



# Offshore Wind meets Hydrogen Offshore

7-10-2022

Prof. Dr. Ad van Wijk



## Ursula von der Leyen, State of the Union 14-9-2022

### A UNION THAT STANDS STRONG TOGETHER

#### Hydrogen can be a game-changer for Europe.

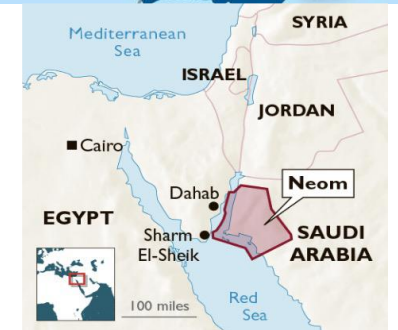
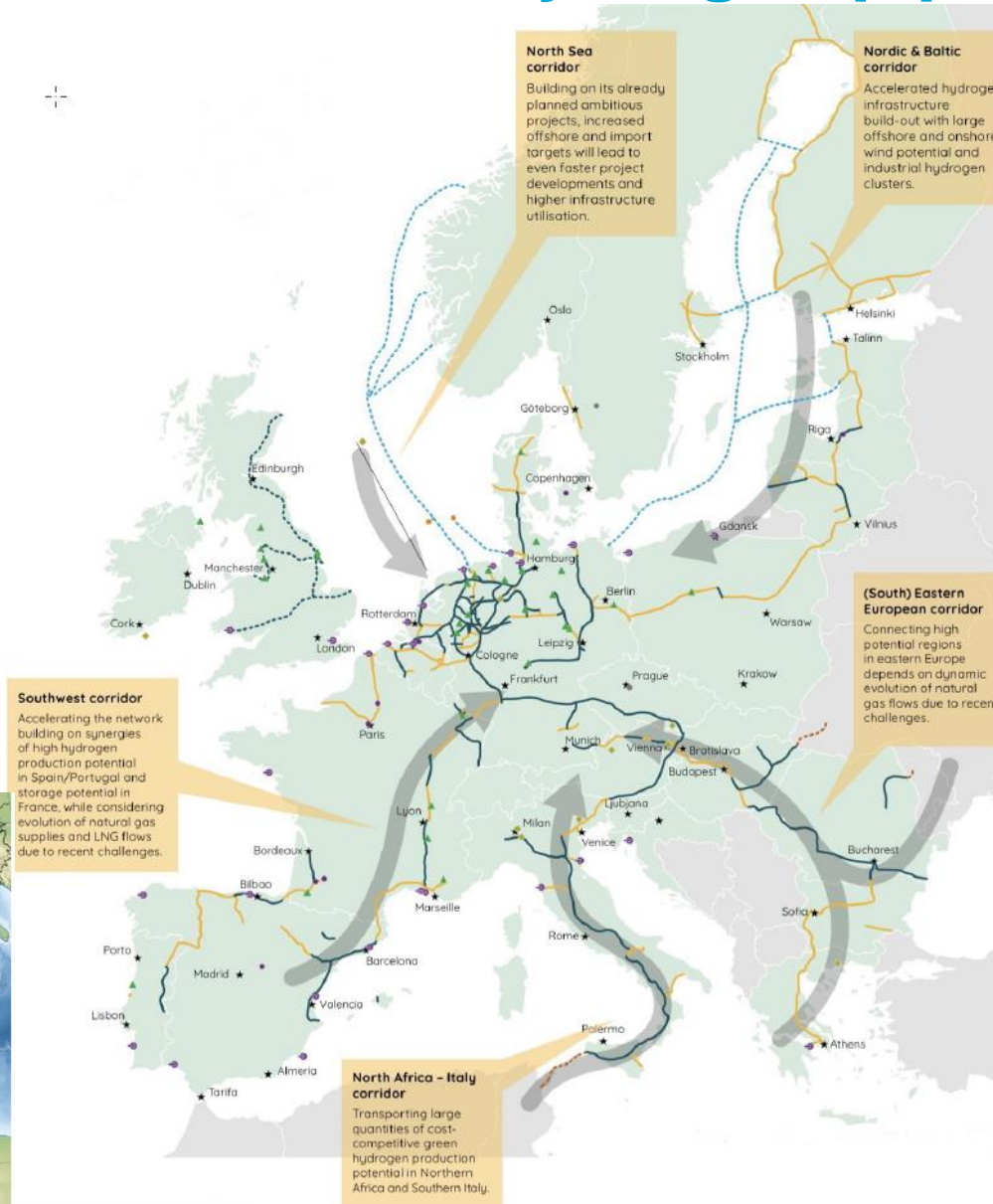
- We need to move from the niche market to the mass market for hydrogen.
- With REPowerEU, we have doubled our target: we want to produce ten million tonnes of renewable hydrogen in the EU each year by 2030.
- To achieve this, we need to create a market maker for hydrogen, to bridge the investment gap and connect future supply and demand.
- This is why I can announce today that we are going to create a new European Hydrogen Bank.
- It will help guarantee the purchase of hydrogen, in particular by using the resources of the Innovation Fund.
- It will be able to invest 3 billion euros to help build the future hydrogen market.

