

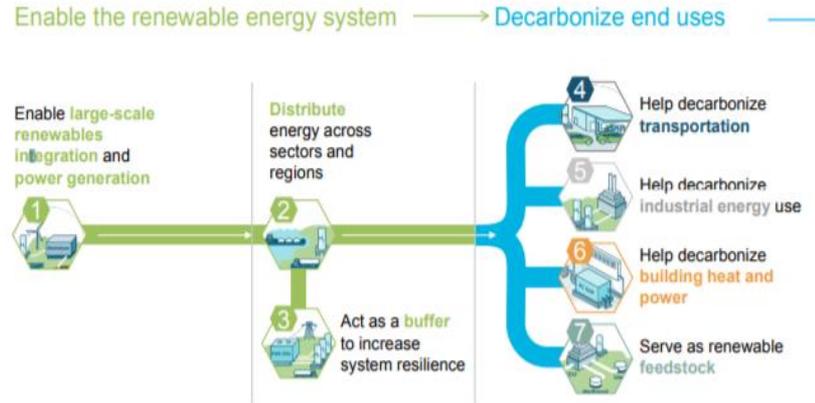
A wide-angle photograph of the TU Delft amphitheater. The foreground is filled with people sitting on the concrete steps. In the background, a large, cylindrical concrete tower with a metal lattice structure on top stands against a clear blue sky. To the right, a modern building and green trees are visible. The scene is bright and sunny.

# 'Missing links' to realize a Dutch hydrogen economy

19-11-2020

Prof. Dr. Ad van Wijk

# Hydrogen, key for a sustainable energy system

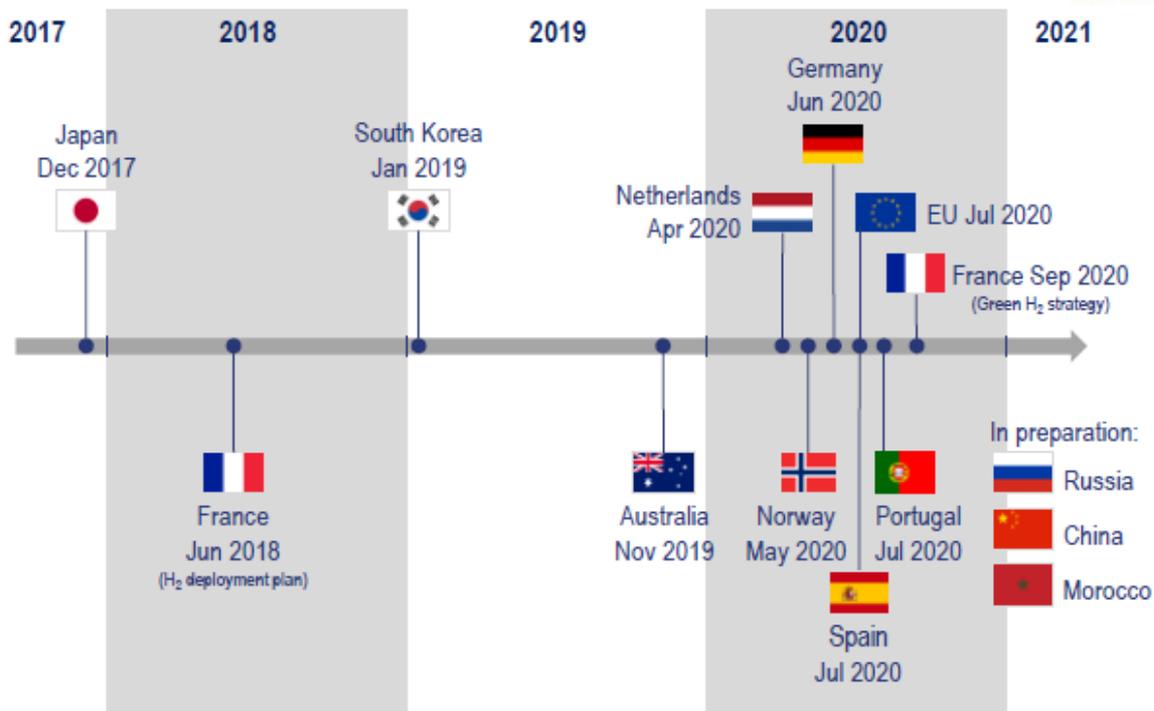


SOURCE: Hydrogen Council

Hydrogen has a systemic role to play as a carbon free energy carrier and commodity

