



Global Hydrogen Review 2023

Hydrogen and Alternative Fuels Unit

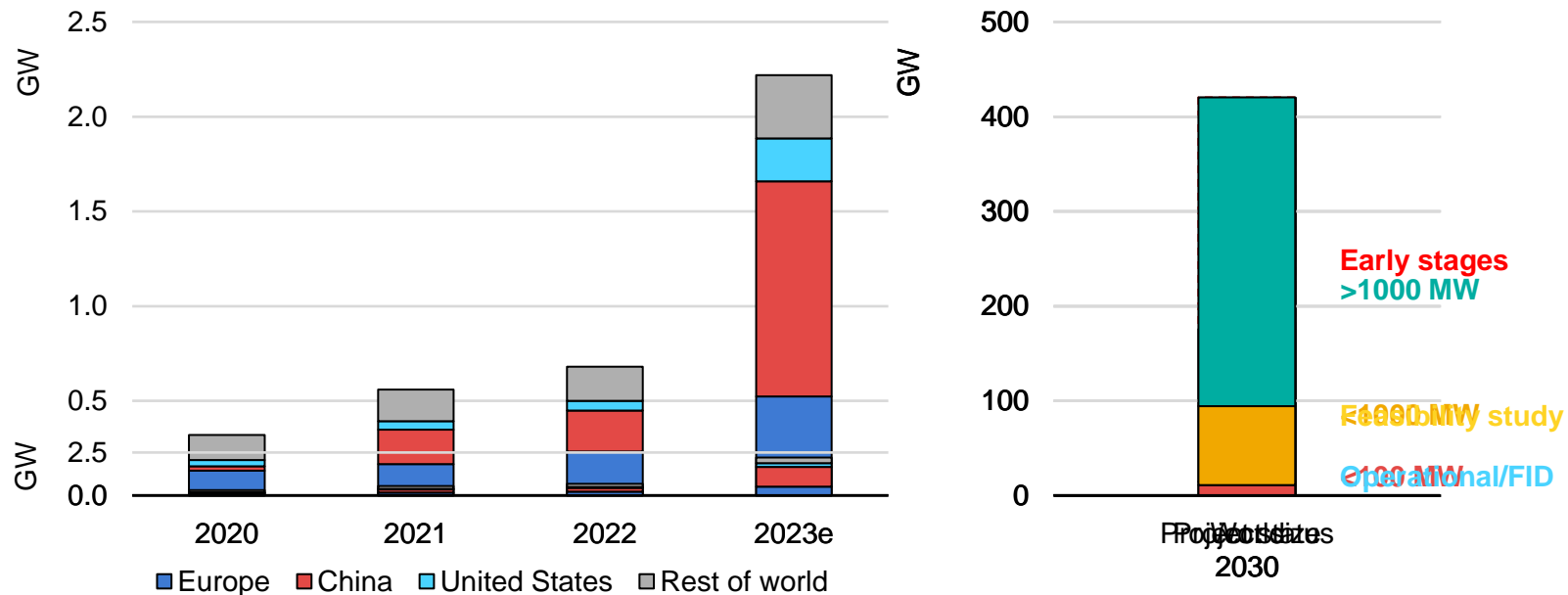
GHR2023 Webinar, 31 October 2023



- Production can increase massively but faces cost challenges
 - Number of announced projects growing rapidly
 - Slow implementation of government support schemes delaying investment decisions
 - Increasing equipment and financial costs putting projects at risk
- Efforts to stimulate demand are not sufficient to meet climate ambitions
 - Limited policy action on demand creation
 - First off-take agreements small and non-binding
 - Unclear demand signals from co-operation initiatives
- What are the key priorities to turn momentum into deployment?

