

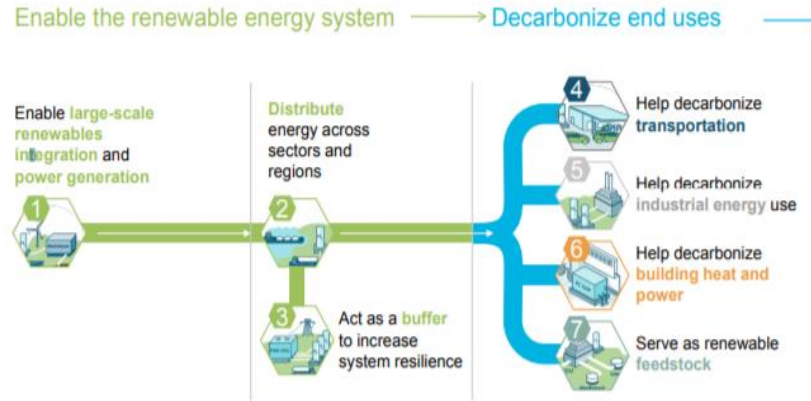


‘Missing links’ to realize a Dutch hydrogen economy

19-11-2020

Prof. Dr. Ad van Wijk

Hydrogen, key for a sustainable energy system

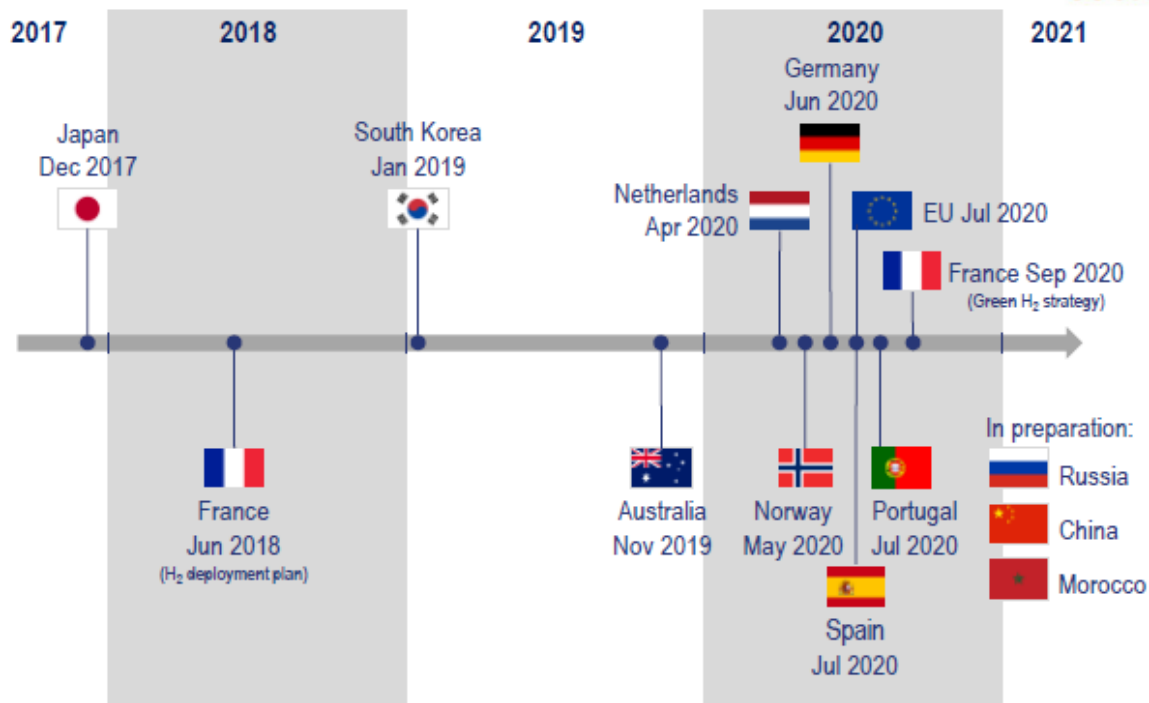


SOURCE: Hydrogen Council

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



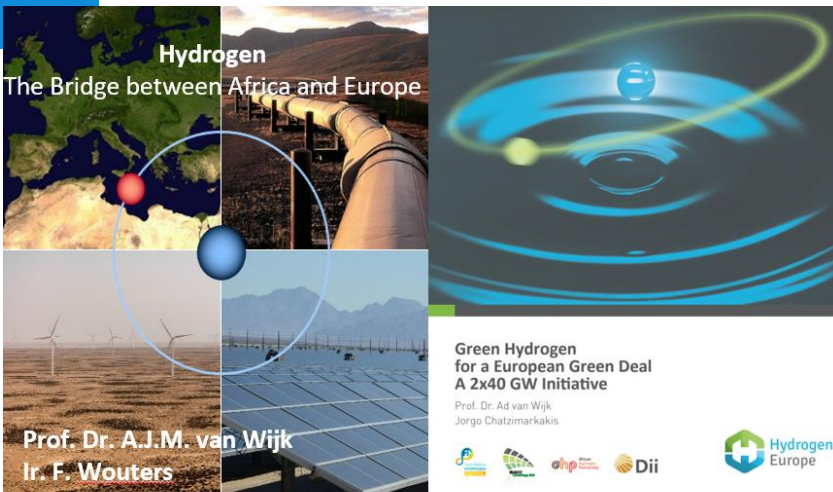
© World Energy Council – Germany | www.weltenergierrat.de | 22 September 2020

4

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)



