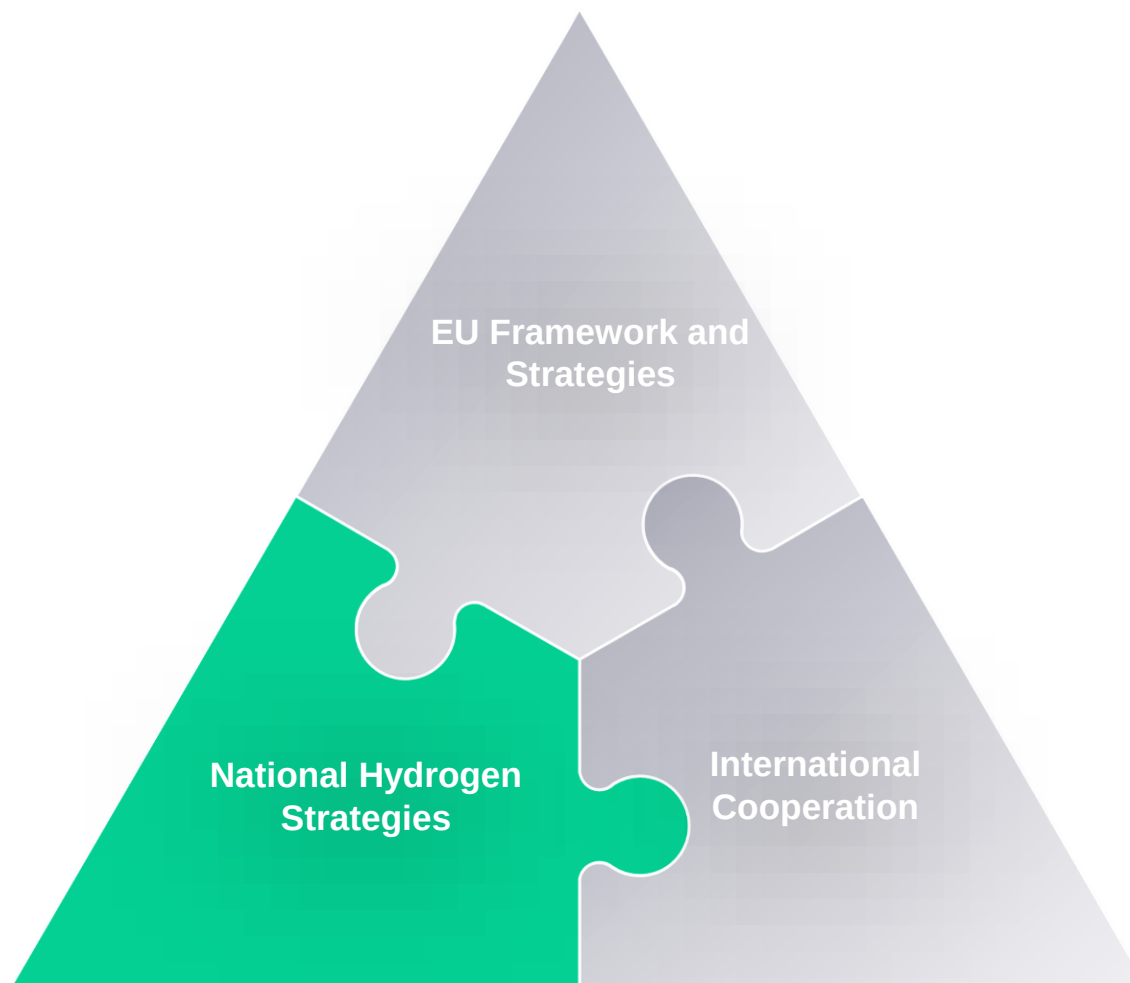
Investment agenda (subsidies, state investments, project financing)

Boosting demand for and scaling up production (establishing of European standards and framework for the production of green hydrogen)

Designing an enabling and supportive framework (planning of a Europe wide infrastructure incl. market rules)

International cooperation (developing and promoting cooperation within the EU and non-member states)

Pieces of hydrogen strategies



Germany | National hydrogen strategy

“Perhaps the most interesting energy source” – Angela Merkel, former chancellor of Germany

- National hydrogen strategy was released in June 2020 and is currently being updated
- Planned green hydrogen electrolyzers capacity: **10 GW** by 2030

Key aspects of the strategy

- Ramp-up hydrogen production and infrastructure
 - **EUR 9 bn** for ramp up of hydrogen industry
 - Align supply and demand (H2Global Foundation)
 - Transform natural gas pipeline into hydrogen pipeline
- Ramp-up of renewable energies
 - **30 GW of offshore wind energy** by 2030 (2022: 8 GW, +275%), the vast majority in the North Sea (26.4 GW)
- International cooperation
 - Cooperation with other European countries (e.g. Ostend Declaration) and non-European countries (e.g. Australia or Namibia)



