

# Hydrogen Strategy: UK vs Germany



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# What are objectives of hydrogen strategy?

### Objectives of the National Hydrogen Strategy of the German Federal Government

**H<sub>2</sub>**

**Green hydrogen**  
on the market as a contributor to achieving climate goals

Initiate market ramp-up of the technology

Establish value creation in Germany

**Create a policy framework**  
to support industry and related investment decisions.

**Seize economic opportunities**  
for ensuring the long-term future of Germany as a technological centre.

**Coordinate international activities**  
to ensure success and alignment of national measures.

**Commit to specific implementation measures** in order to place existing activities, e.g. the NIP, in an overarching context and to define a comprehensive strategy of the German government through the adoption of further measures.

**Consider the entire value chain** - from production, storage and infrastructure, to use in transport, industry and heating.

### Aspects of the National Hydrogen Strategy

Assuming global responsibility

Making green hydrogen competitive

Shaping the domestic market

Establishing hydrogen as an alternative energy carrier

Securing global market opportunities for German companies

Supporting science, training specialists

Securing energy supply through international hydrogen activities

### Successful implementation of the strategy requires:

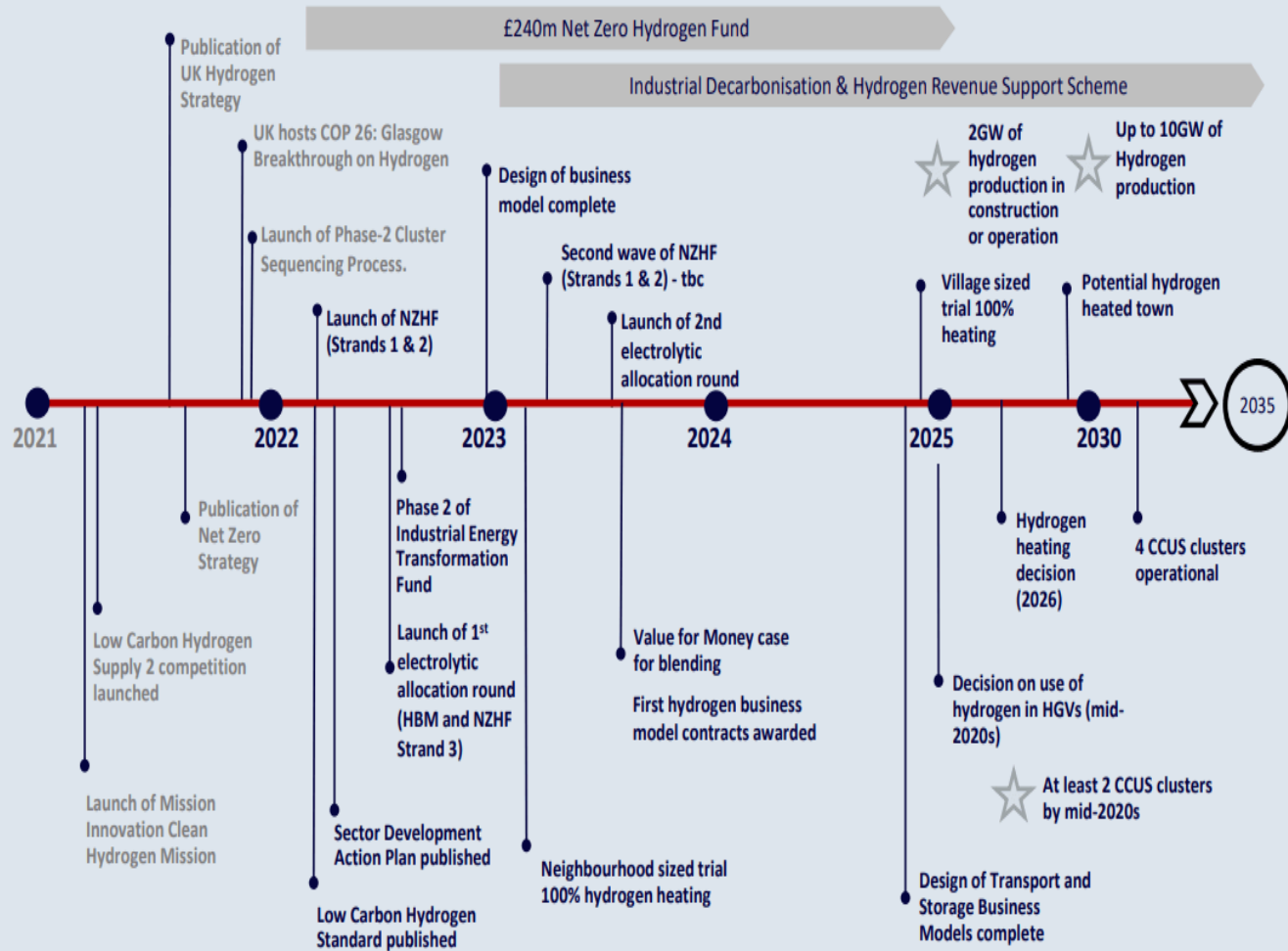
The establishment of a joint approach by politics, industry and science.

A holistic approach to the production, distribution and use of green hydrogen in industry, transport and heating.

The introduction of a governance structure for the implementation and further development of the strategy.