- Hydrogen can be transported worldwide by ship and pipeline
- Hydrogen can be stored underground in large volumes
- Hydrogen can cost-efficiently deliver cheap renewable energy at the right time and place

Next to this systemic role, hydrogen is important to decarbonize energy use in hard to abate sectors



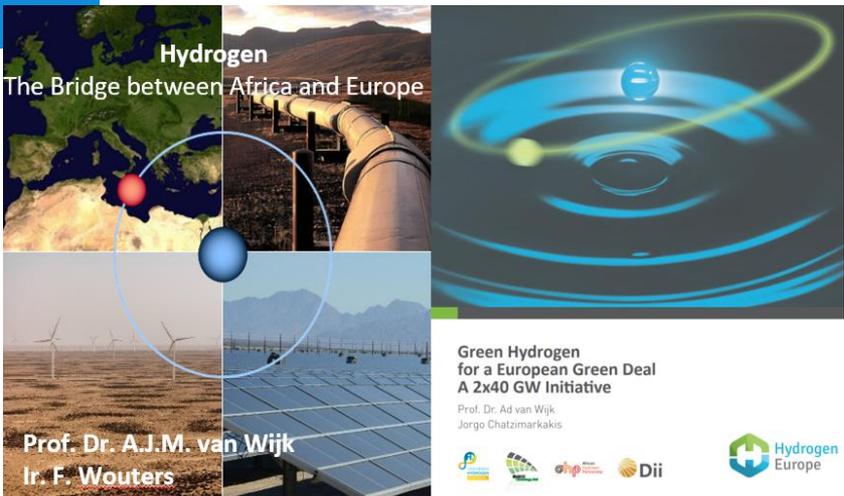
© World Energy Council – Germany | [www.weltenergierrat.de](http://www.weltenergierrat.de) | 22 September 2020

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[https://www.weltenergierrat.de/wp-content/uploads/2020/09/Presentation\\_Hydrogen-Study\\_2020-09-22\\_final\\_final.pdf](https://www.weltenergierrat.de/wp-content/uploads/2020/09/Presentation_Hydrogen-Study_2020-09-22_final_final.pdf)

# A EU Hydrogen strategy for a climate-neutral Europe

(8 July 2020)