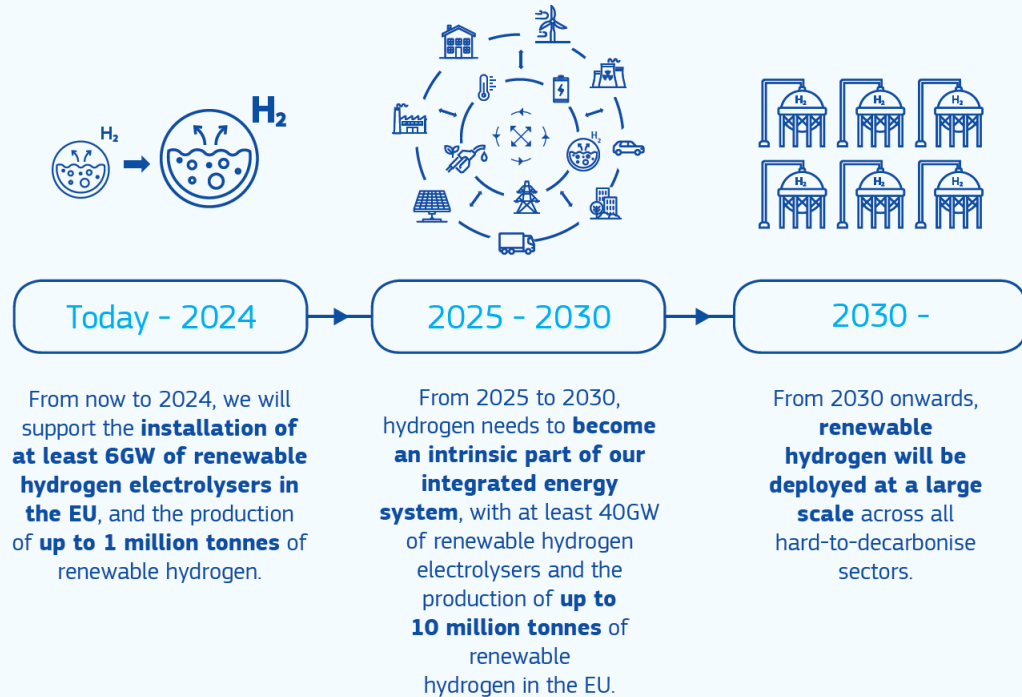
September 2019

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

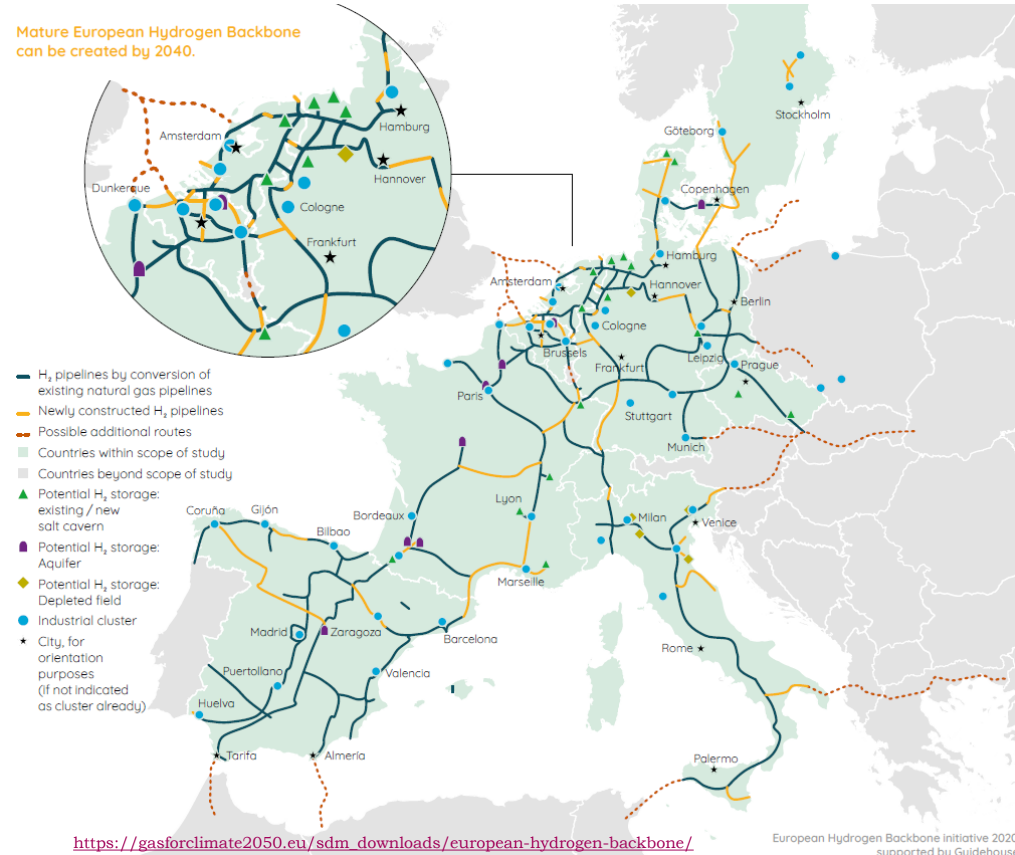
The path towards a European