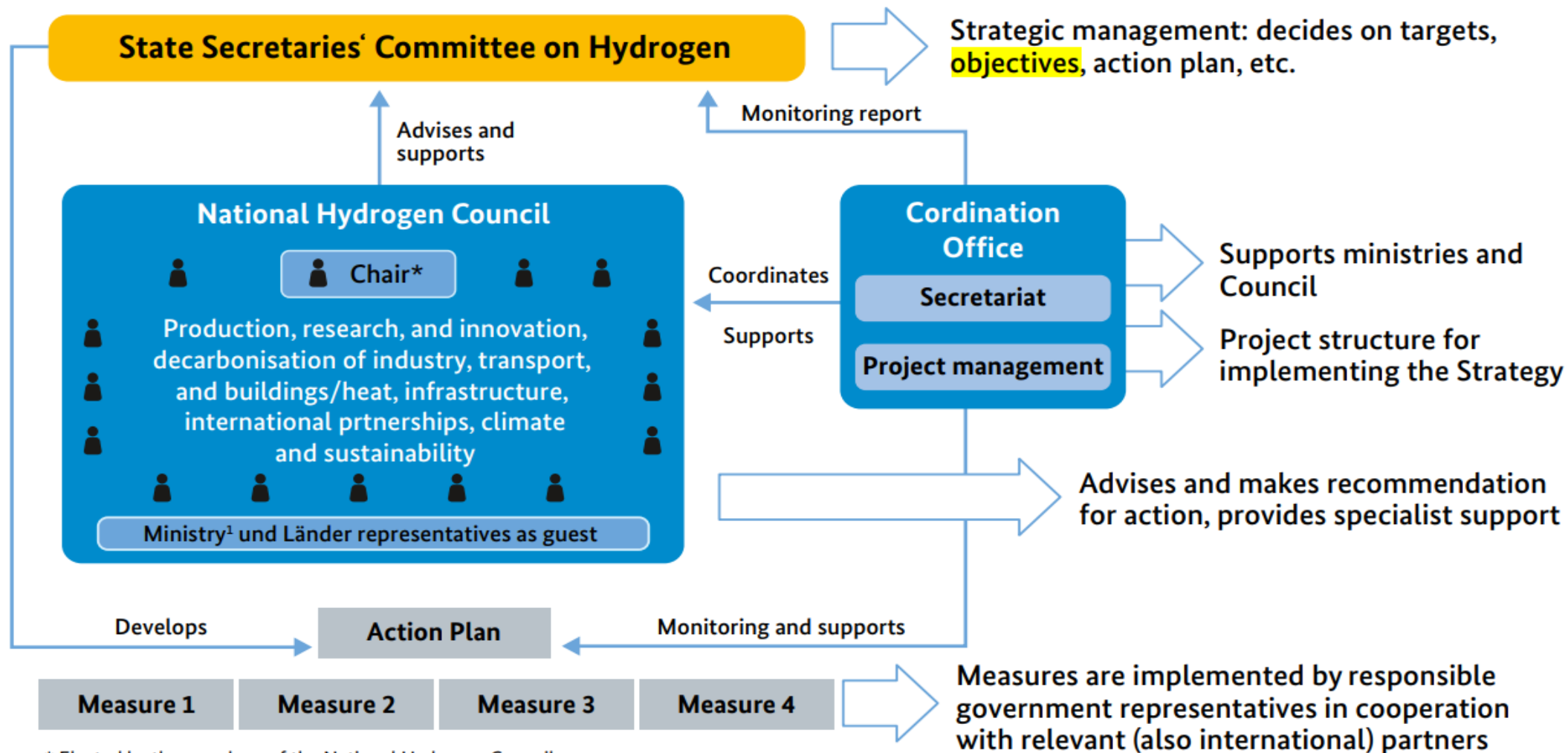
## Our 2035 Delivery Plan

Critical activities and milestones on a path to developing the UK hydrogen economy





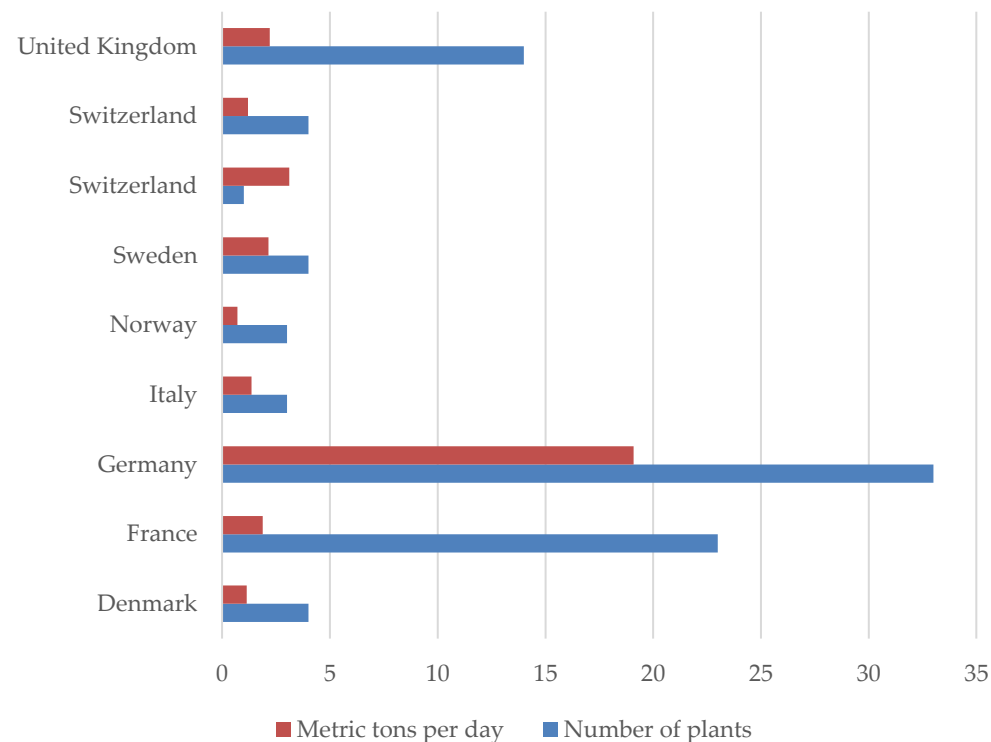
# Governance Structure of Germany Hydrogen Strategy



\* Elected by the members of the National Hydrogen Council  
<sup>1</sup> e.g. at Director-General level

# Status Quo of Germany and UK in Global Hydrogen Landscape

Number of electrolysis plants and supply capacity, 2022

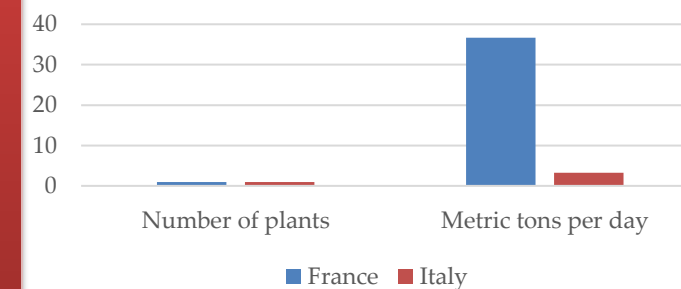


☐ Only France and Italy currently operate SMR with CCS in Europe

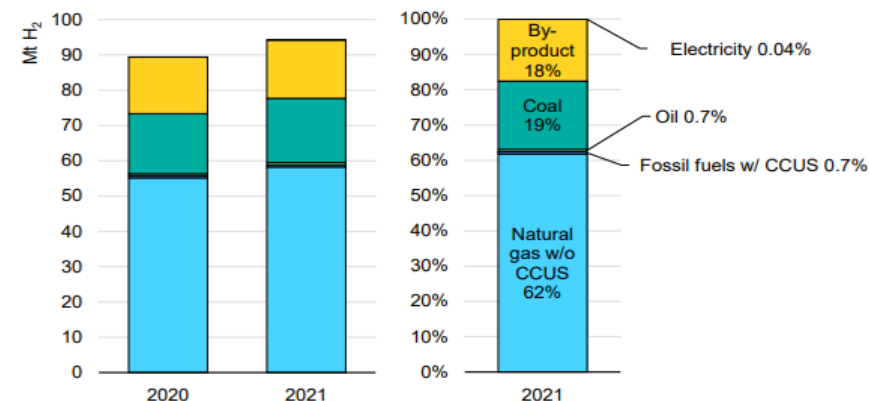
Source: Fuel cells and hydrogen observatory 2022 <https://www.fchobservatory.eu/observatory/technology-and-market/hydrogen-supply-capacity>

	Reforming without CCS	
	Number of plants	Metric tons per day
Denmark	3	83.8
France	11	1664.2
France	11	248.2
Germany	44	5002.9
Italy	30	2108.7
Norway	5	733.3
Sweden	11	531.2
Switzerland	4	57.9
United Kingdom	26	1757.5