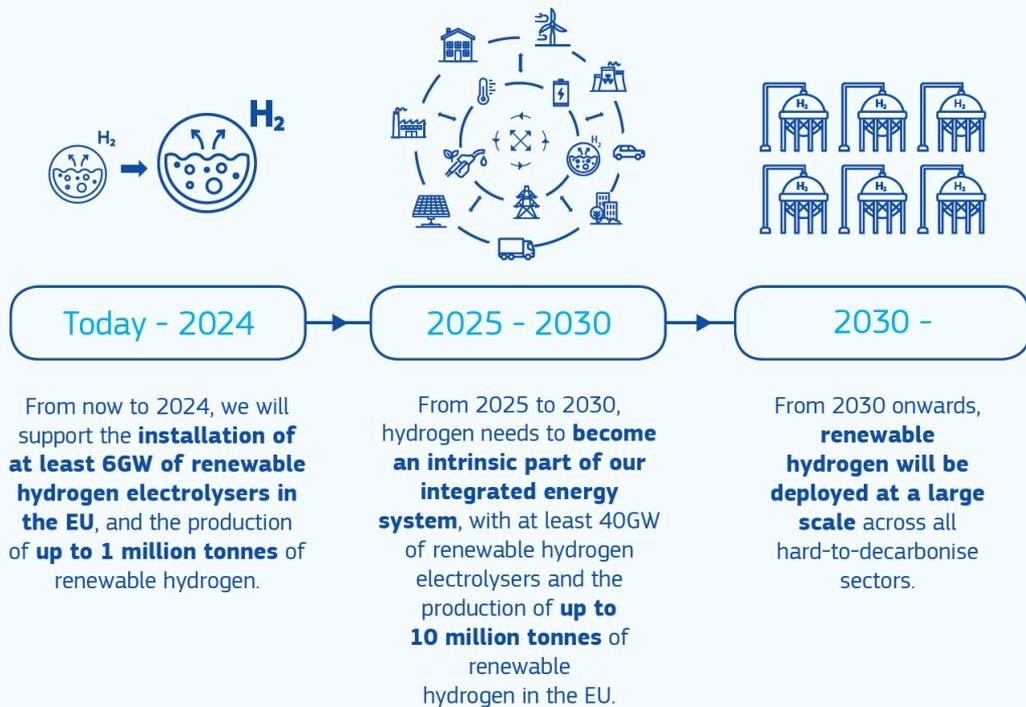
September 2019

March 2020

<http://profadvanwijk.com/hydrogen-the-bridge-between-africa-and-europe/>

[https://hydrogeneurope.eu/sites/default/files/Hydrogen%20Europe\\_2x40%20GW%20Green%20H2%20Initiative%20Paper.pdf](https://hydrogeneurope.eu/sites/default/files/Hydrogen%20Europe_2x40%20GW%20Green%20H2%20Initiative%20Paper.pdf)

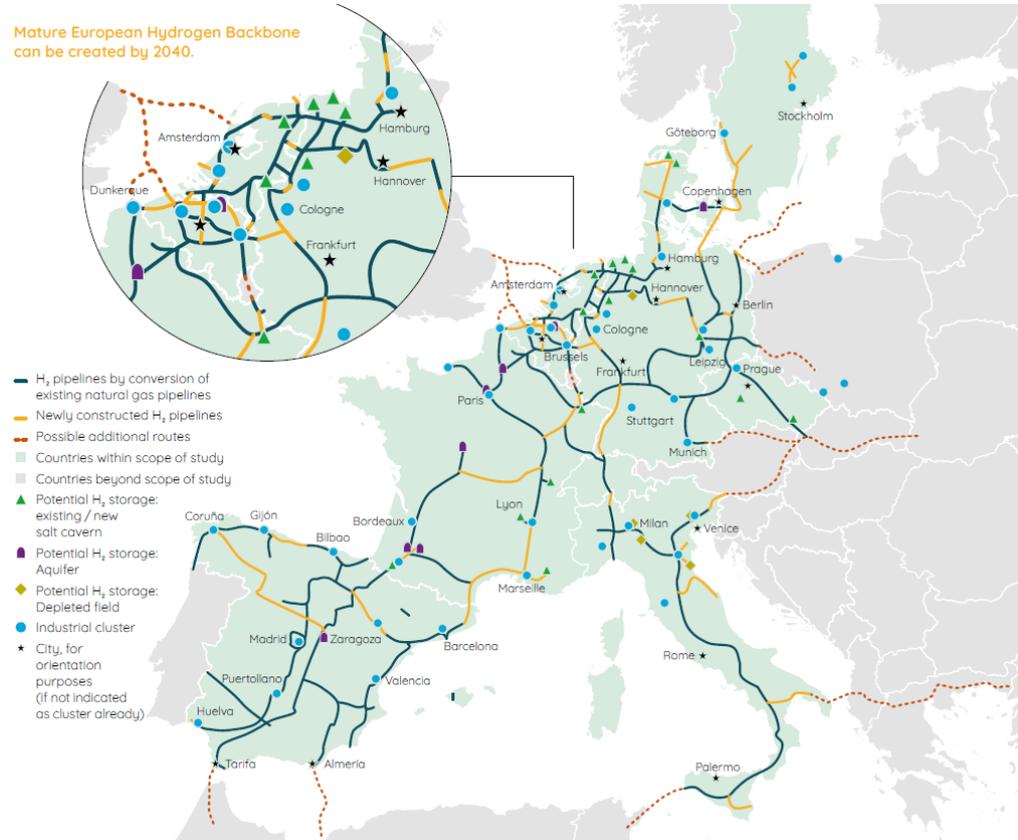
The path towards a European hydrogen eco-system step by step :



