#H2OffThePress

Green molecules or Green electrons

Is producing green H2 and transporting via H2 pipelines across intercontinental distances (<5000 km) the best option?

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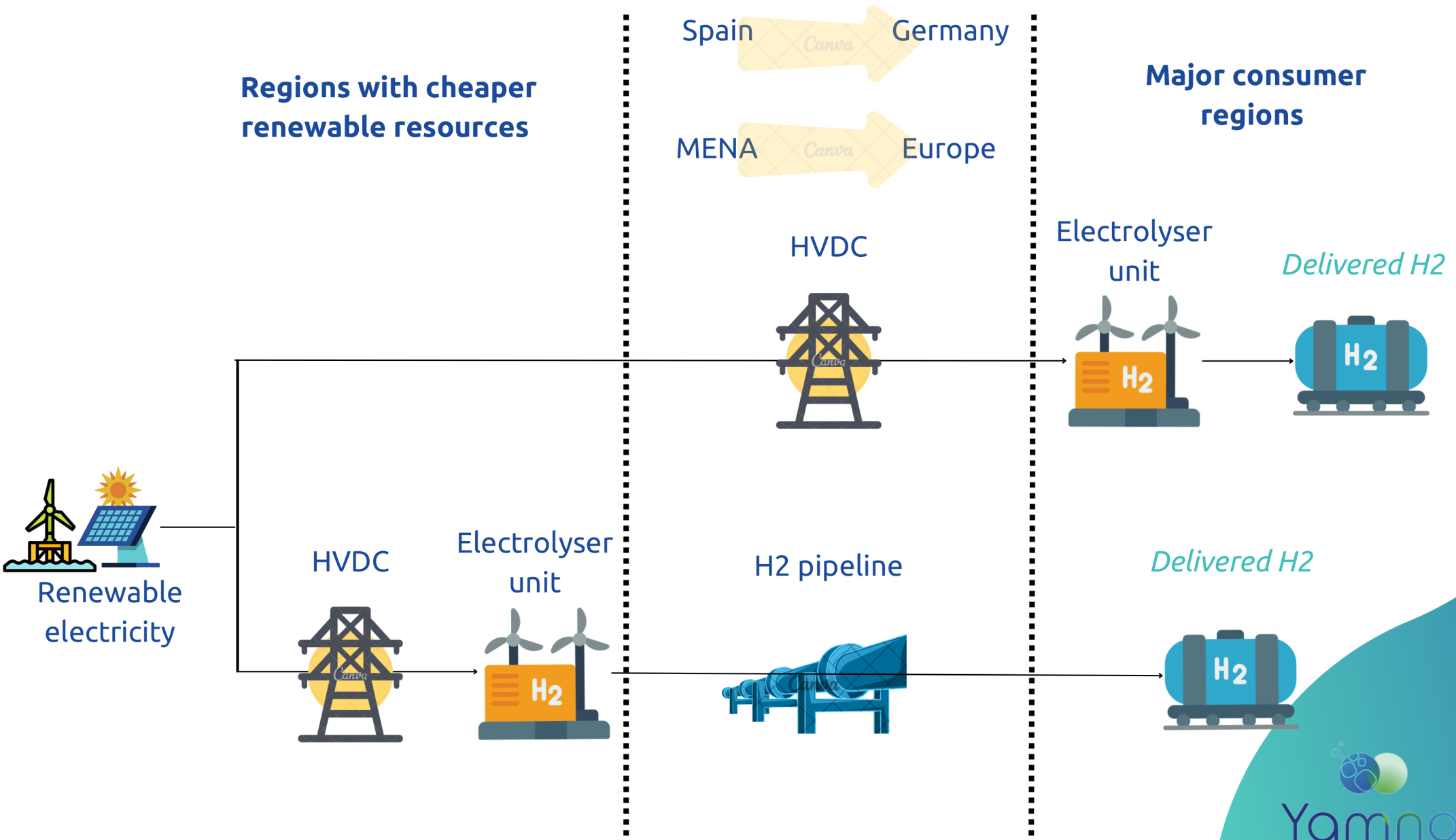
The issue of where to place the electrolyser along the supply chain