Reforming (Carbon Capture), 2022



Hydrogen production mix, 2020 and 2021

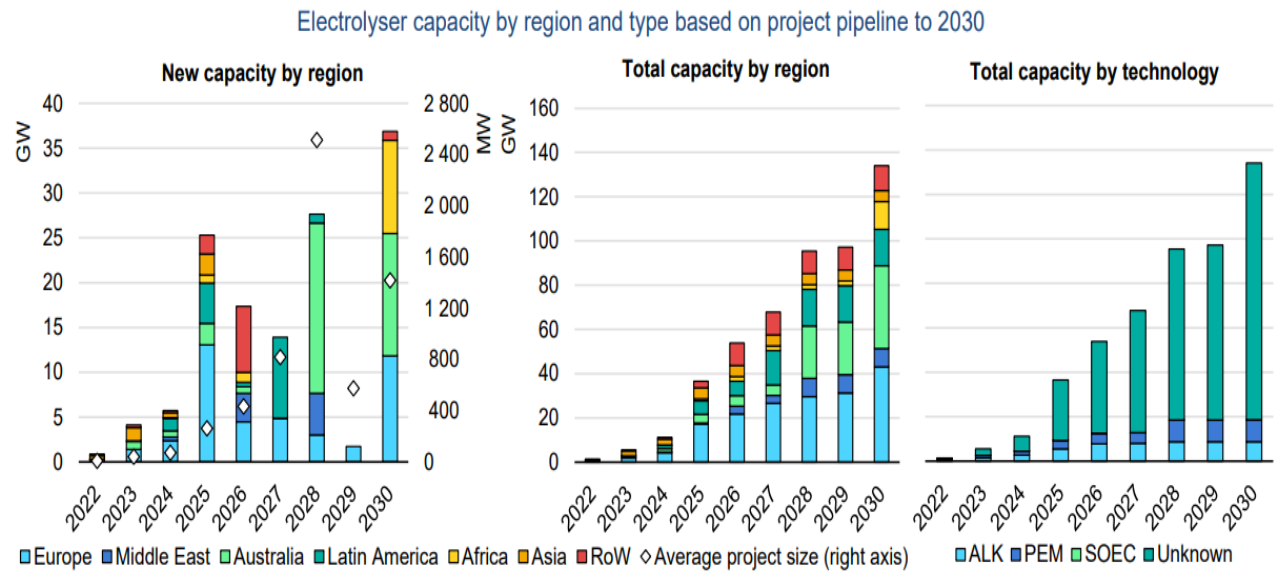
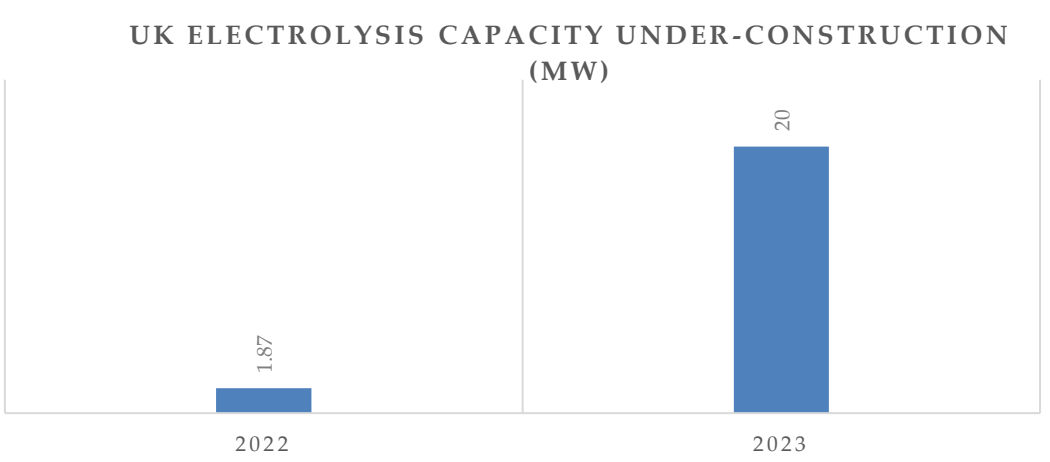
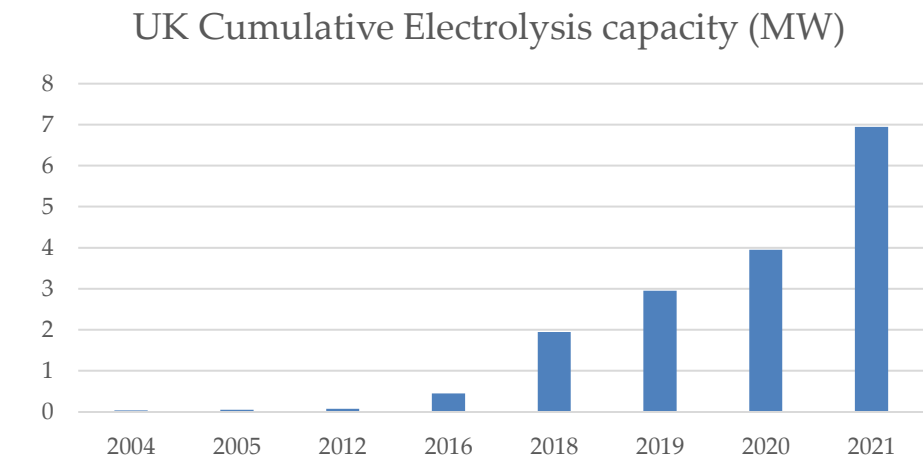
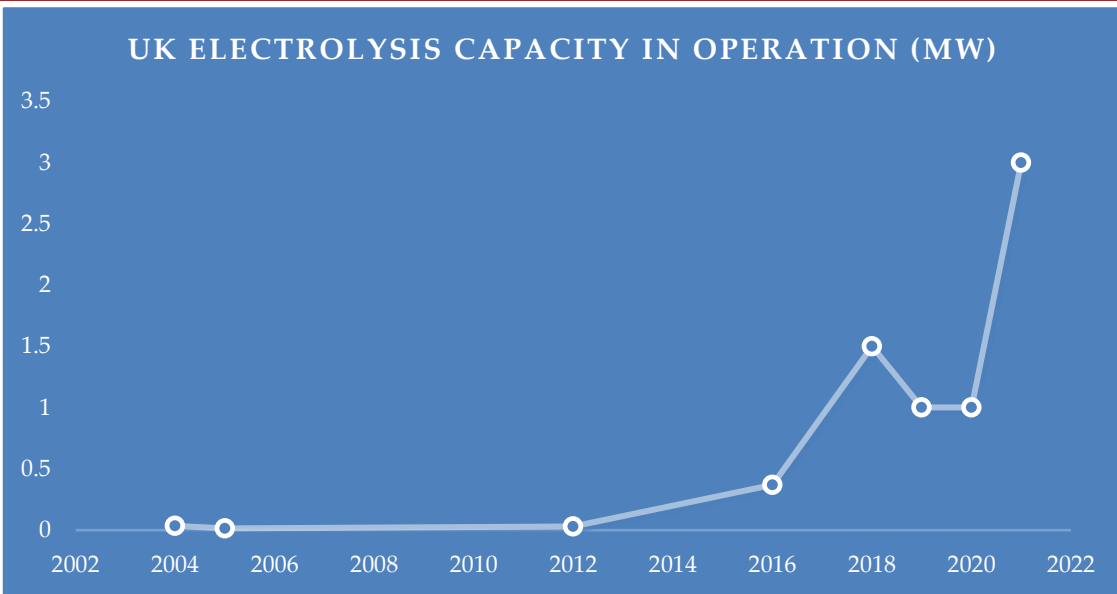