**This is how the economy of the future will be built.**

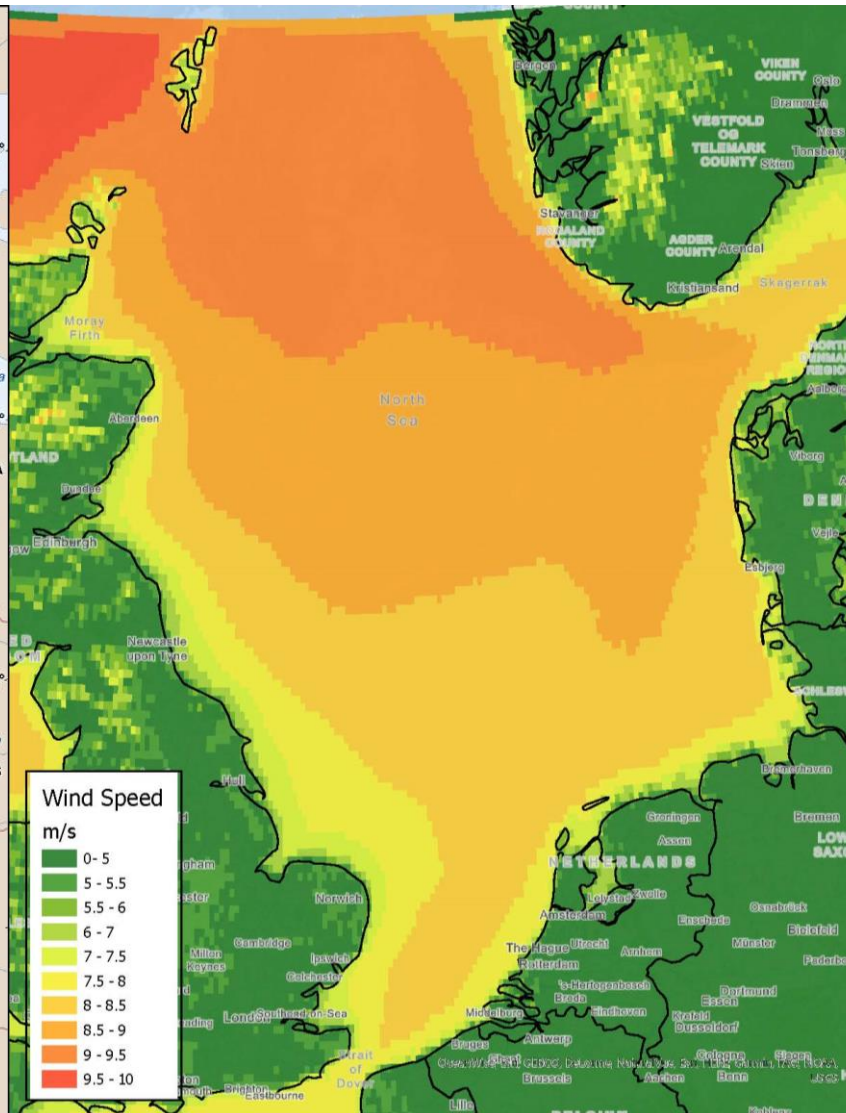
# REPowerEU; Joint European Action for more affordable and sustainable energy, EC 8-3-2022

REPOWER EU TRACK	FOCUS	FF55 AMBITION BY 2030	REPOWEREU MEASURE	REPLACED BY THE END OF 2022 (BCM equivalent) estimate	ADDITIONAL TO FF55 BY 2030 (BCM equivalent) estimate
GAS DIVERSIFICATION	NON-RU NATURAL GAS	-	LNG diversification	50*	50
		-	Pipeline import diversification	10	10
	MORE RENEWABLE GAS	17 bcm of biomethane production, saving 17 bcm	Boost biomethane production to 35bcm by 2030	3.5	18
	<b>HYDROGEN ACCELERATOR</b>	<b>5.6 million tonnes of renewable hydrogen, saving 9-18.5 bcm</b>	<b>Boost hydrogen production and imports to 20mt by 2030</b>	-	<b>25-50</b>
ELECTRIFY EUROPE	HOMES	Energy efficiency measures, saving 38 bcm	EU-wide energy saving, e.g. by turning down the thermostat for buildings' heating by 1°C, saving 10bcm	14	10
		Counted under overall RES figures below	Solar rooftops front loading – up to 15 TWh within a year	2.5	frontloaded
		30 million newly installed heat pumps installed in 2030, saving 35 bcm in 2030	Heat pump roll out front loading by doubling deployment resulting in a cumulative 10 million units over the next 5 years	1.5	frontloaded
		POWER SECTOR	Deploy 480 GW of wind capacities and 420 GW of solar capacities, saving 170bcm (and producing 5.6 Mt of Green Hydrogen)	Wind and solar front loading, increasing average deployment rate by 20%, saving 3bcm of gas, and additional capacities of 80GW by 2030 to accommodate for higher production of renewable hydrogen.	20
TRANSFORM INDUSTRY	ENERGY-INTENSIVE INDUSTRIES	Front load electrification and renewable hydrogen uptake	Front load Innovation Fund and extend the scope to carbon contracts for difference	Gas savings counted under the renewable hydrogen and renewables targets	