Distances between hydrogen production hubs (low-carbon energy resources) and demand centers (industrial hubs) are usually long

Two ideas emerge for long distance transport

- → ***Option 1: Transport hydrogen***
- → ***Option 2: Transport electricity and produce hydrogen at destination***



Big infrastructure ambitions highlight a preference towards H2 pipelines

H2 pipeline span over 4500 km globally with over 90% in the EU and North America

The EU is set to create the European Hydrogen Backbone (EHB) by 2040

Aim

To create **5 supply and import corridors**, all regions where Green H2 can be produced at low costs

2040 ambitions

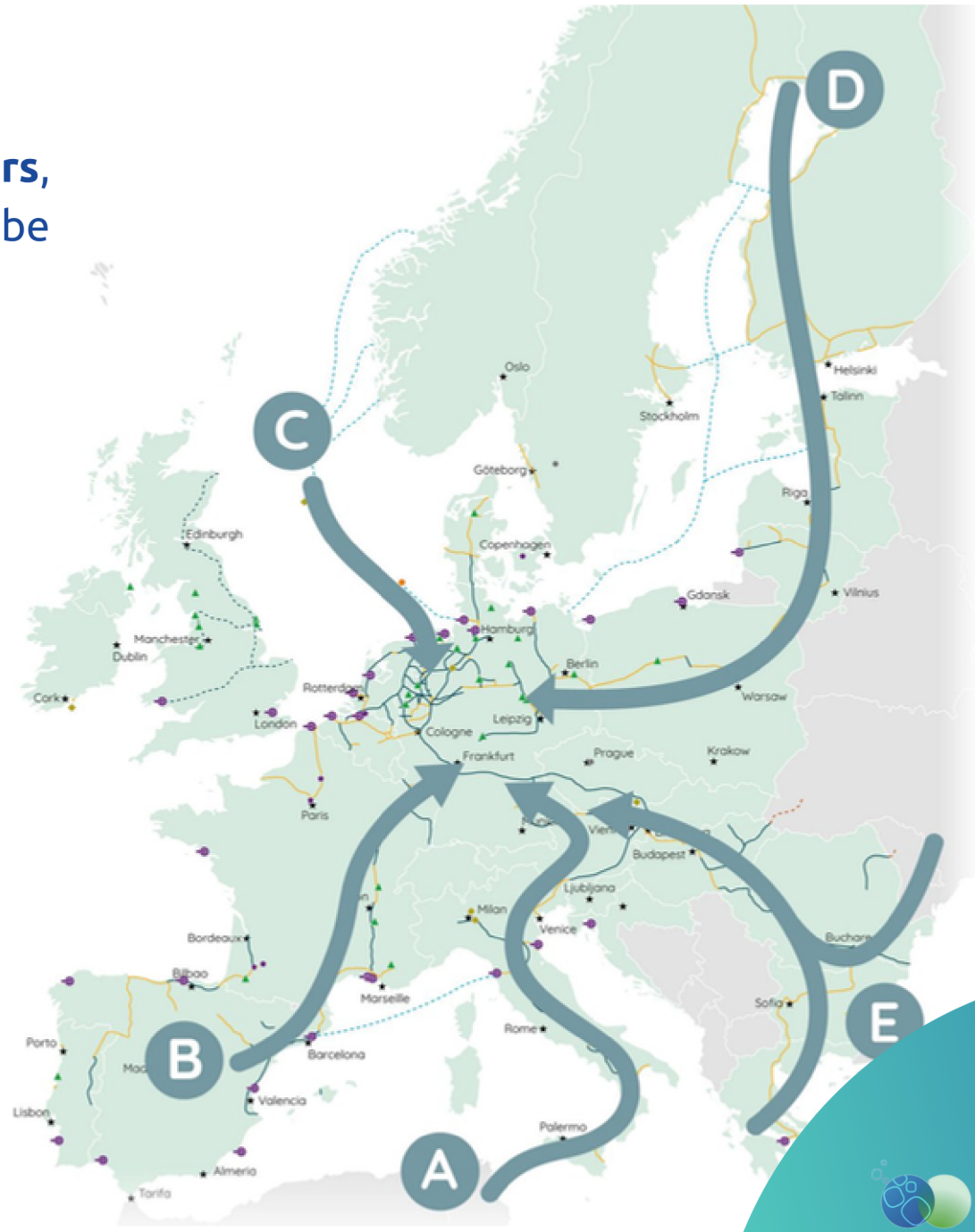
Total length: **53,000 km**

Number of EU countries included: **28**

Pipeline split:
60% repurposed existing infrastructure
40% new hydrogen pipelines

Transportation cost: **0.11 – 0.21 €/kg**

Transport capacity: **Atleast 1,640 TWh of H2**
(all of estimated EU demand)



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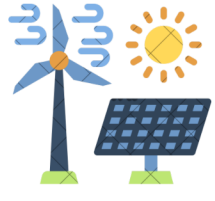
Direct Current (DC) prevails over Alternating Current (AC) for longer transmission of electrons