Source: IEA Global Hydrogen Review 2022 <https://www.iea.org/reports/global-hydrogen-review-2022>



# SUPPLY AND DEMAND OF HYDROGEN OUTLOOK

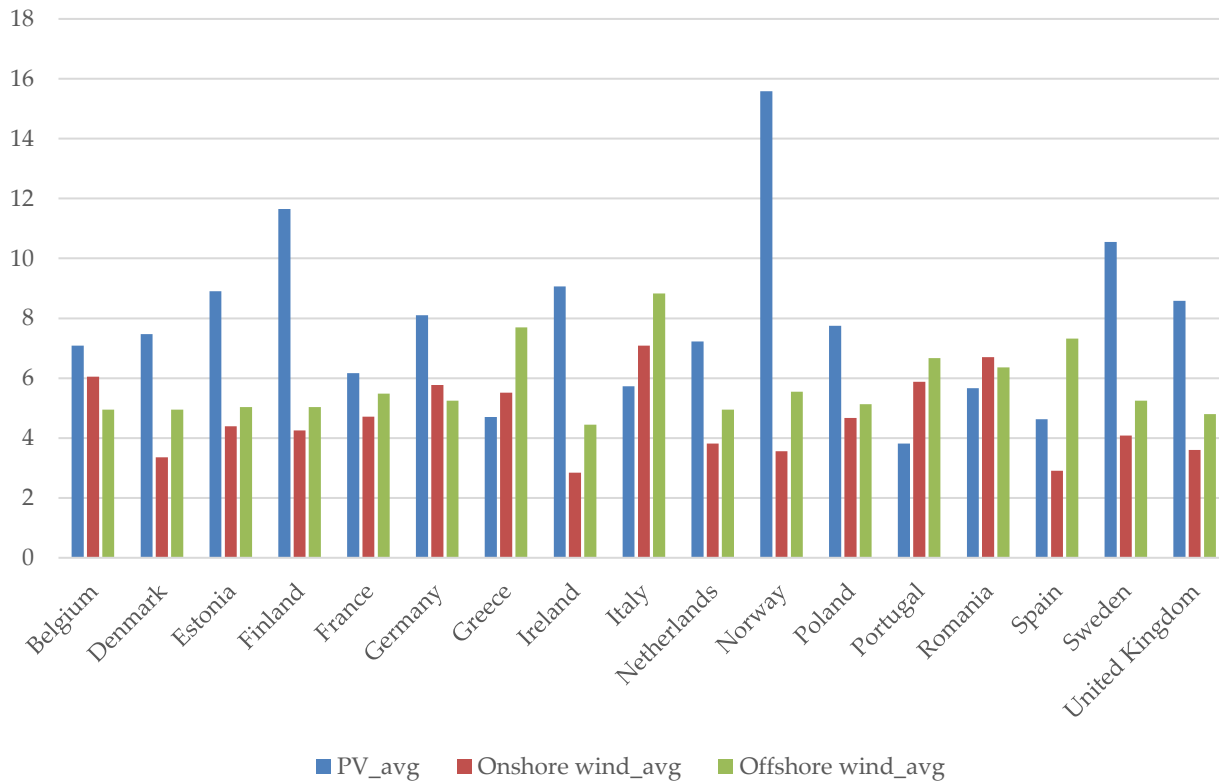
# Electrolysis Technology Capacity



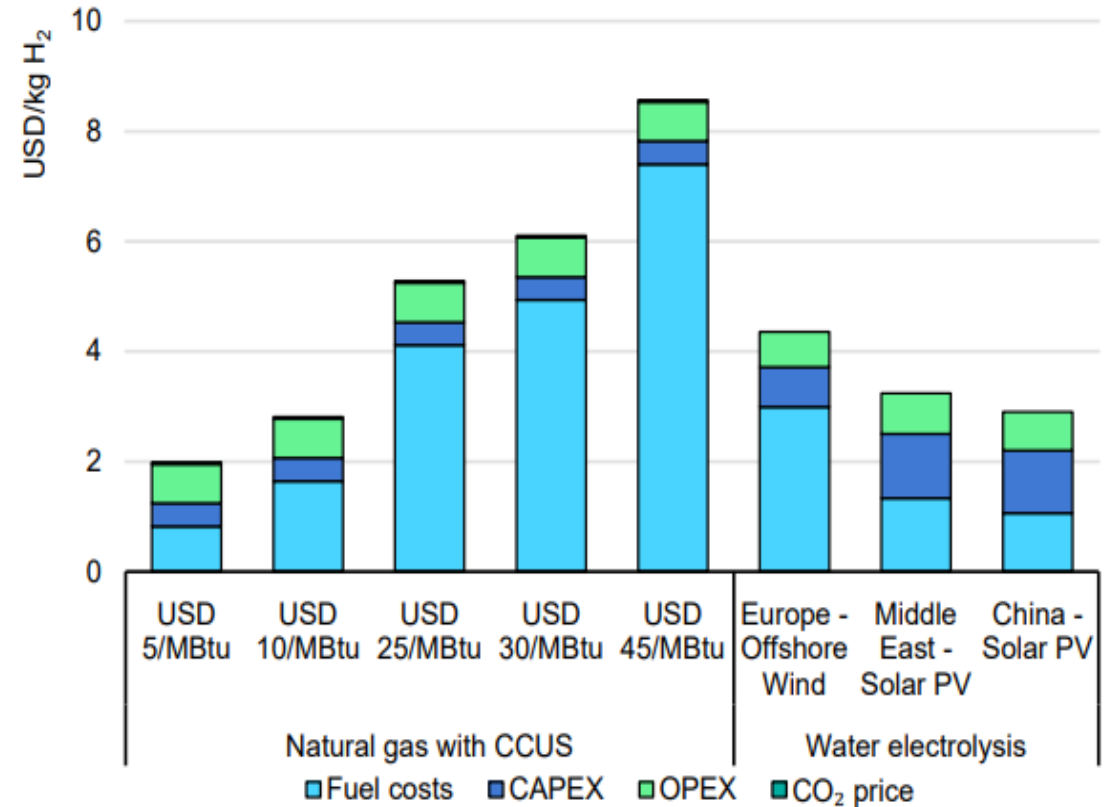
Source: Fuel cells and hydrogen observatory 2022