hydrogen eco-system step by step :



Dutch and European Hydrogen Backbone

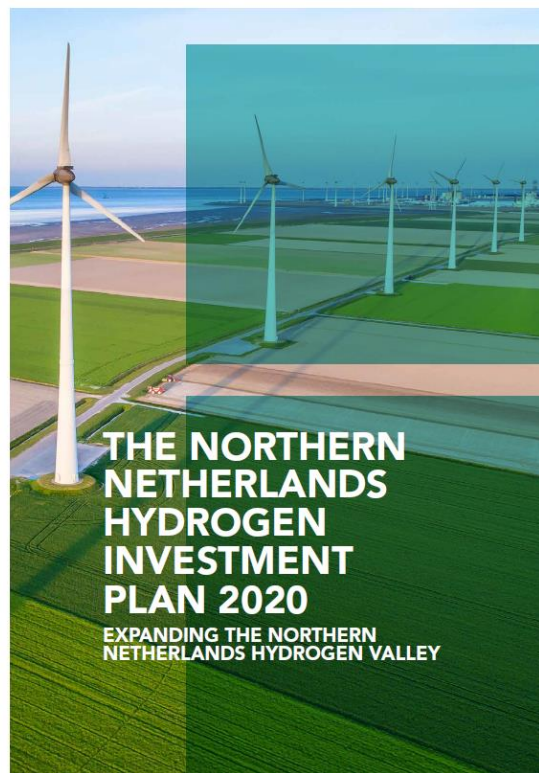


Mature European Hydrogen Backbone can be created by 2040.