# Hydrogen Accelerator; hydrogen pipeline infrastructure



# Water Depth, Wind speed, Gas pipelines North Sea

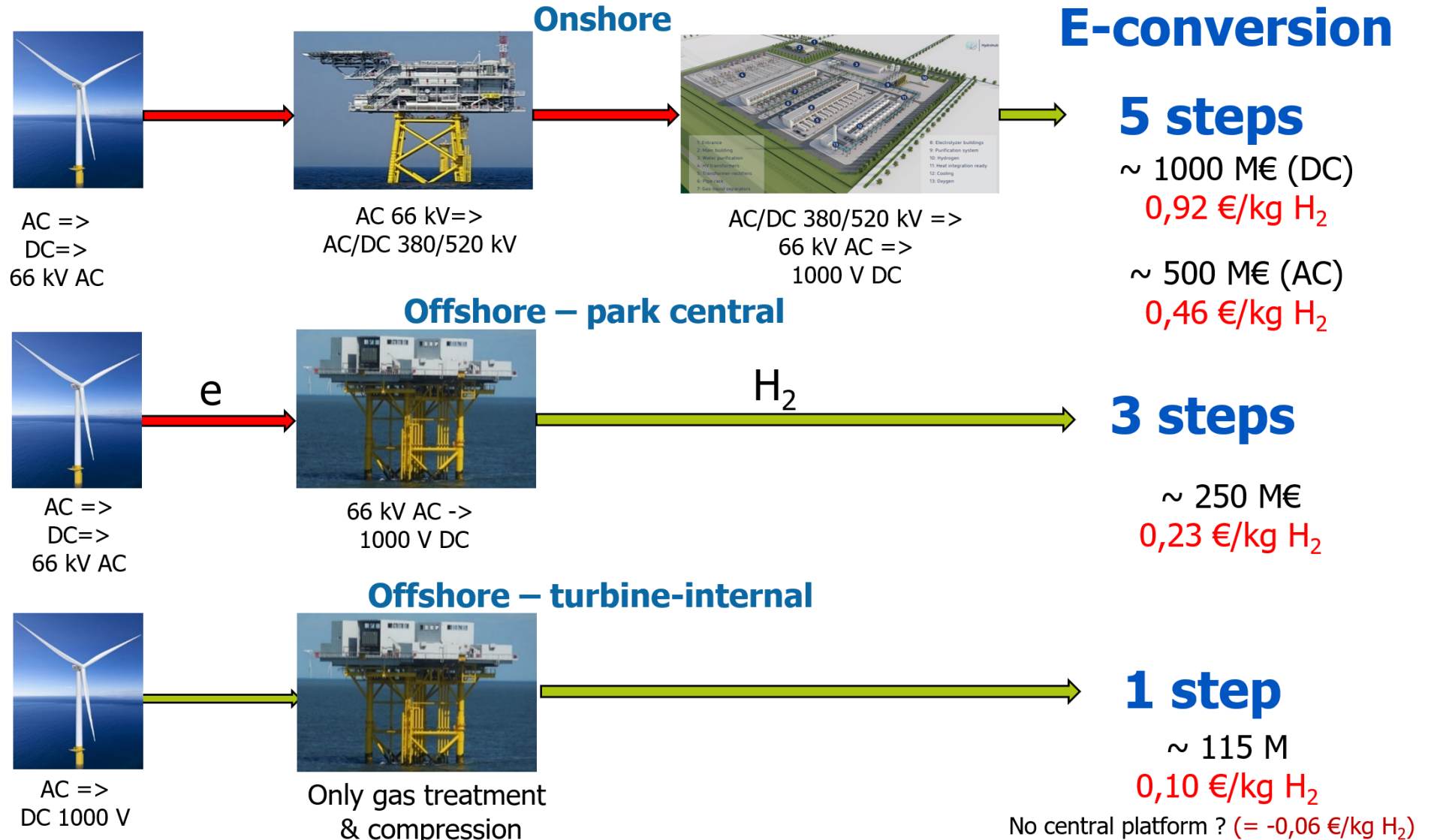


# Floating wind turbine development



“ScotWind” seabed tender, March 2022 : Auction 8,600 km<sup>2</sup> of sea space which could host almost 25 GW of offshore wind. 17 projects won. With 15 GW floating offshore wind.

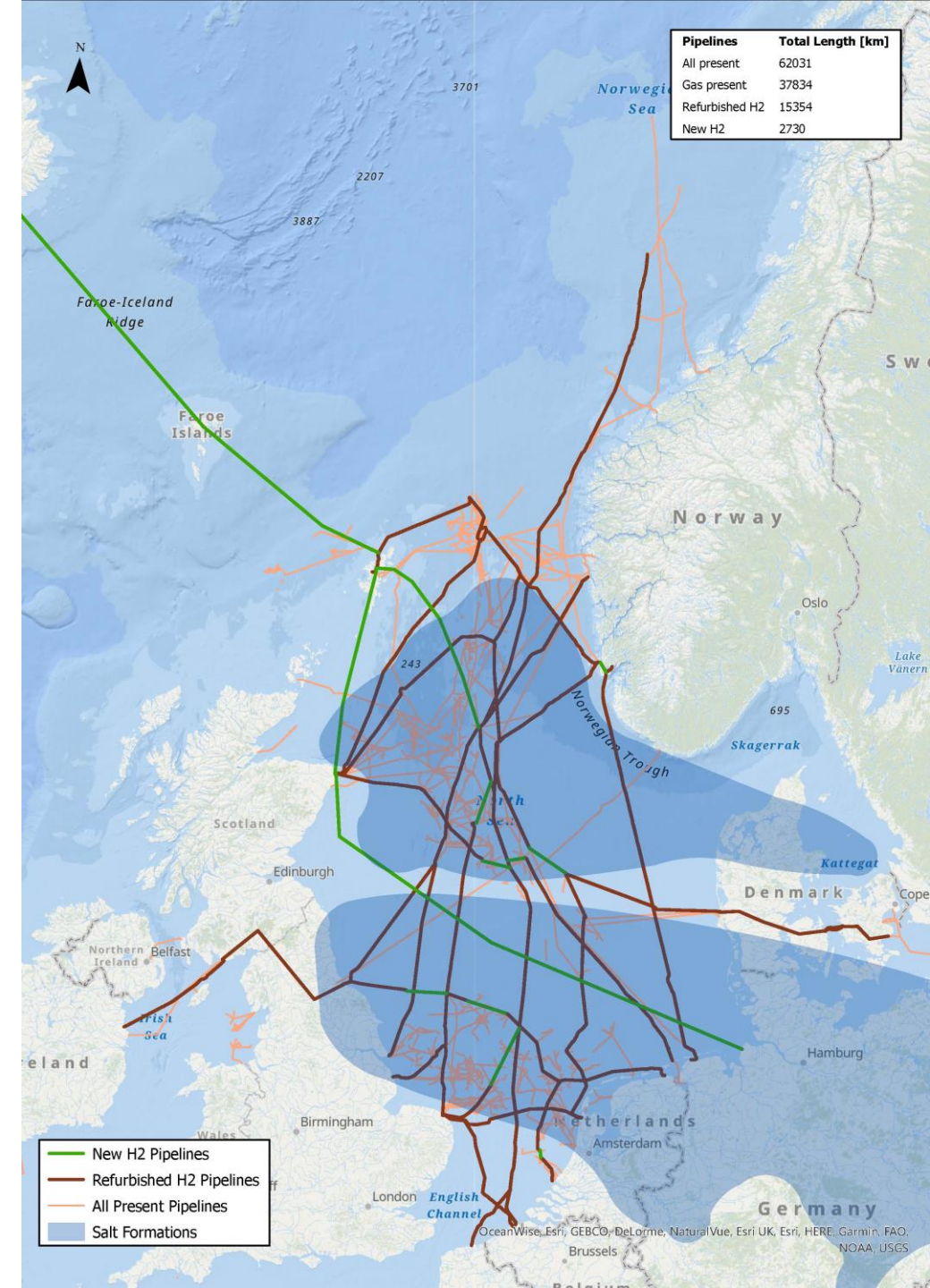
# Integrating electrolyser in wind turbine reduces hydrogen production cost, due to savings on electricity conversions