In High-Voltage Direct Current (HVDC) transmission, ***electricity flows in one direction with a constant voltage level*** over long distances or between systems with different characteristics

→ *HVDC is better than HVAC (High Voltage Alternating Current) lines for long distance transmission due to*

Lower capacitive loss, enables higher power transmission

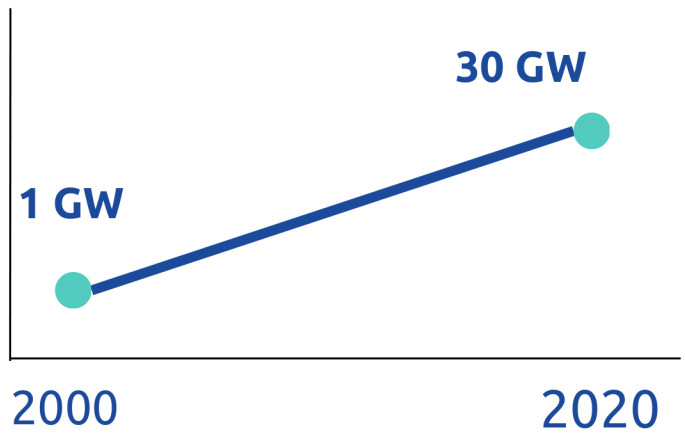


Enabling renewables integration, meaning more stable and predictable power transmission

→ Even with these advantages,
*HVAC lines currently span **4.7 million km** worldwide while,*
*HVDC lines remains at **0.1 million km***

This trend is slowly changing as shown by the increase in adoption over the past years

HVDC cumulative capacity globally



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HVDC, the preferred mode of long distance electron transport

HVDC lines have gained prominence as the preferred transmission technology for long-distance bulk power supply

*There have also been positive announcements such as the **Xlinks Project***

The project aims to transport renewable electricity from **solar and wind rich Morocco** to satiate **8% of Great Britain's demand**

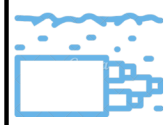
Cost

£20bn (entire project cost including generation)