# Dutch and European Hydrogen Backbone

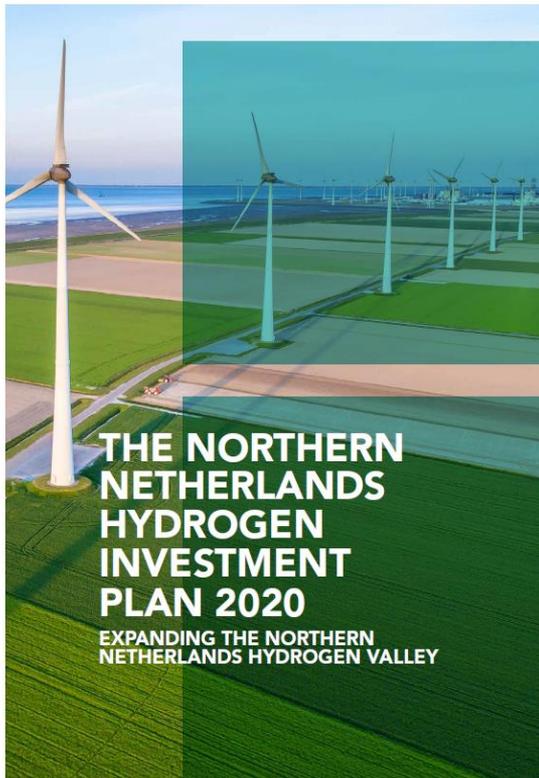


Mature European Hydrogen Backbone can be created by 2040.



[https://gasforclimate2050.eu/sdm\\_downloads/european-hydrogen-backbone/](https://gasforclimate2050.eu/sdm_downloads/european-hydrogen-backbone/)