# Hydrogen Infrastructure Design at the North Sea

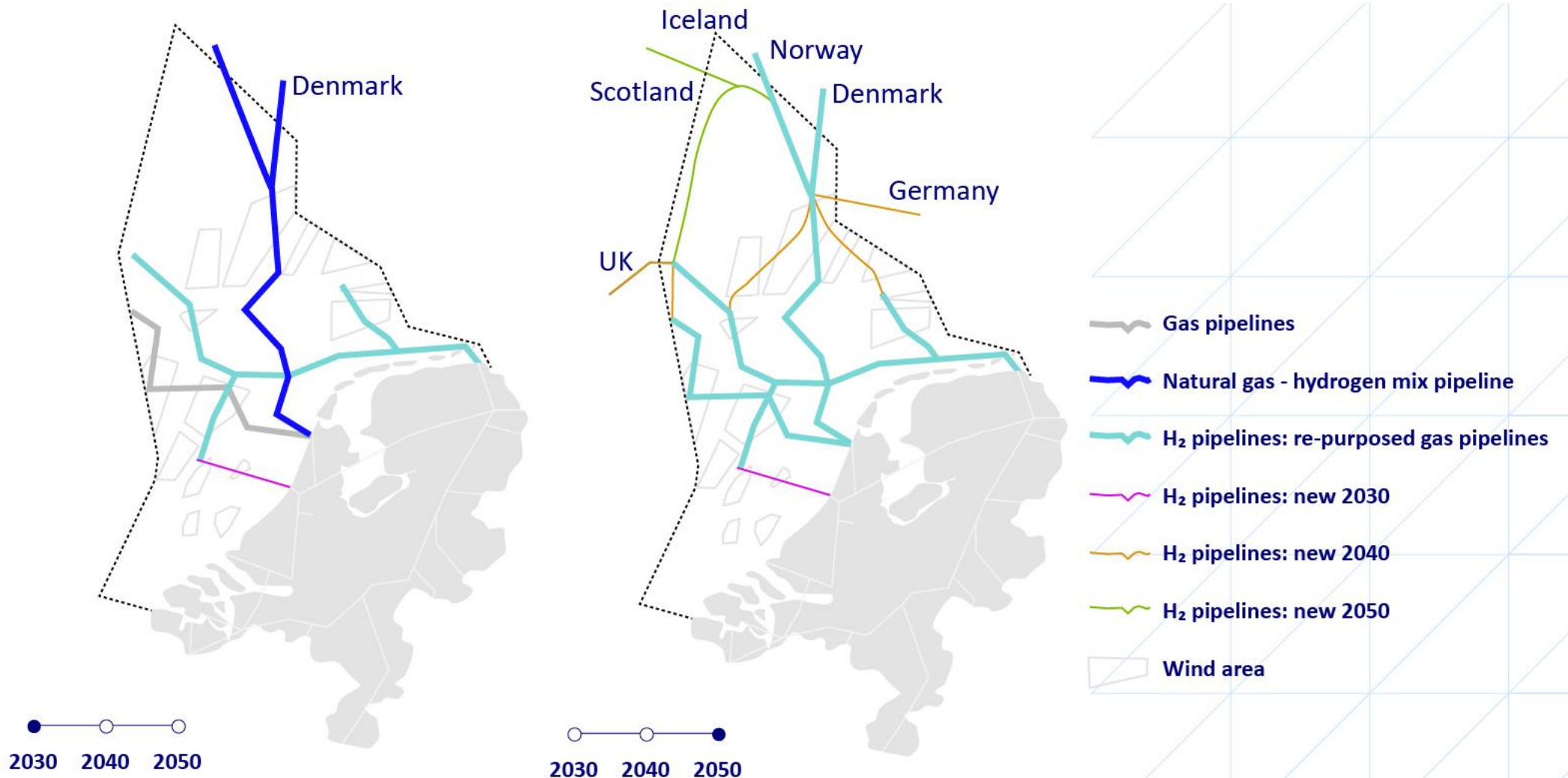
## Design assumptions

- Able to transport similar energy volumes as for gas
- Re-using as much as possible existing gas infrastructure
- Using same onshore landing points as for gas.
- Connecting to proposed European Hydrogen Backbone
- Connecting feasible renewable hydrogen production locations