https://gasforclimate2050.eu/sdm_downloads/european-hydrogen-backbone/

European Hydrogen Backbone Initiative 2020, supported by Guidehouse

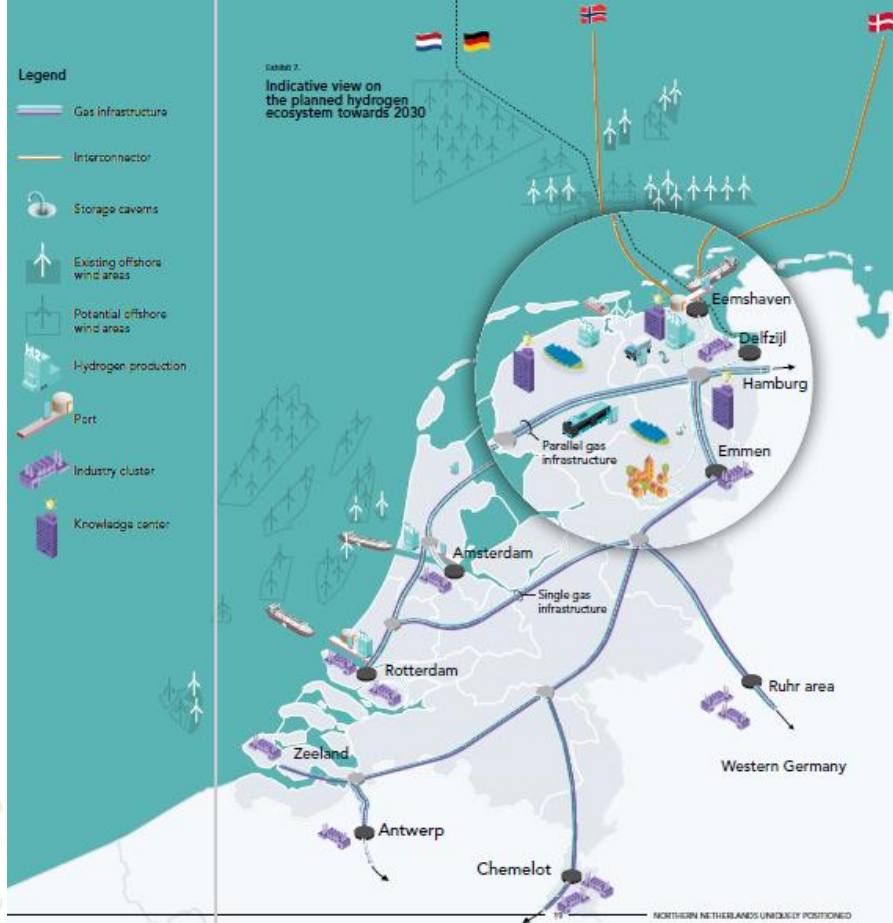


Milestones 2030

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

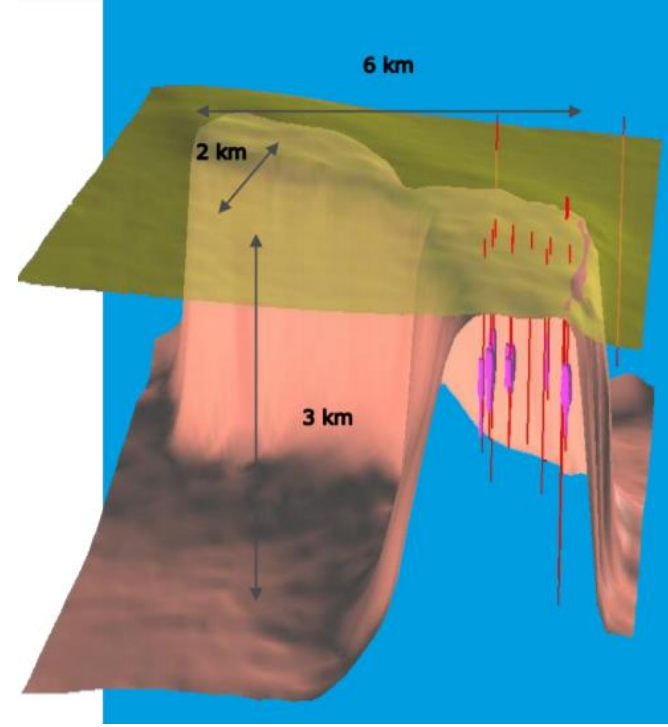
<https://www.mijntoekomstiswaterstof.nl/app/uploads/2020/10/investment-plan-hydrogen-northern-netherlands-2020.pdf>