# Levelised Hydrogen Production Cost

Levelised Cost of Hydrogen from a renewable electricity generation source (€/kg), 2022



Levelised hydrogen production costs from natural gas at various gas prices and from renewable electricity, 2022

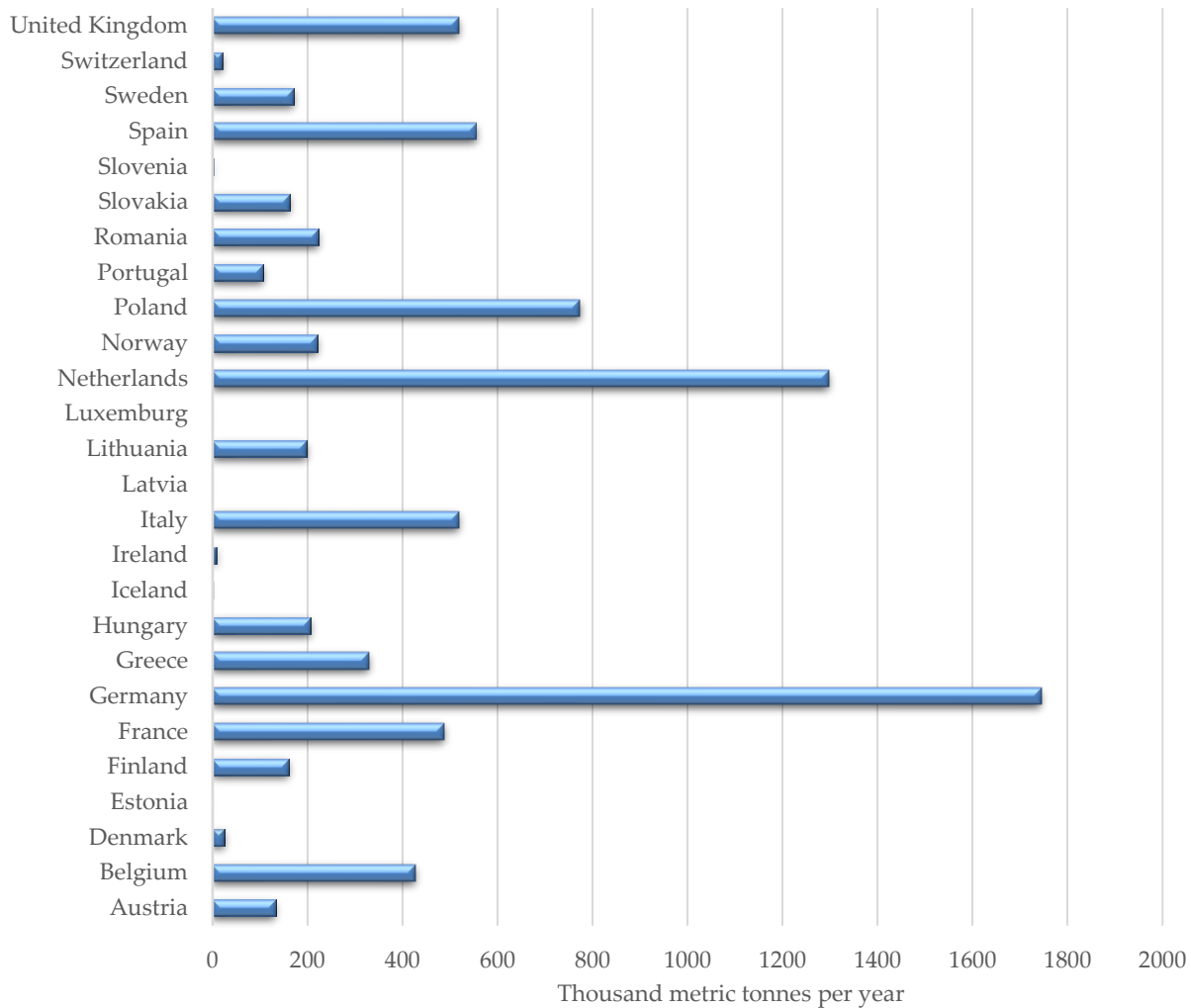


Source: Fuel cells and hydrogen observatory 2022

Source: IEA Global Hydrogen Review 2022 <https://www.iea.org/reports/global-hydrogen-review-2022>