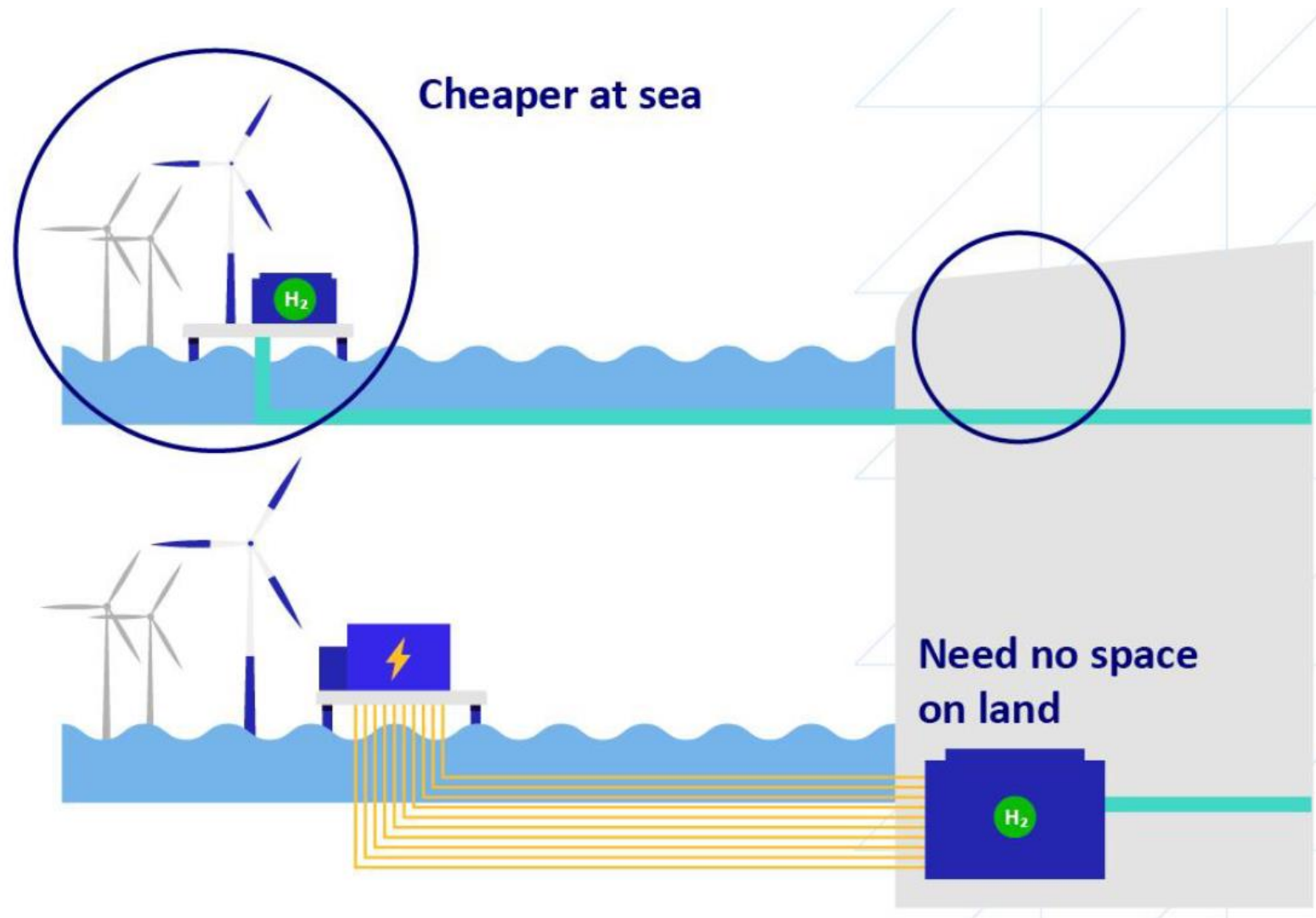




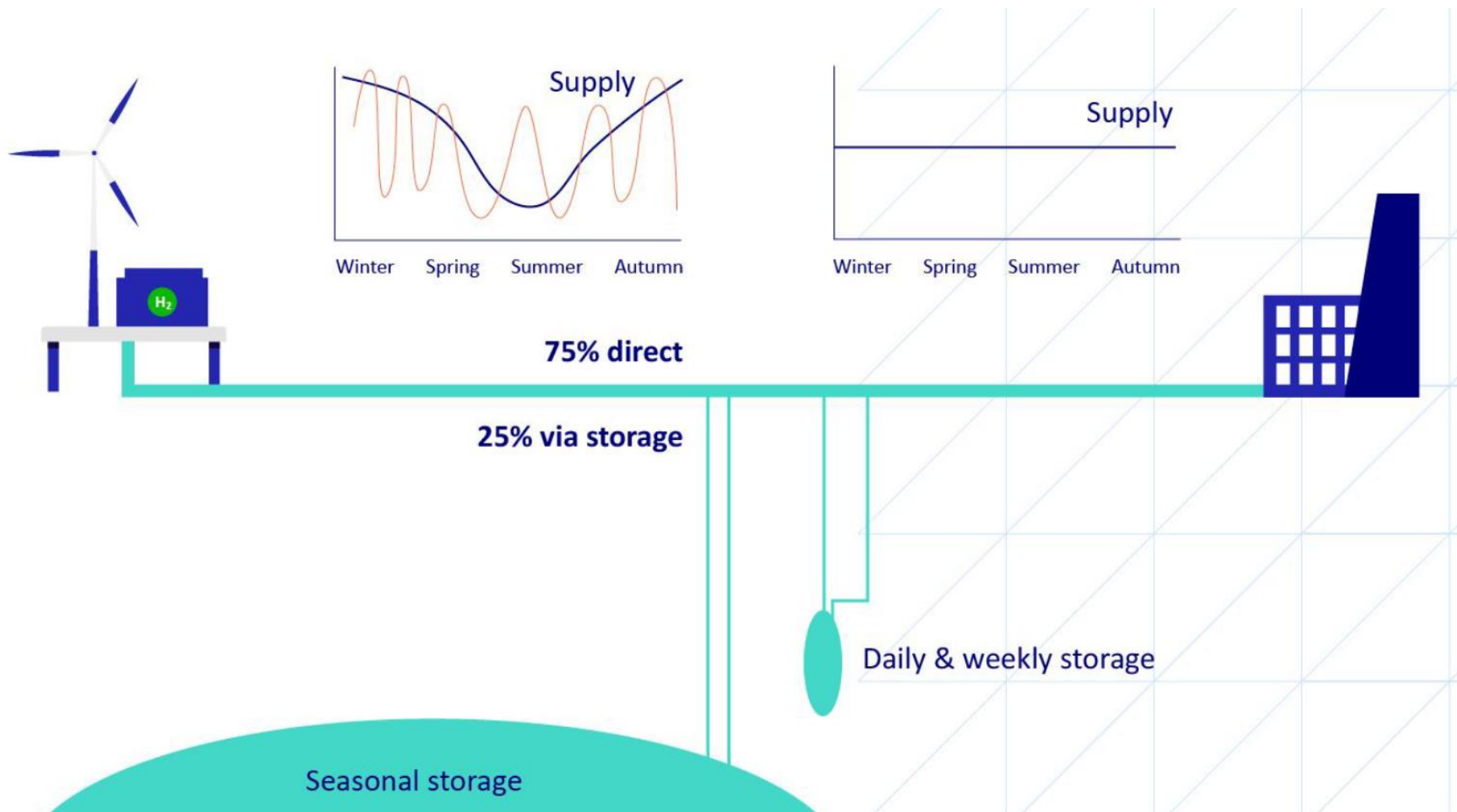
# Roadmap Dutch North Sea: re-purpose gas pipelines for hydrogen



**Offshore wind hydrogen production is cheaper than onshore hydrogen production from offshore wind:  
production from offshore wind:  
less electricity conversion cost and cheaper transport cost.**