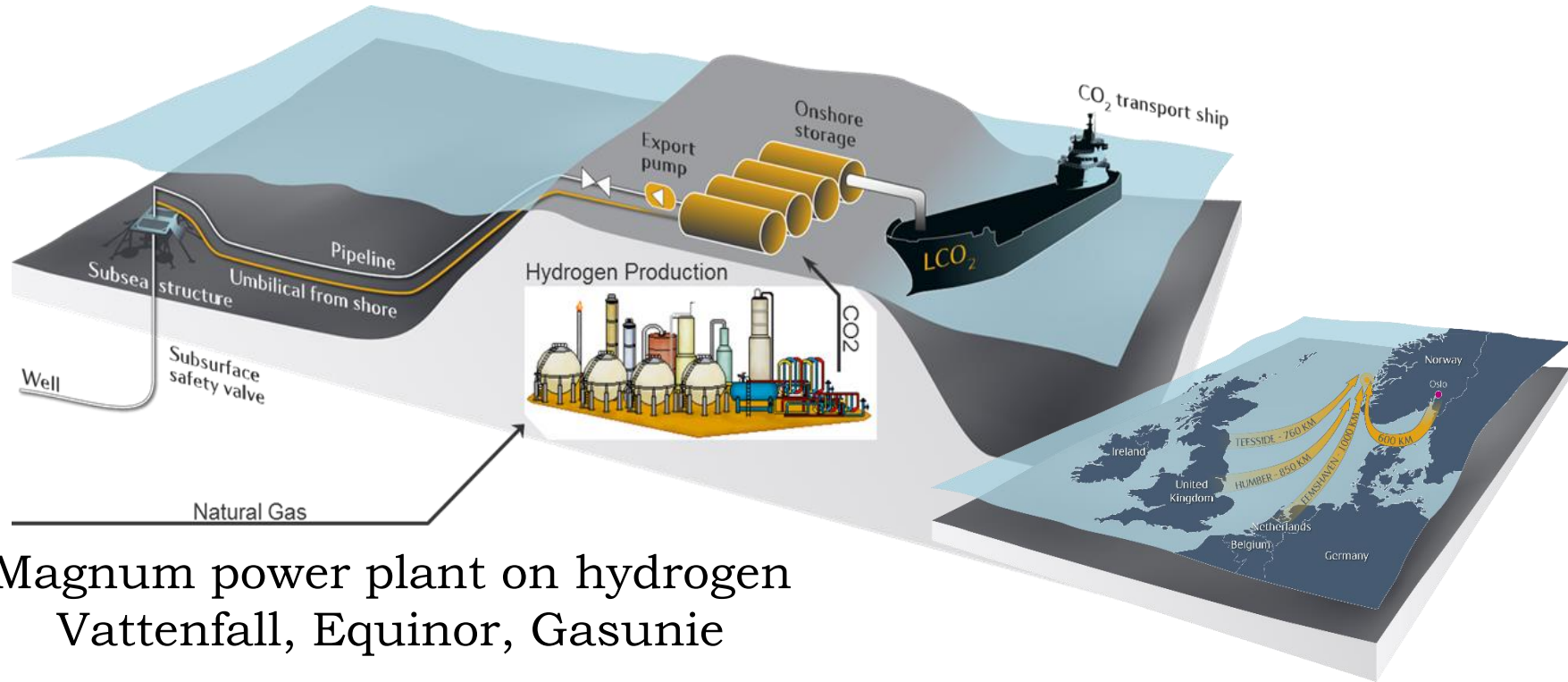
Groningen-Zuidwending

hydrogen storage in salt caverns

first cavern ready 2025, 5.000 ton hydrogen storage



Gas-Hydrogen production with CO₂ storage in Smeaheia field