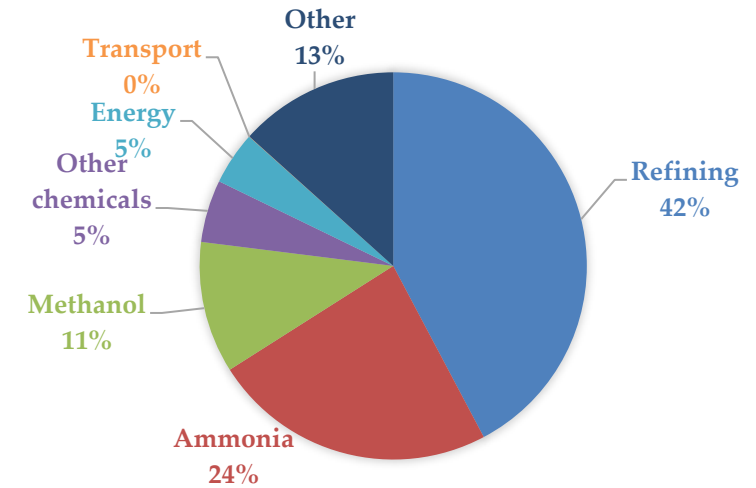


# Hydrogen Demand in Europe 2022

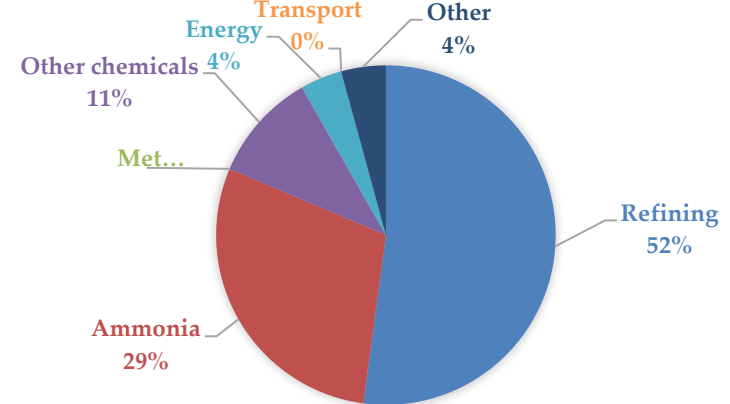


Source: Fuel cells and hydrogen observatory 2022

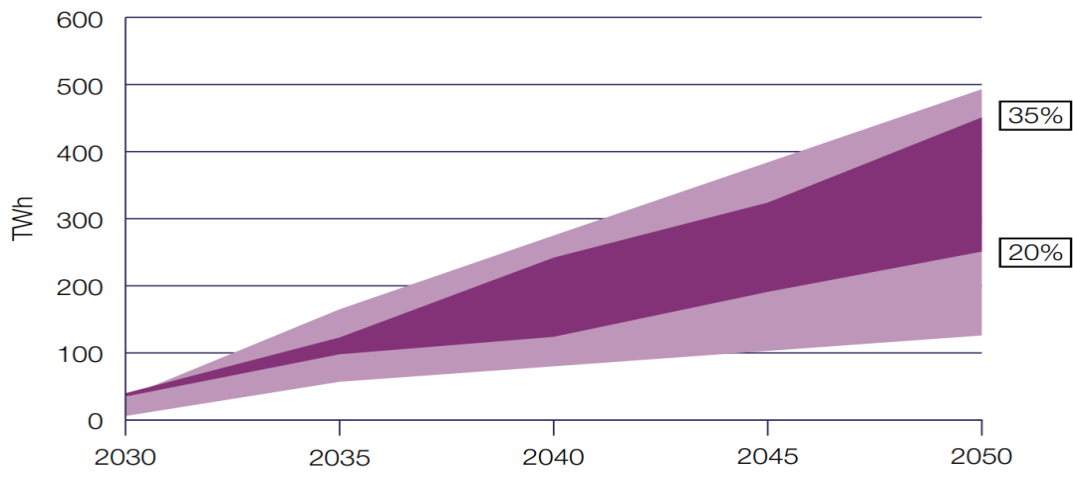
## GERMANY'S HYDROGEN DEMAND



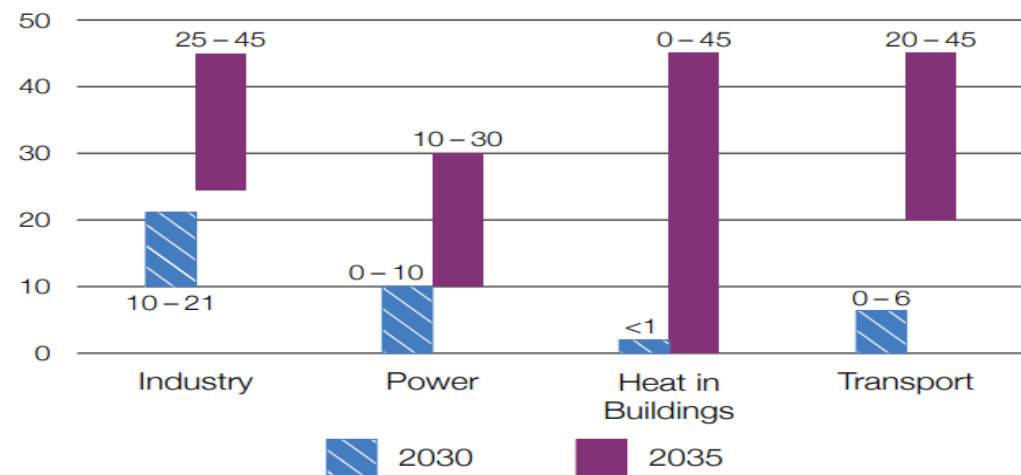
## UNITED KINGDOM'S HYDROGEN DEMAND 2022



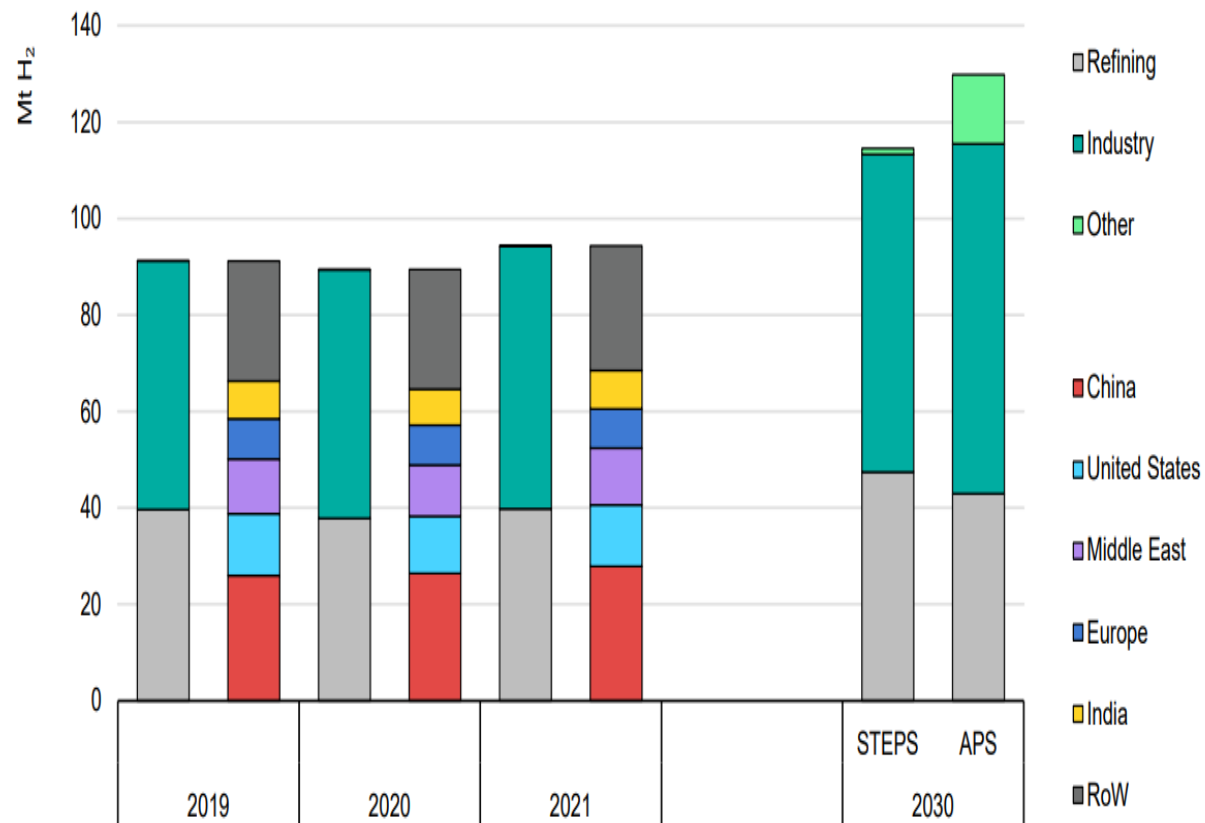
# Evolution of UK Future Hydrogen Demand



% = hydrogen as proportion of total energy consumption in 2050



Hydrogen demand by sector and by region in the Stated Policies and Announced Pledges scenarios, 2019-2030



IEA. All rights reserved.

Notes: Mt H<sub>2</sub> = million tonnes of hydrogen; STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario. *Other* includes transport, buildings, power generation sectors and production of hydrogen-derived fuels and hydrogen blending.