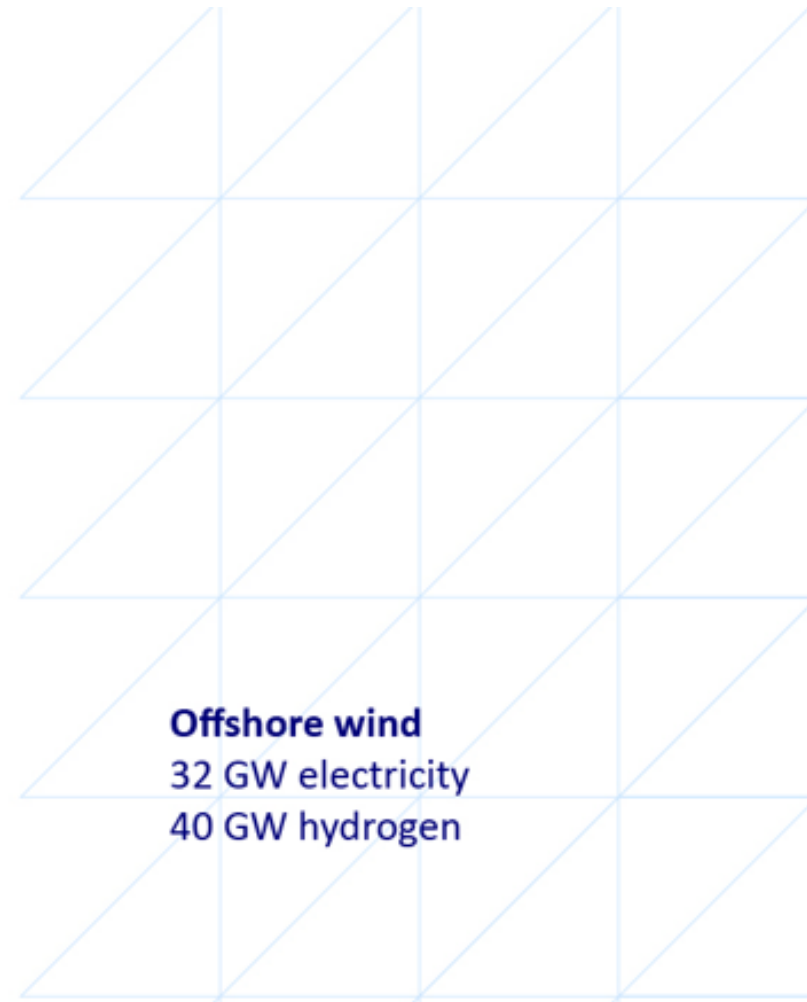
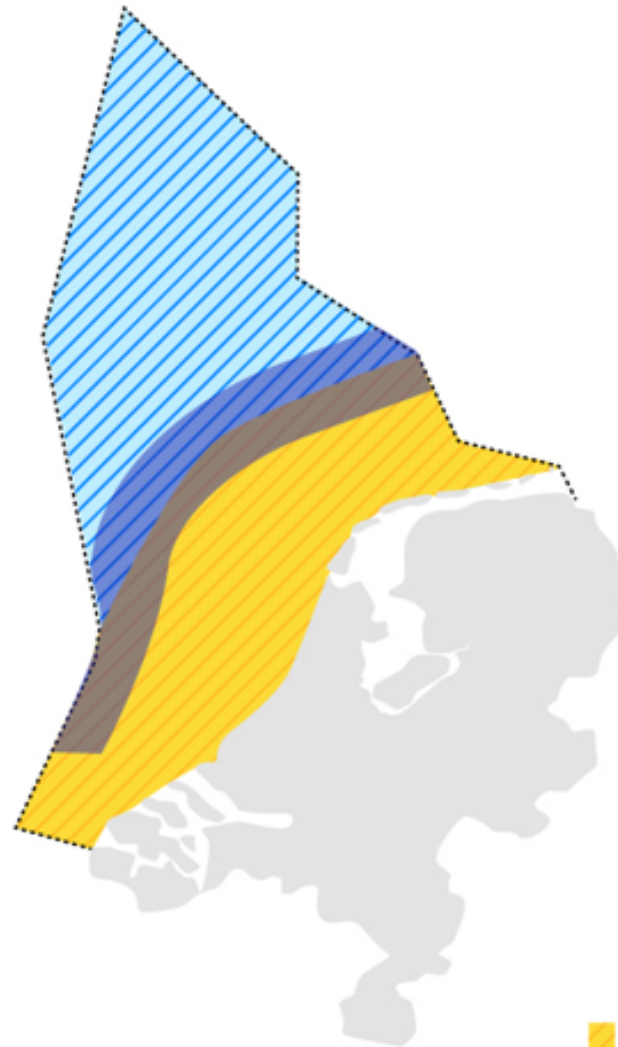


**Wind hydrogen production volumes are fluctuating over time.  
To deliver base load hydrogen, requires 25% production flow via storage**



# A cost effective offshore wind energy development scenario

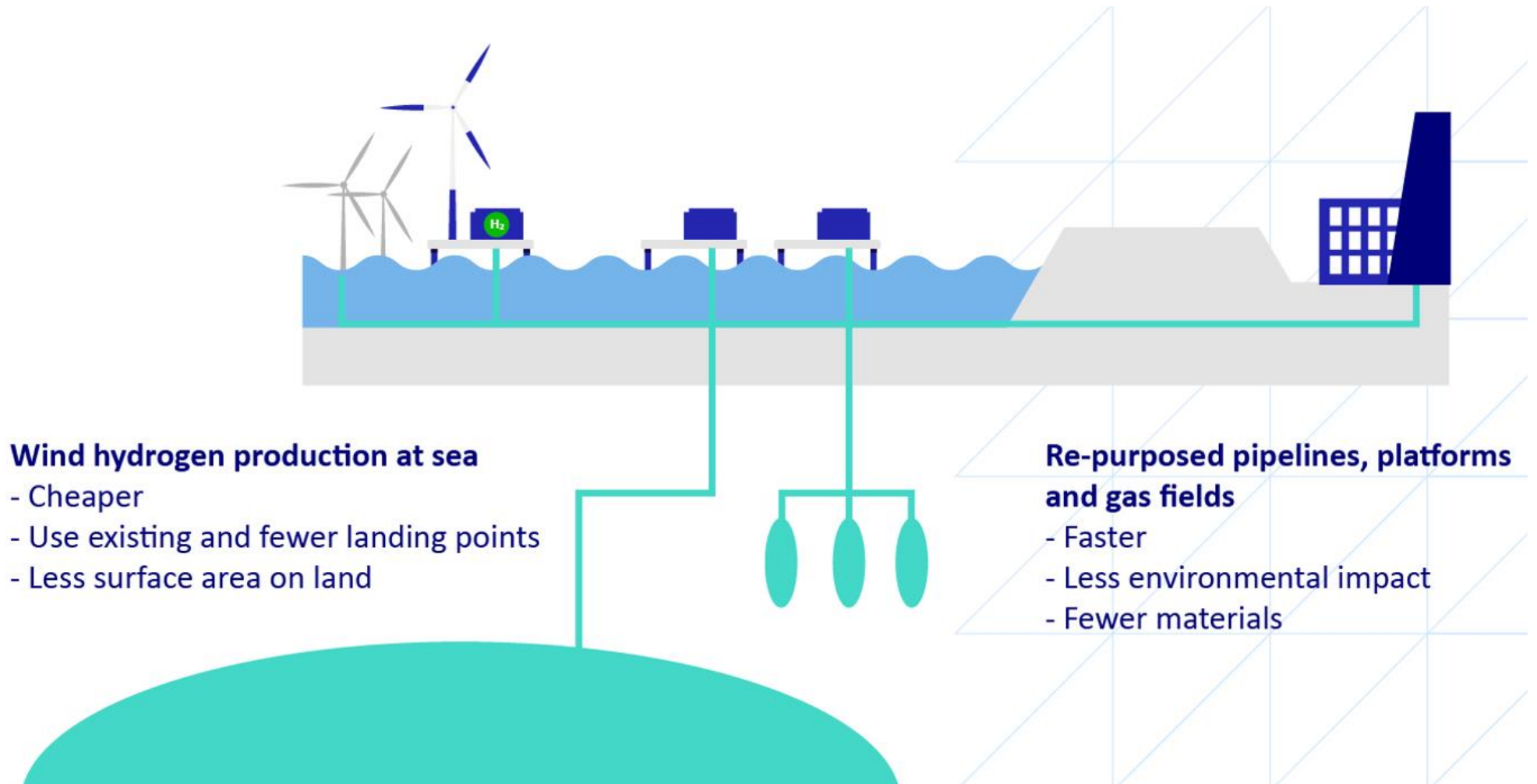
- Wind electricity production up to 75 km from shore
- Wind hydrogen production more than 100 km from shore
- Wind electricity and/or hydrogen production between 75-100 km from shore