Magnum power plant on hydrogen
Vattenfall, Equinor, Gasunie

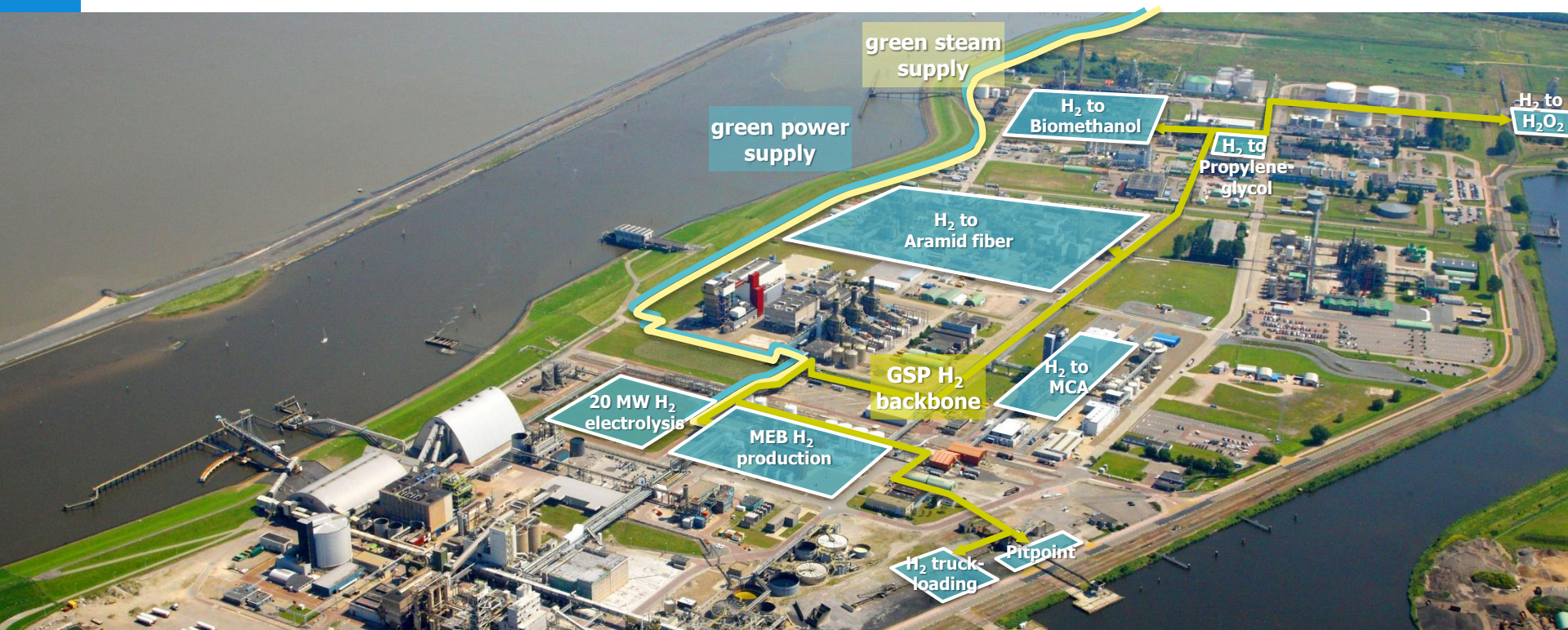
Shell, Gasunie, Groningen Seaports 10.000 MW offshore wind-hydrogen