European Hydrogen Backbone Initiative 2020, supported by Guidehouse



# THE NORTHERN NETHERLANDS HYDROGEN INVESTMENT PLAN 2020

EXPANDING THE NORTHERN NETHERLANDS HYDROGEN VALLEY

## Milestones 2030

**6 GW**

Dedicated offshore wind

**100 PJ**

Hydrogen production

**400 PJ**

Addressable hydrogen market

**>EUR 9 bn**

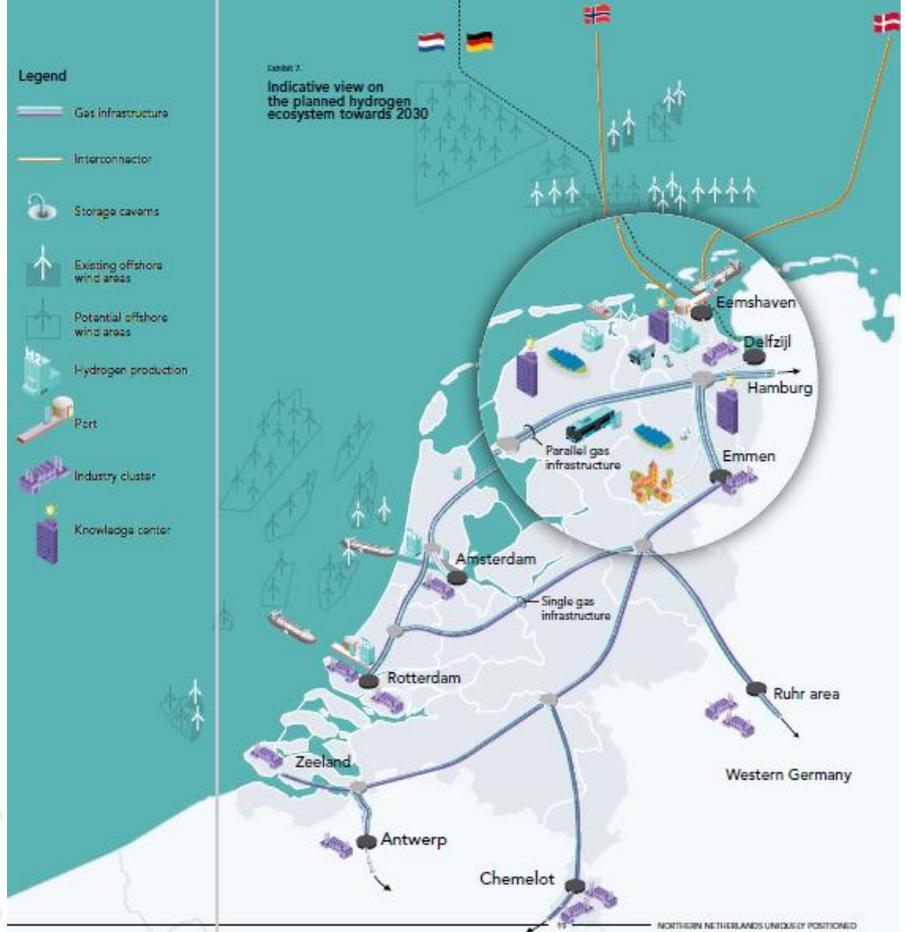
Investments

**25,000 FTE**

Job creation

Source: Northern Netherlands Hydrogen Coalition

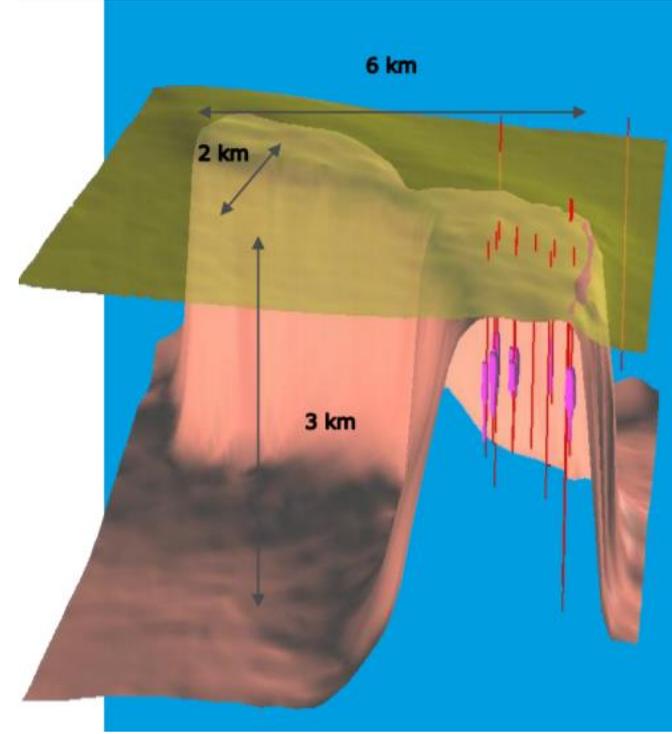
<https://www.mijntoekomstiswaterstof.nl/app/uploads/2020/10/investment-plan-hydrogen-northern-netherlands-2020.pdf>