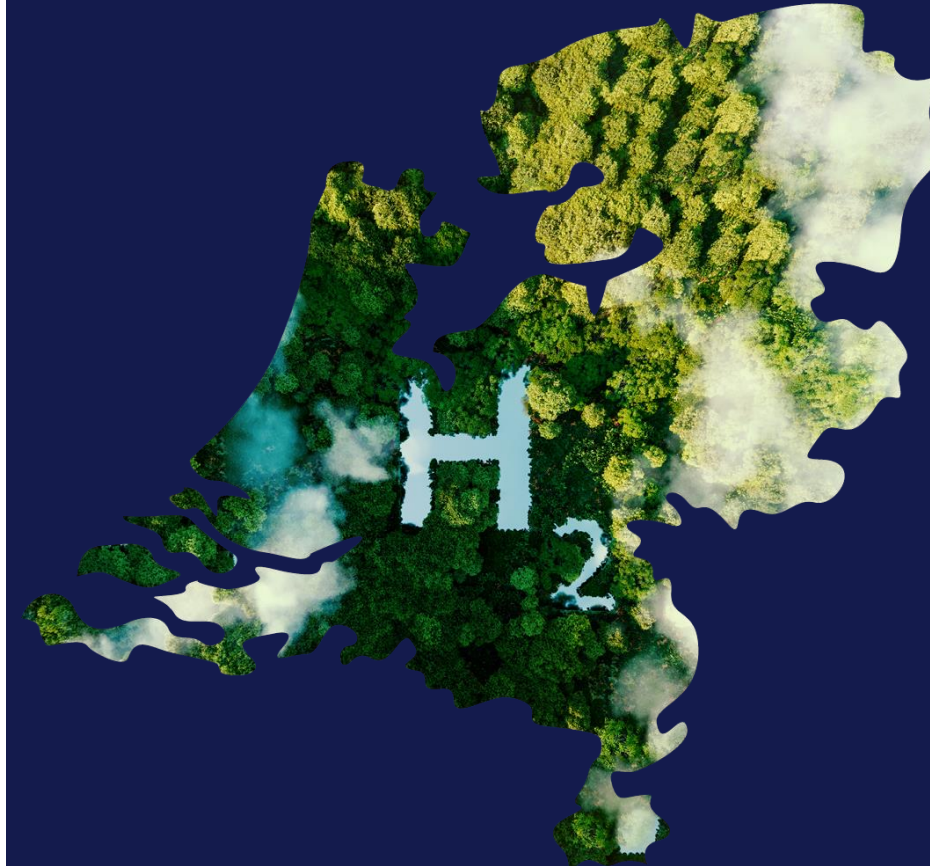
The Netherlands | National hydrogen strategy

“By significantly expanding our electricity and hydrogen network and connecting it even better to neighbouring countries, and by collaborating with countries that can supply hydrogen, electricity and hydrogen can be imported and exported more easily and we can better respond to local imbalances in demand and supply” – Rob Jetten, Minister for climate and energy

- National hydrogen strategy was released in March 2020
- Planned green hydrogen electrolyzers capacity: **4 GW** by 2030

Key aspects of the strategy

- Ramp-up hydrogen production and infrastructure
 - **EUR 7.5 bn** for ramp up of hydrogen industry
 - Transform natural gas pipeline into hydrogen pipeline
- Linking hydrogen to offshore wind energy
 - Ramp up offshore wind: **21 GW by 2030** (2022: 2.5 GW +740%)
 - Development of offshore hydrogen production (North of the Wadden Islands, 500 MW electrolysis capacity = (currently) the world largest hydrogen production project)
- The Netherlands as hydrogen hub (Port of Rotterdam as gateway for green hydrogen)



Denmark | National strategy

“We have had an economy which has been based primarily on oil but in the future, it will be based on hydrogen” – Dan Jørgensen, former Minister for Climate, Energy and Utilities

- National Power-to-X strategy (PtX) was released in December 2021
- Planned green hydrogen electrolyzers capacity: **4-6 GW** by 2030

Key aspects of the strategy

- Installation of hydrogen production and infrastructure
 - **EUR 170 mio.** for ramp up of hydrogen industry
 - Construction of hydrogen production and pipeline grid
 - Becoming a **net exporter** of green hydrogen
- Establishment of the world's first **energy islands** and offshore wind, *inter alia*, in the North Sea with 3 GW installed capacity by 2030 (VindØ)



Joint Opportunities in the North Sea Region

“Together with our partner countries, we can expand offshore wind energy in the North Sea region even faster and more efficiently and tap new potential for green hydrogen” – Robert Habeck, Vice-Chancellor of Germany

- Hydrogen has a major role in achieving the climate goals and tackling climate change
- The hydrogen industry is just at the beginning and significant growth can be expected
- A significant part will take place in the North Sea region
 - 75% of the current green hydrogen projects concentrate around the North Sea
 - Offshore wind ramp up: **120 GW by 2030** (2022: 30 GW, +300%)
 - Green hydrogen production: ~3.7 million tonnes by 2030 (corresponds to about 40 % of the European production of green hydrogen)
 - Hydrogen Valley

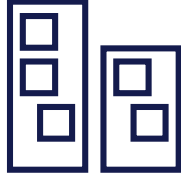


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