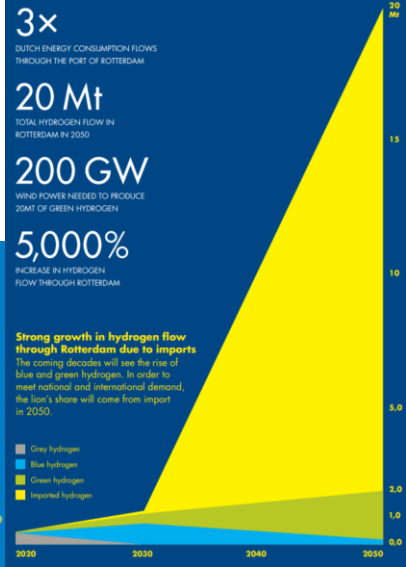
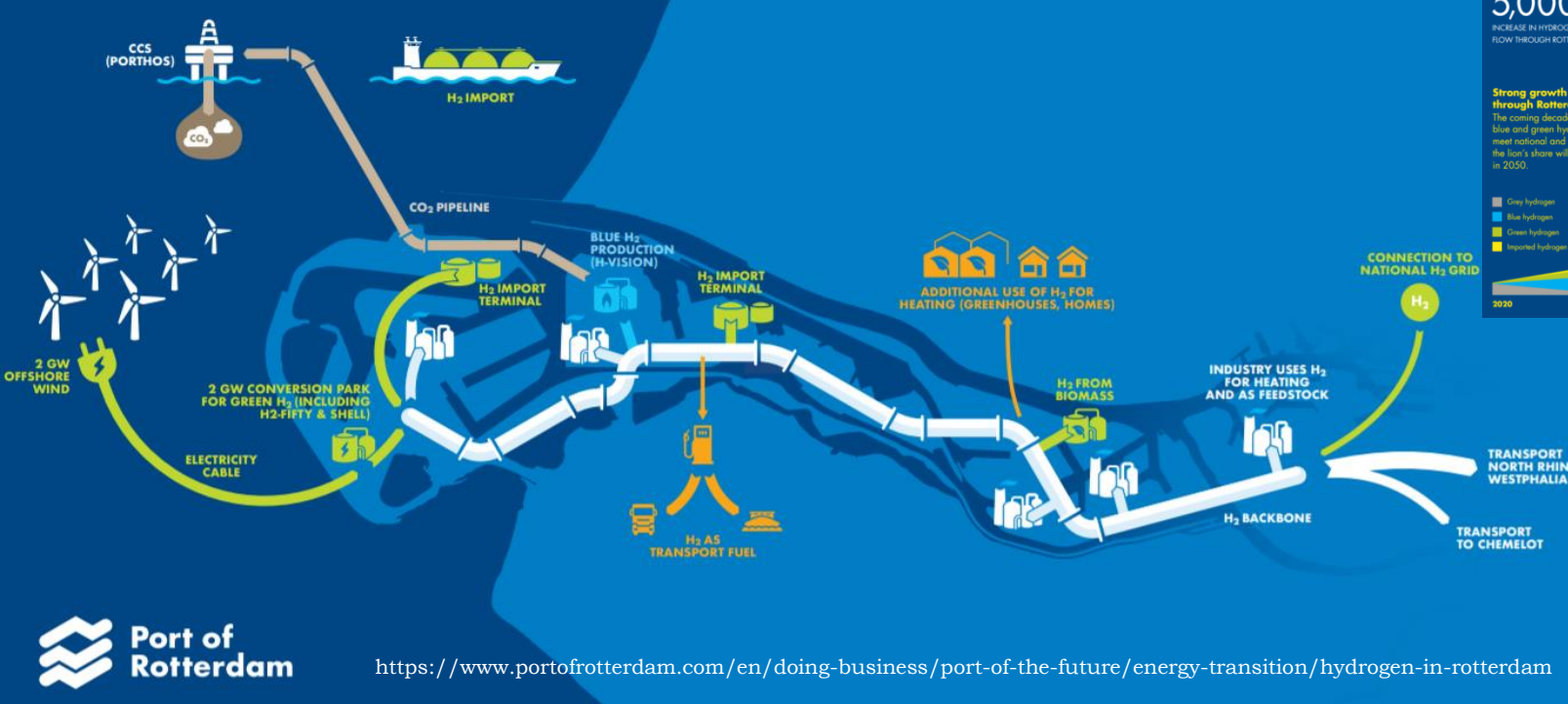
NorthH₂

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 Rigal, 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+H₂ (2-10-2020)



Airbus: Airplane, LH₂+Gasturbine (21-9-2020)



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



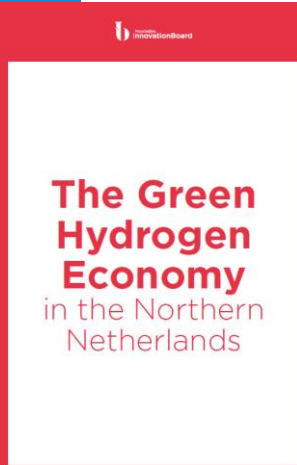
Home fuel cell system, electricity and heat
Panasonic: Japan > 300.000 sold

Missing links in the Netherlands

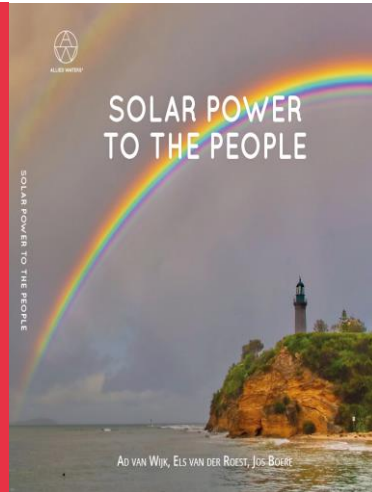
- Robust financial framework to stimulate hydrogen production
- 10 GW wind offshore-hydrogen production target for 2030
- Quota for hydrogen use in chemical, steel, transport fuels, gas, etc.
- Hydrogen import and export policy with bi-lateral agreements
- Coordinated plan to convert all gas infrastructure 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



April 2017



November 2017



May 2018



September 2019



April 2020