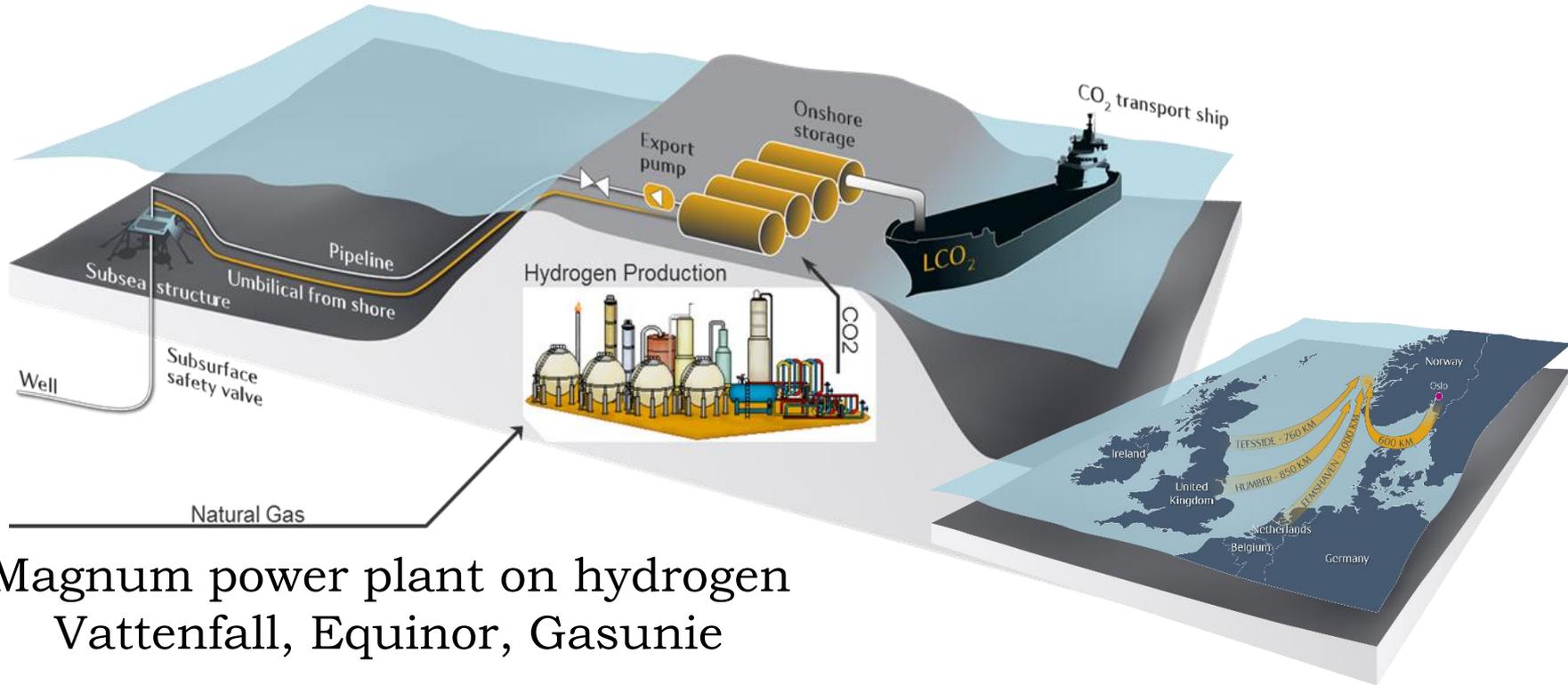
# Groningen-Zuidwending

## hydrogen storage in salt caverns

first cavern ready 2025, 5.000 ton hydrogen storage



# Gas-Hydrogen production with CO<sub>2</sub> storage in Smeaheia field



Magnum power plant on hydrogen  
Vattenfall, Equinor, Gasunie

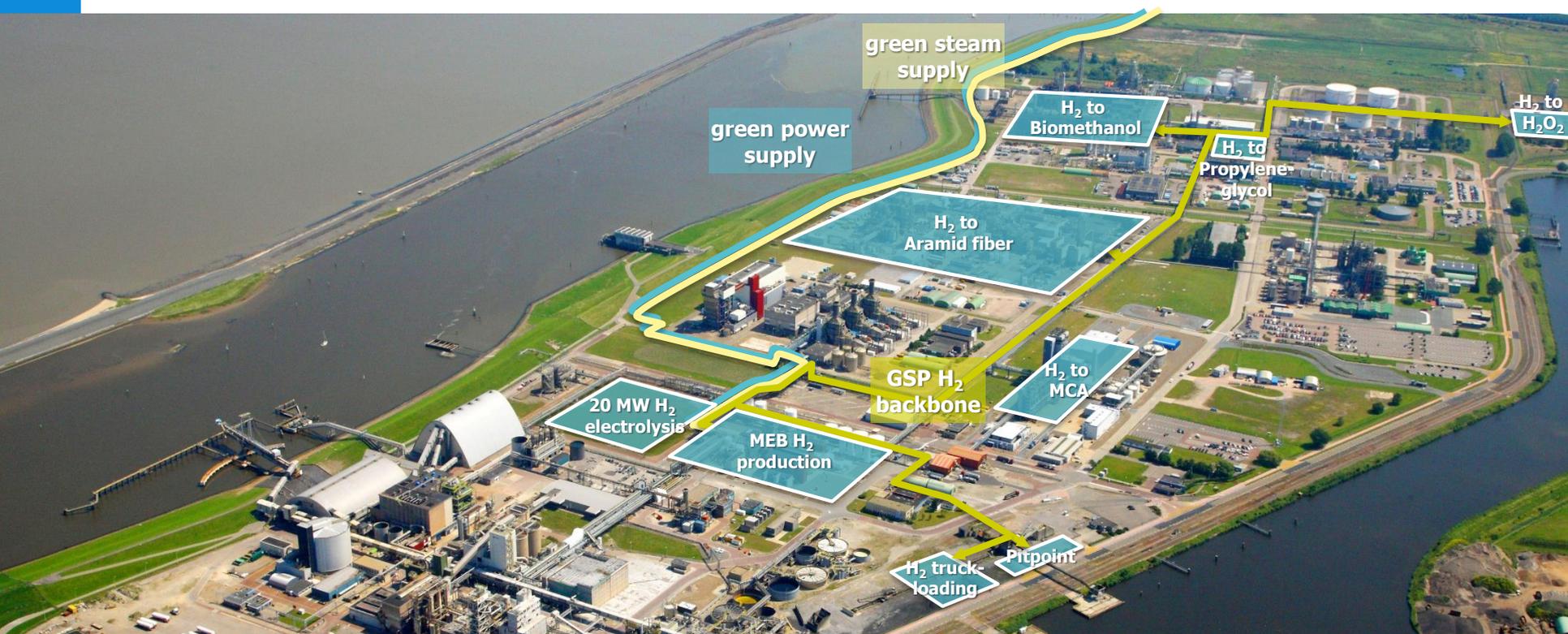
# Shell, Gasunie, Groningen Seaports 10.000 MW offshore wind-hydrogen