**Offshore wind**  
32 GW electricity  
40 GW hydrogen

■ Electricity   ■ Hydrogen   ■ Mix electricity hydrogen

# Offshore wind hydrogen production at sea!



## Wind hydrogen production at sea

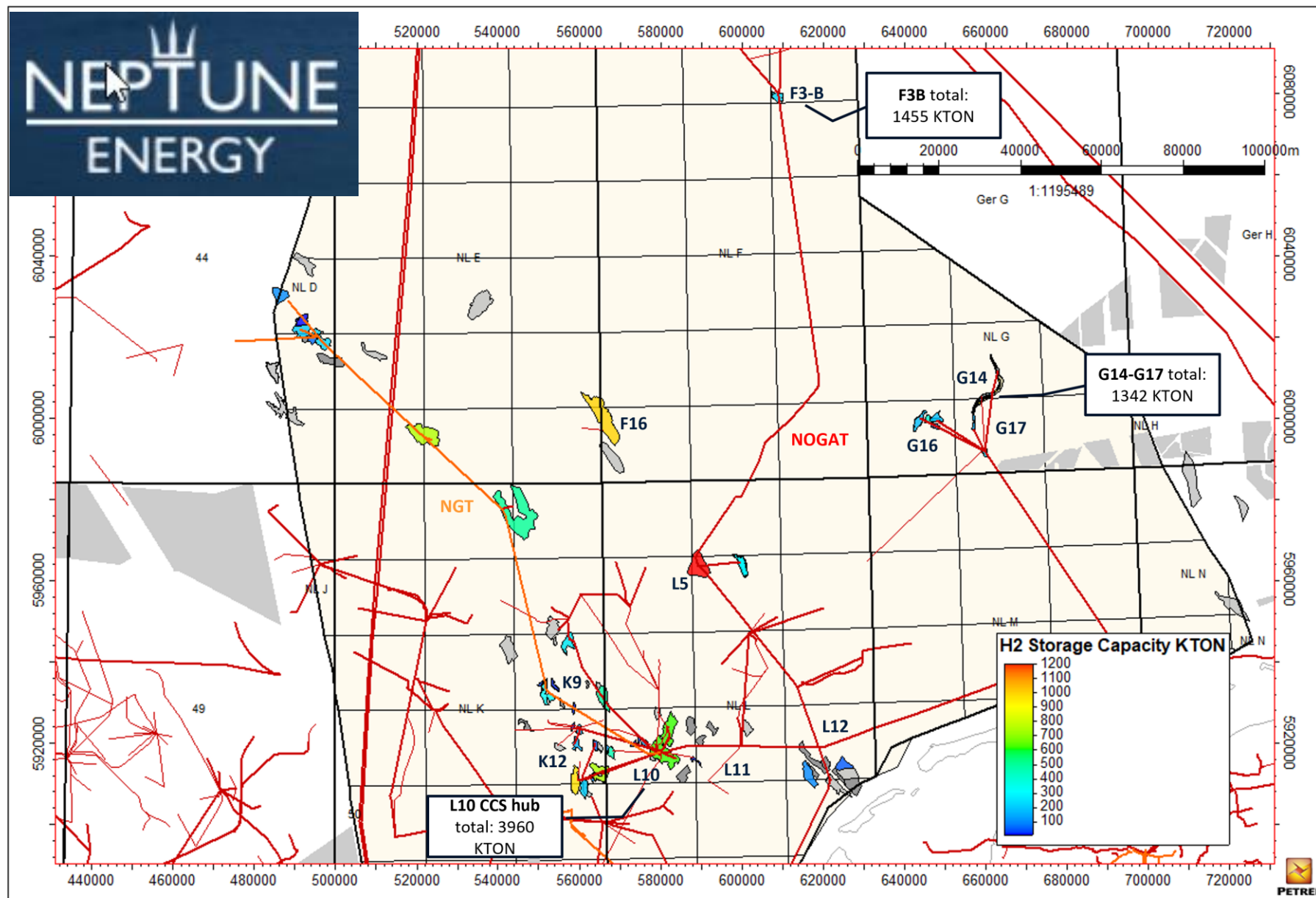
- Cheaper
- Use existing and fewer landing points
- Less surface area on land

## Re-purposed pipelines, platforms and gas fields

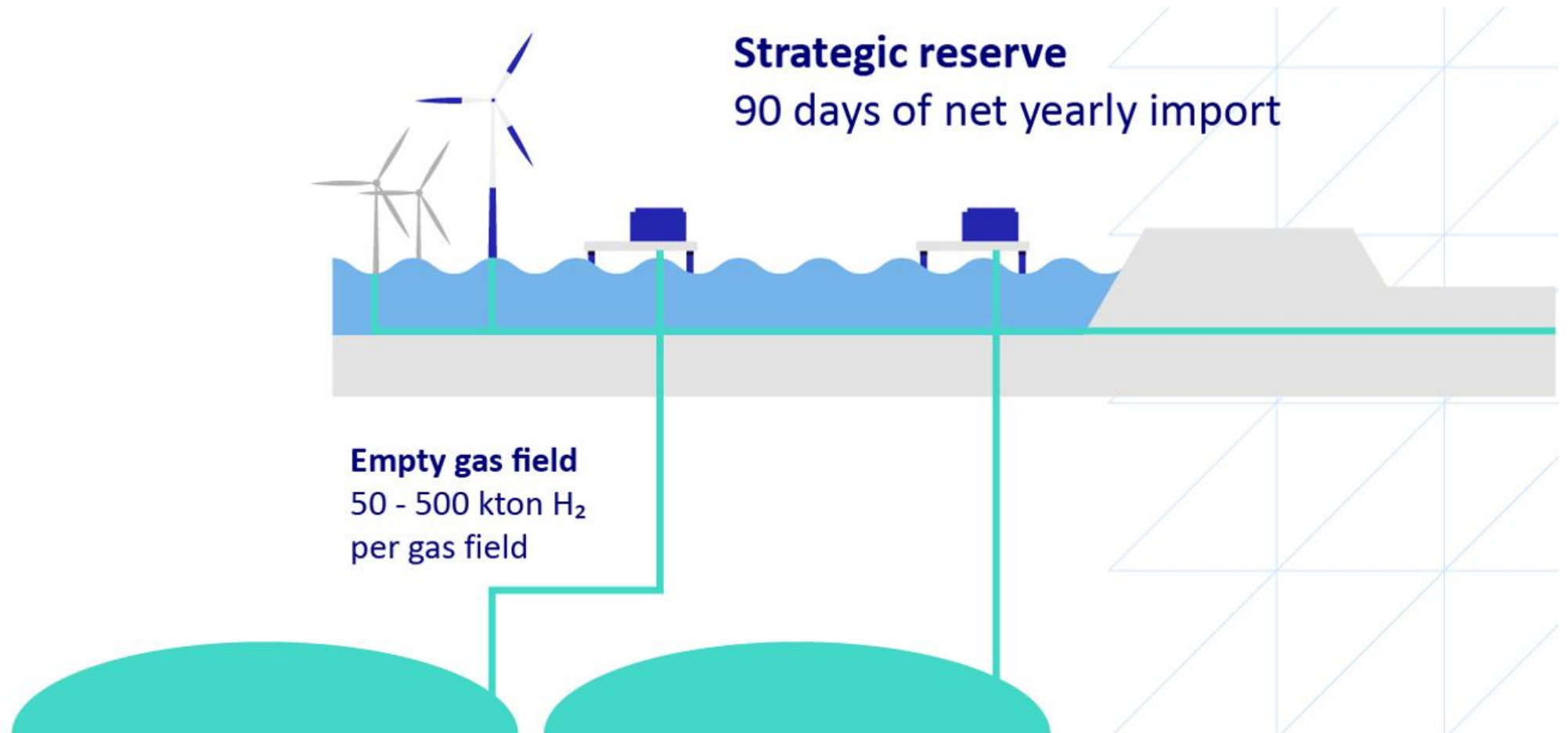
- Faster
- Less environmental impact
- Fewer materials