Generation

11.5 GW solar and wind

5 GW battery storage



Transmission

3800 km HVDC

Delivery

Will power 7 million homes delivering 3.6 GW for 20+ hours

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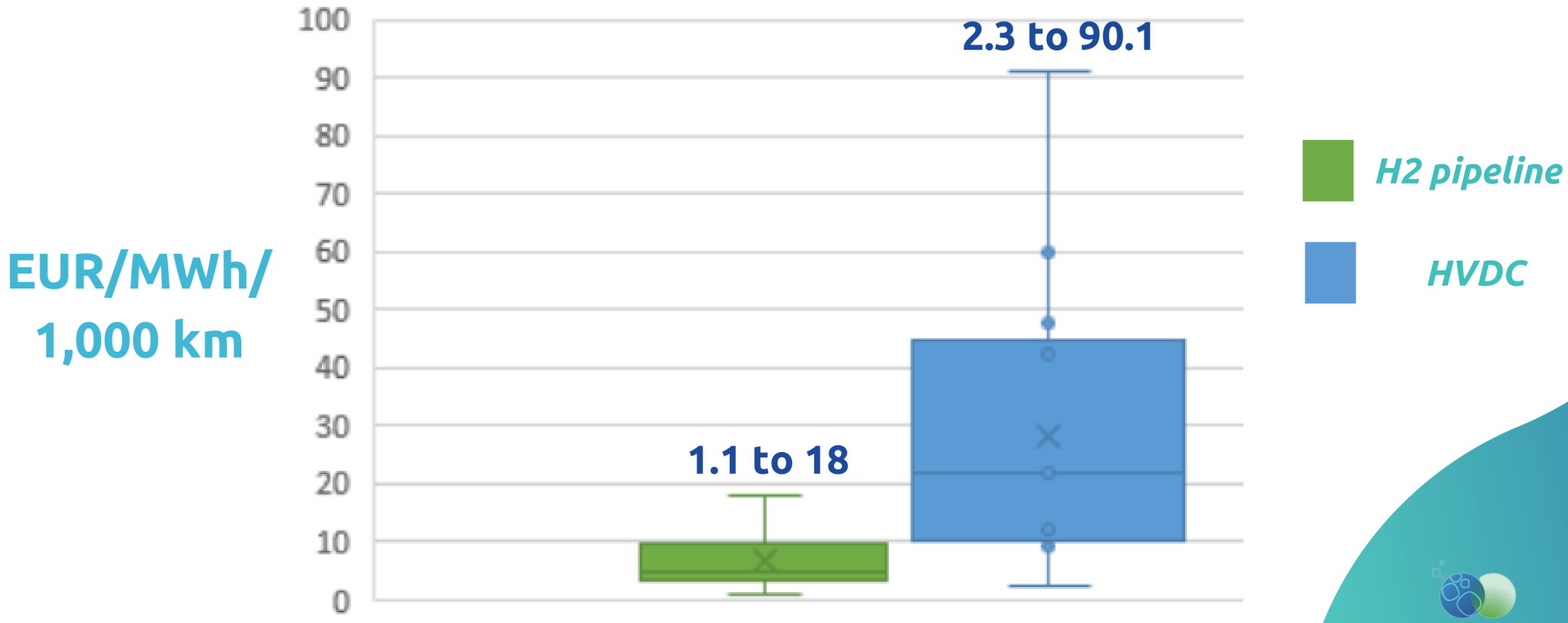
Differences in costs overshadow the similarity in risks and losses

Safety risks and losses	H2 pipeline	HVDC
Electrical shock		⚠
Fire and explosion	⚠	⚠
Leakage	⚠	
Losses	0.5% to 1%	3%

→ ***Analysis show that H2 pipelines may be cheaper to construct than HVDC lines****



*Oxford Institute for Energy Studies, 2023 Hydrogen pipelines vs. HVDC lines: Should we transfer green molecules or electrons?

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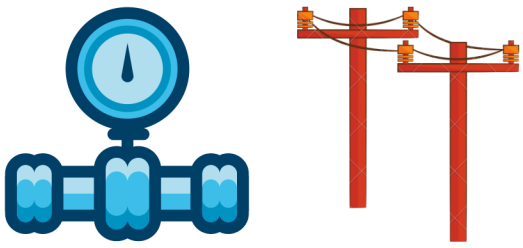
No clear winner, with other factors coming into play

Both have their merits when it comes to general and techno-economic characteristics

→ *Hence rather than viewing them as competitors, these technologies should be seen as complementary components of a complex energy system to enable the widespread adoption of the H2 economy*

Decisions can be taken on the basis of:



Existing Infrastructure

Location

Availability of water

Risk assessment

Social and Environmental restrictions

Budget

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