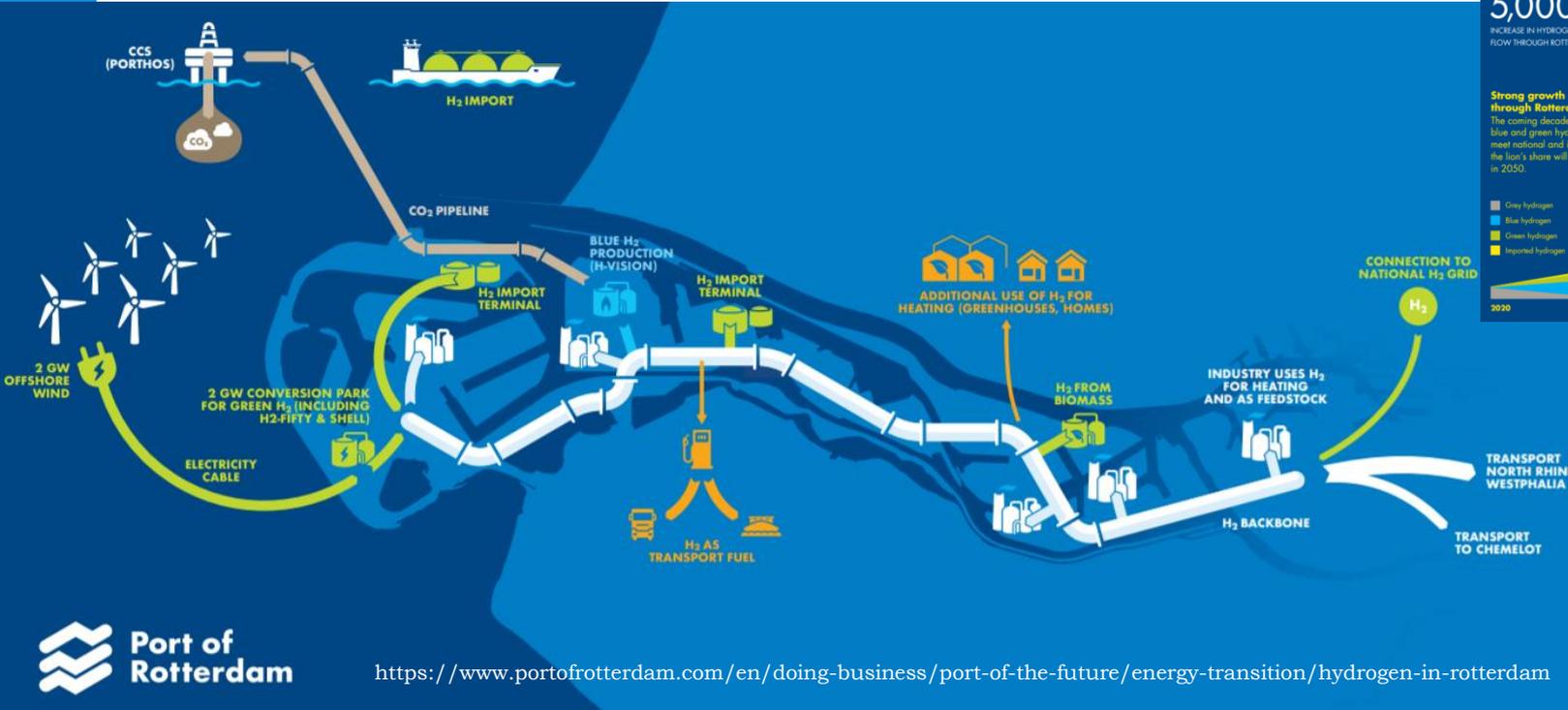
**NorthH<sub>2</sub>**

Launched Febr. 2020

# Delfzijl: A green hydrogen chain in the making



# Hydrogen Port of Rotterdam



# Green Flamingo project; import-export hydrogen in Europe



## Portuguese government confirms world record solar price of \$0.01316/kWh

The Portuguese government has revealed some of the preliminary results of the national solar auction which closed on Tuesday. Antonio Delgado Rígal, chief executive of energy forecasting service Aleasoft, said that the 15-year contracts awarded in the auction were the key to understanding the reason of such a low price. This, combined with the rights for land and grid connection guaranteed by the auction, makes attractive bidding at low prices.

AUGUST 27, 2020 **EMILIANO BELLINI**

## Netherlands: Ministers sign MoU on import green hydrogen from Portugal



# Hydrogen Applications accelerating



New-Holland: Tractor, diesel+H<sub>2</sub> (2-10-2020)