Source: UK Hydrogen Strategy 2022 [UK hydrogen strategy - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/103122/uk-hydrogen-strategy-2022.pdf)

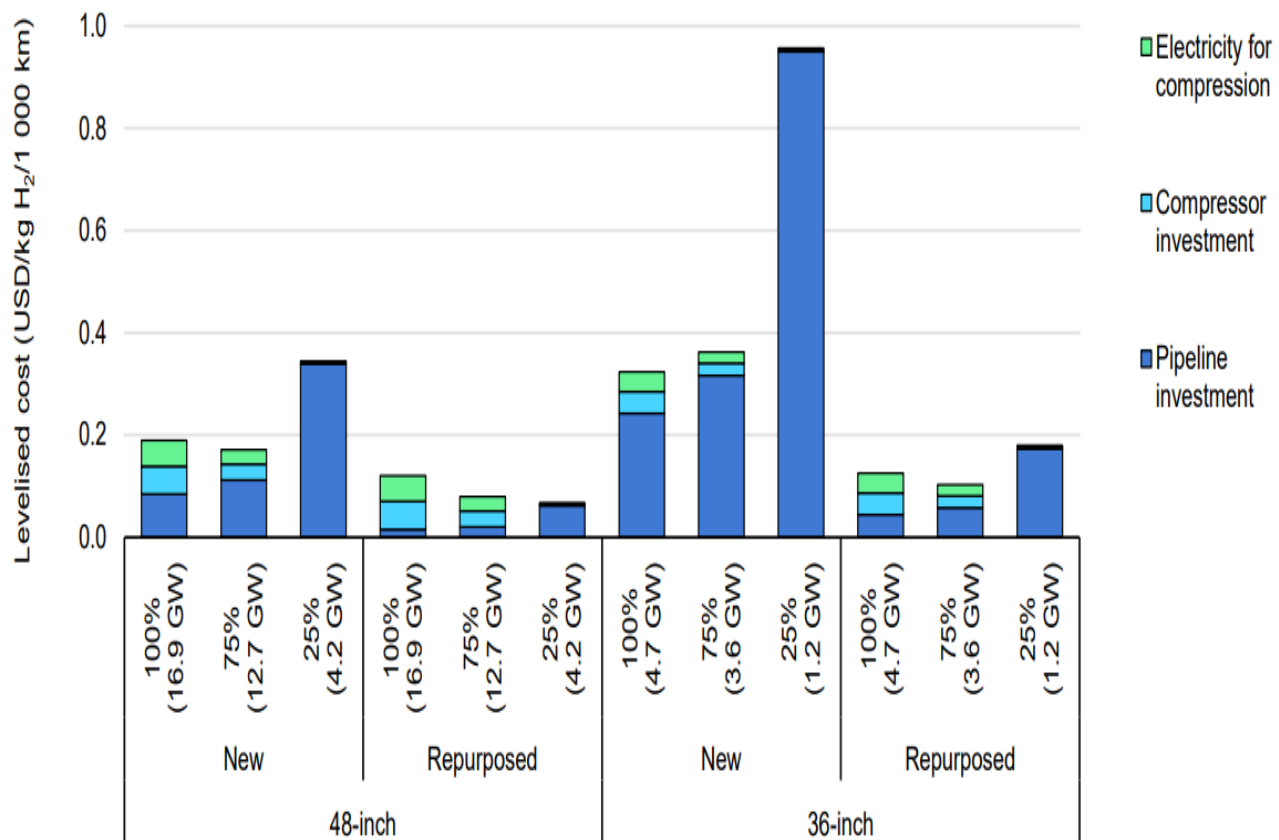
Source: IEA Global Hydrogen Review 2022 <https://www.iea.org/reports/global-hydrogen-review-2022>



# HYDROGEN INFRASTRUCTURE, INVESTMENT AND TRADE

# Hydrogen Infrastructure Cost and Facilities

Levelised cost of hydrogen transmission based on pipeline diameter and throughput capacity



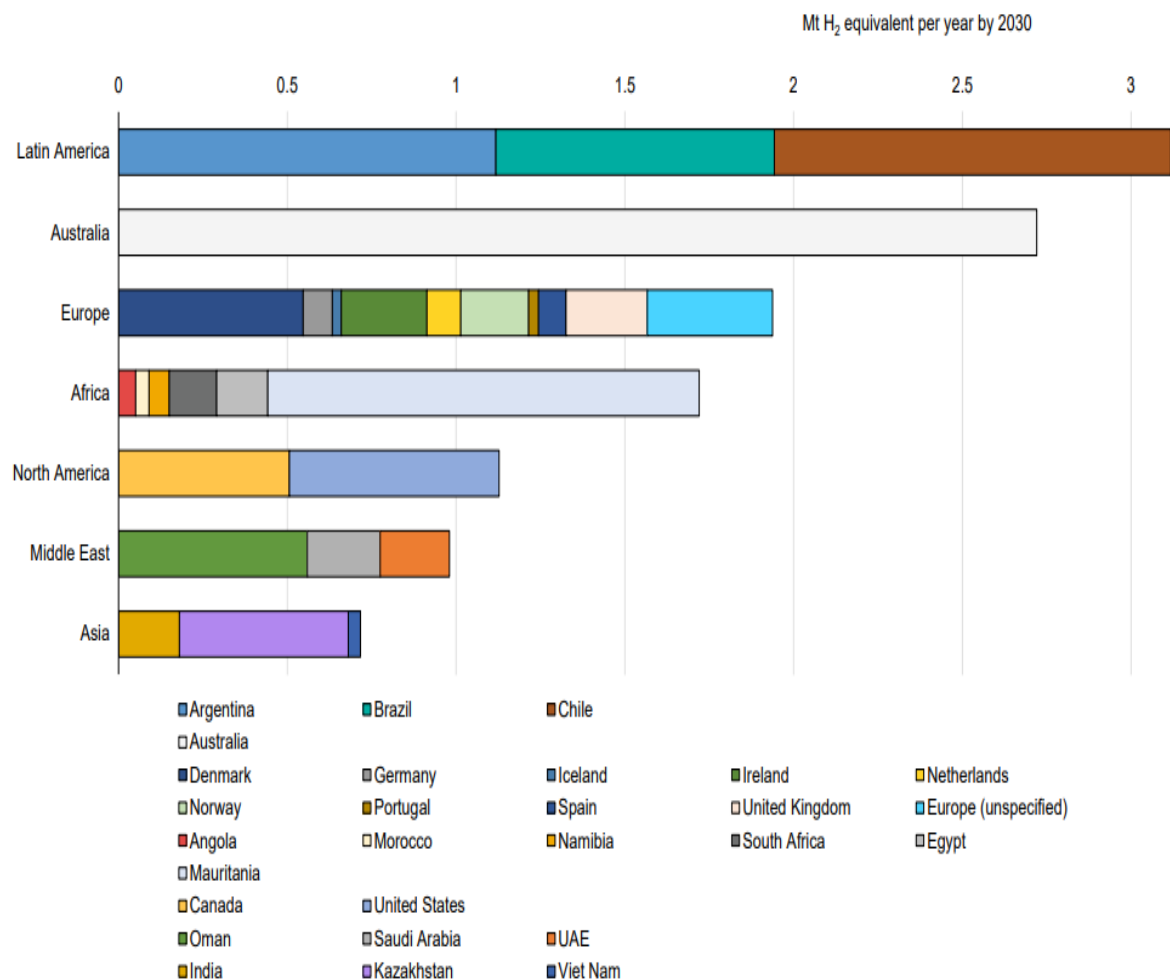
Planned underground hydrogen storage facilities