# Potential hydrogen storage capacity in NEPTUNE empty gas fields at Dutch part North Sea

not all of these fields are suitable



**Carbon free Security of Supply requires strategic hydrogen reserve**  
**Dutch North Sea empty gas fields could fulfil the strategic reserve**  
**via hydrogen storage in empty gas fields for a large part of the EU**



**Speed up and scale up fast  
by going hydrogen offshore now!**

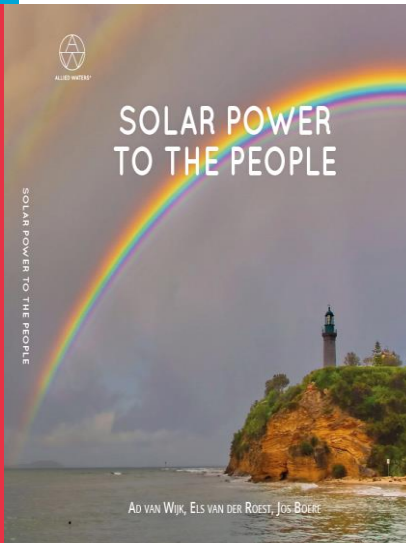


# Further Reading

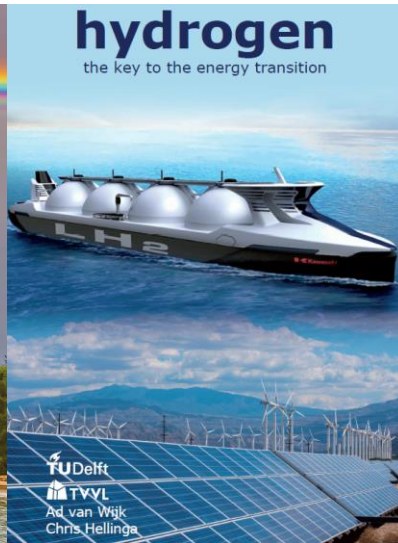
[www.profadvanwijk.com](http://www.profadvanwijk.com)



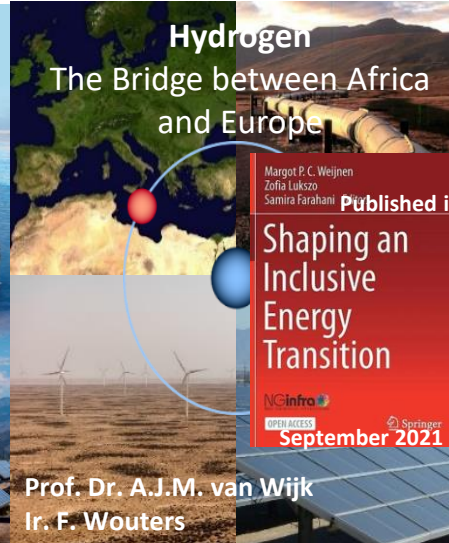
April 2017



November 2017



May 2018



September 2019



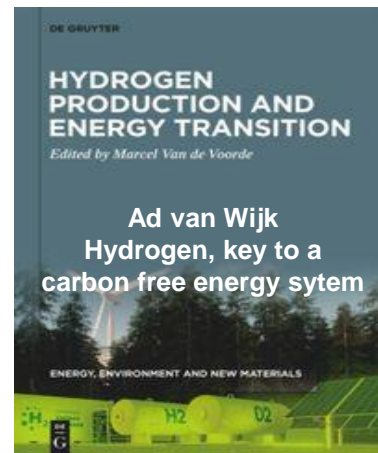
November 2019



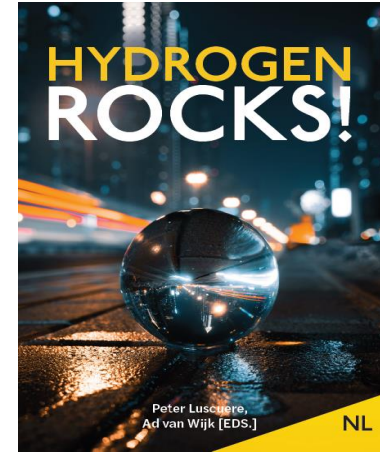
April 2020



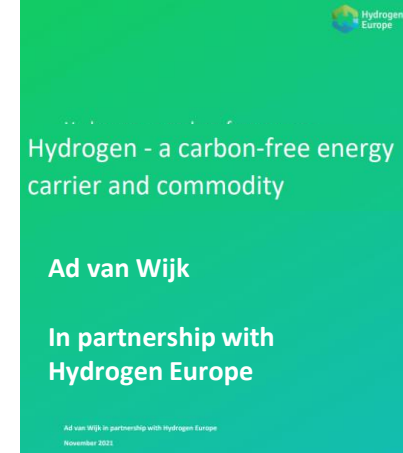
April 2021



September 2021



October 2021



November 2021



May 2022