Airbus: Airplane, LH<sub>2</sub>+Gasturbine (21-9-2020)



Bosch: Hydrogen ready boiler (15-11-2019)



Home fuel cell system, electricity and heat  
Panasonic: Japan > 300.000 sold

# Missing links in the Netherlands

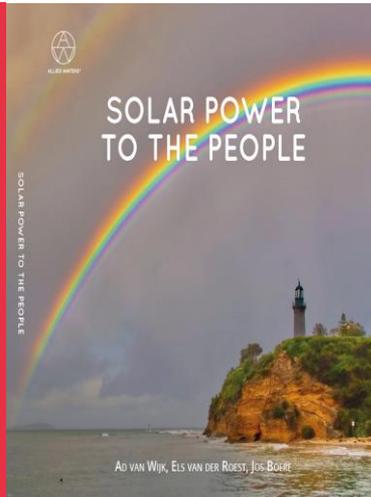
- Robust financial framework to stimulate hydrogen production
- 10 GW wind offshore-hydrogen production target for 2030
- Quota for hydrogen use in chemical, steel, transport fuels, gas, etc.
- Hydrogen import and export policy with bi-lateral agreements
- Coordinated plan to convert all gas infrastructure into hydrogen  
(transport and distribution pipelines, storage system, import/export port facilities, etc.)
- **But above all national coordination and direction**

# Further reading about hydrogen

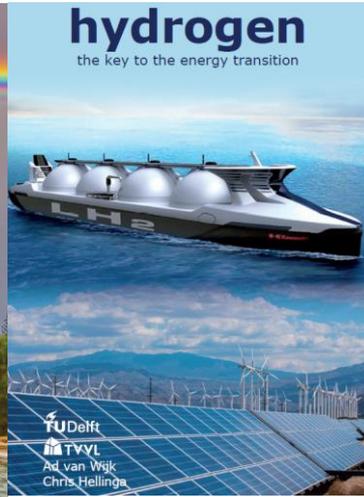
[www.profadvanwijk.com](http://www.profadvanwijk.com)



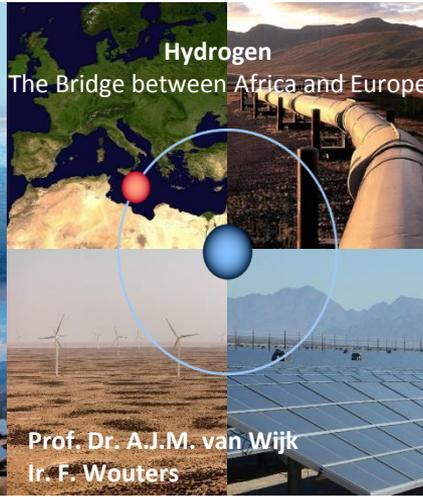
April 2017



November 2017



May 2018



September 2019



April 2020