Type	Project name	Country	Project start year	Operator/developer	Working storage (GWh)	Status
Salt cavern	Green Hydrogen Hub	Denmark	2025	Gas Storage Denmark A/S, Corre Energy BV, Eurowind Energy A/S	250	Feasibility study
	HyGreen Provence	France	2028	Engie, Storengy	200	Feasibility study
	StorHy Cerville	France	2026	Storengy	0.3	Concept (Demo)
	H2 Gronau-EPE	Germany	2027	RWE Gas Storage West	115	Feasibility study
	Energiepark Bad Lauchstädt	Germany	2027	VNG Gasspeicher, ONTRAS Gastransport, DBI, Terrawatt, Uniper	150	Feasibility study
	HyStock Zuidwending	Netherlands	2027	Gasunie	165 (per cavern, up to 4 caverns)	Feasibility study
	Damaslawek	Poland	2030	Gaz-System	-	Concept
	H2toES Cuenca Vasco-Cantábrica	Spain	-	Repsol	-	Concept
	Humber Hydrogen Storage	United Kingdom	2028	Equinor, SSE Thermal	320	Feasibility study
	HyNet/HyKeuper	United Kingdom	2030	INOVYN, Costain, Geostock	70 (per cavern, up to 19 caverns)	Feasibility study
	HySecure	United Kingdom	mid-2020s	Storengy, Inovvn, Element Energy	40	Concept
	Advanced Clean Energy Storage	United States	2025	Mitsubishi Power, Magnum Development	150 (per cavern, up to 100 caverns)	Feasibility study
	Hydrogen City – South Texas	United States	2026	Green Hydrogen International, Energy Estate	120 (per cavern, initially 2 caverns and possibly, up to 50)	Concept

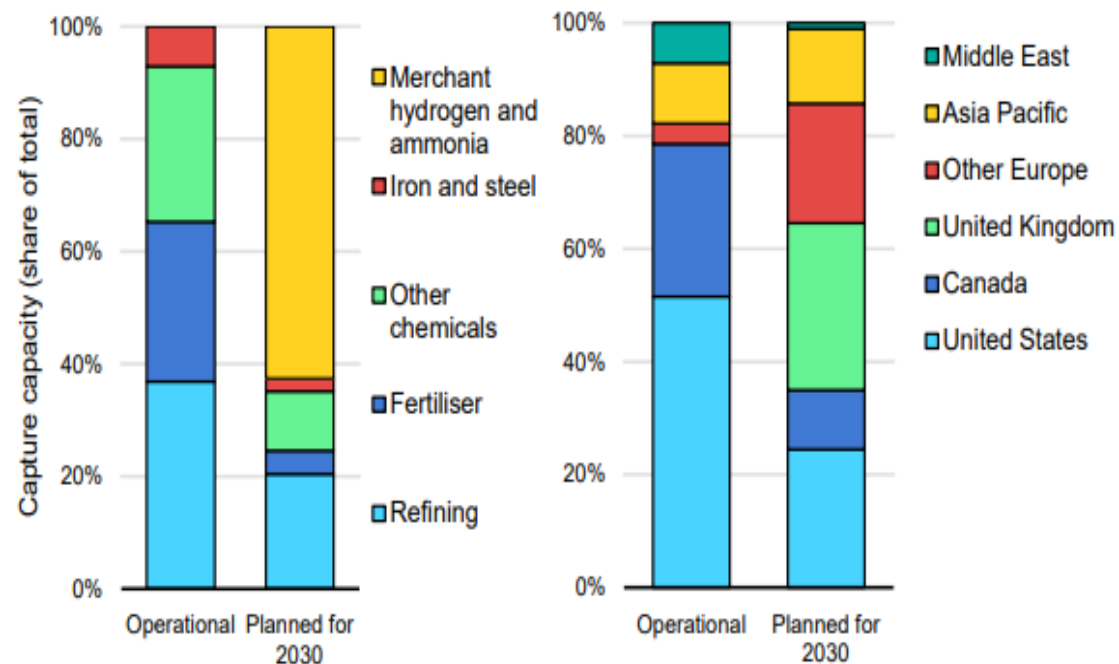
Source: IEA Global Hydrogen Review 2022 <https://www.iea.org/reports/global-hydrogen-review-2022>

# Potential Hydrogen Exports and Applications

Planned hydrogen exports by region/country, 2030



Hydrogen production with CCUS project pipeline by application and region



Source: IEA Global Hydrogen Review 2022 <https://www.iea.org/reports/global-hydrogen-review-2022>



# Hydrogen Investment Roadmap

Major policies		Core objectives of the strategy	Production and procurement forecasts
<b>Budget</b>	<b>Policy details</b>		
3.6 billion euros	Support for conversion to fuel cells for automobiles, trains, and coastal and inland water transportation vessels (~2023)	(1) Green hydrogen will play a central role in the promotion and completion of Germany's energy transition policy	Hydrogen use in Germany 2030: 90-110 TWh 2050: ~380 TWh
3.4 billion euros	Support for development of hydrogen refueling and recharging infrastructure (~2023)	• For decarbonization	Green hydrogen production
1.91 billion euros	Support for hydrogen technology research (e.g., NIP II, a program for innovation in hydrogen and fuel cell technology) (~2026)	• As a means of storing renewable energy	Domestic production 2030: 14 TWh (4,000 hours full-load operation of water electrolyzer, average energy efficiency ratio 70%)
1.1 billion euros	Support for PTL facilities that convert electricity to liquid fuel (~2023)	• As an energy source	Facility capacity 2030: 5 GW 2040: 10 GW or more
1 billion euros	Investment in new technologies and large-scale facilities (~2023)	• As raw material	Imports 2030: Almost none 2050: Imports will account for the majority of demand
700 million euros	Support for the introduction of fuel cell heaters (~2024)	(2) Fulfilling the global responsibility to meet the challenge of reducing CO <sub>2</sub> emissions	
600 million euros	Support for hydrogen research and industrialization through the Real-World Laboratories program (~2023)	(3) Building a hydrogen society is a collective task for the EU	
50 million euros	Support for research on the practical application of fuel cell powered airplanes and ships (~2024)		
<b>Total 12.36 billion euros</b>			
+			
9 billion euros	Appropriation from Coronavirus economic stimulus package - Support for the launch of the hydrogen market (7 billion euros) - International collaboration and cooperation (2 billion euros)		

## Why invest in UK Hydrogen?

A sector with striving ambitions and major opportunities for growth



[Hydrogen net zero investment roadmap - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/92422/hydrogen-net-zero-investment-roadmap-2021.pdf)

# How Successful the Hydrogen Strategy will be?

## Challenges

- Regulatory issues
- Hydrogen production technology cost uncertainty
- Wide infrastructure investment gap
- Hydrogen demand uncertainty



# Thank You

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