Growth in electrolyser projects has mushroomed

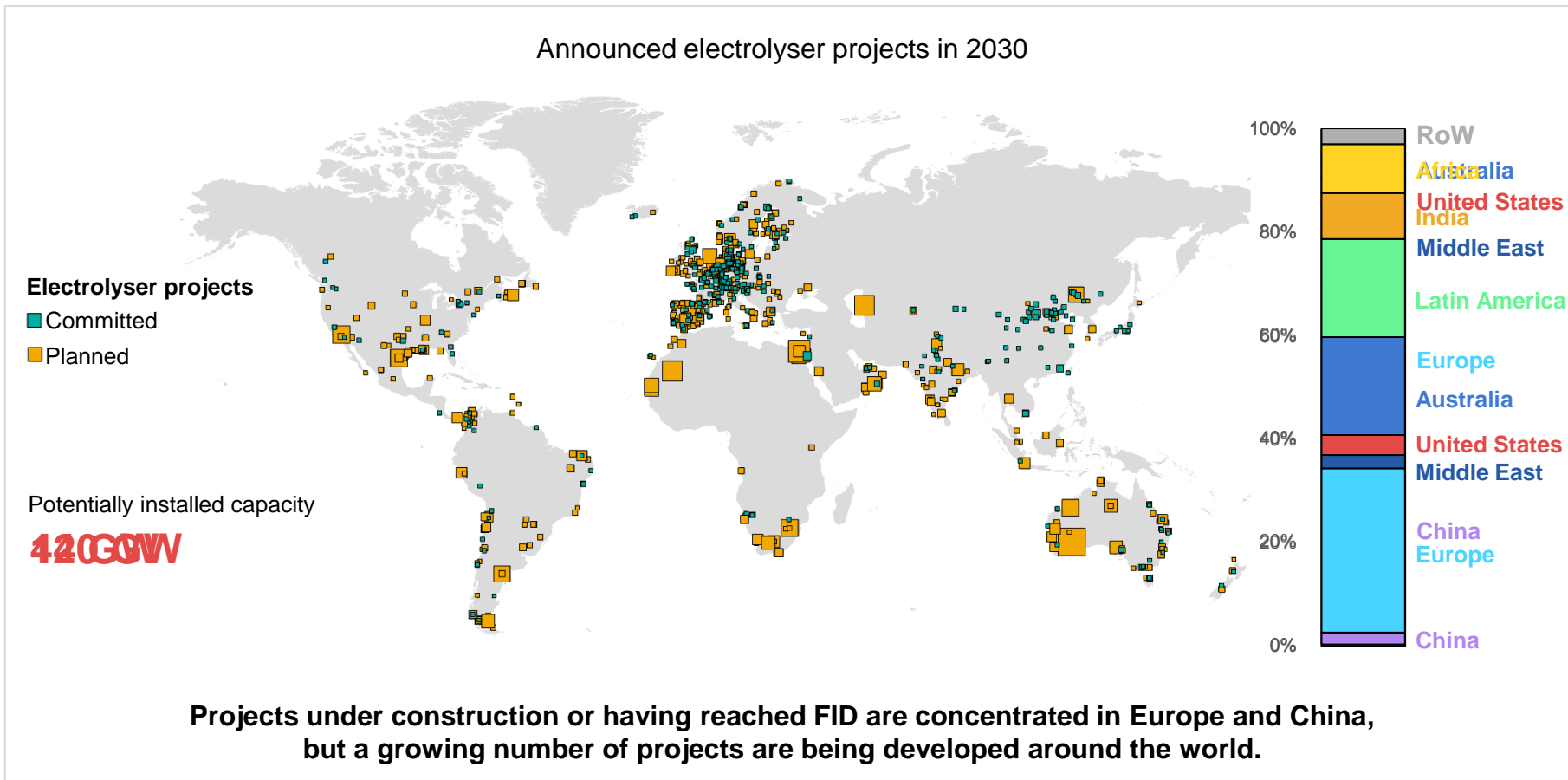
Historical deployment of water electrolyzers and capacity in 2030 based on announced projects



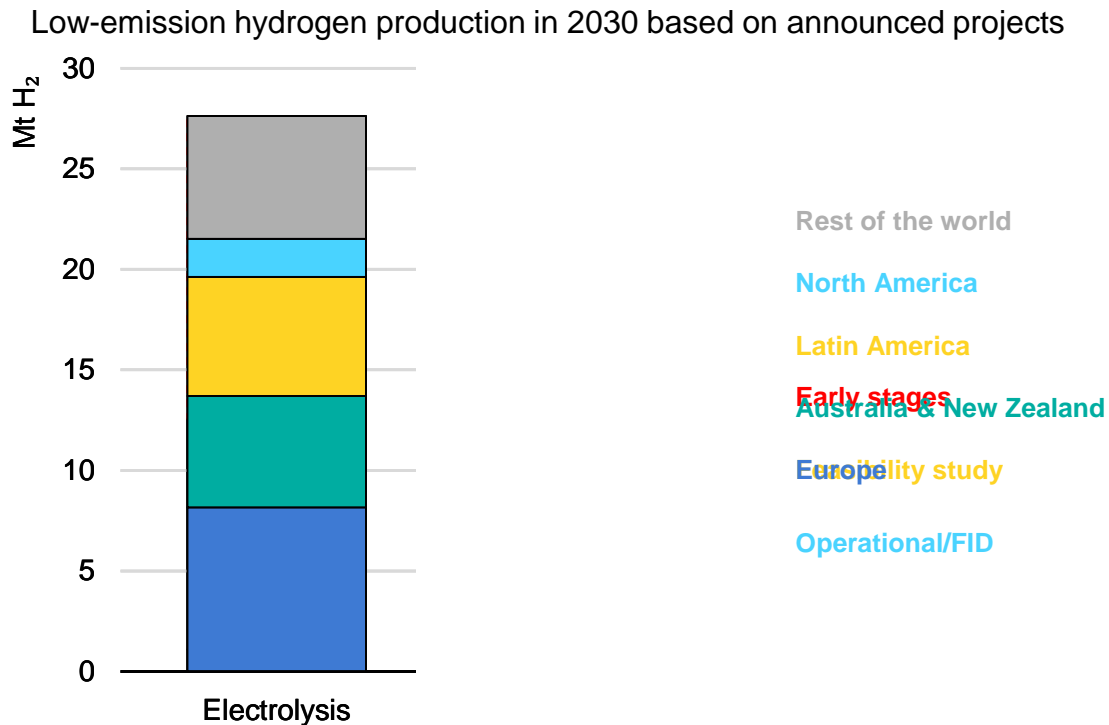
2023e = estimate for 2023

Based on announced projects, 420 GW could be installed by the end of the decade, with a trend towards larger projects.

Geographical diversity of electrolyser projects is increasing

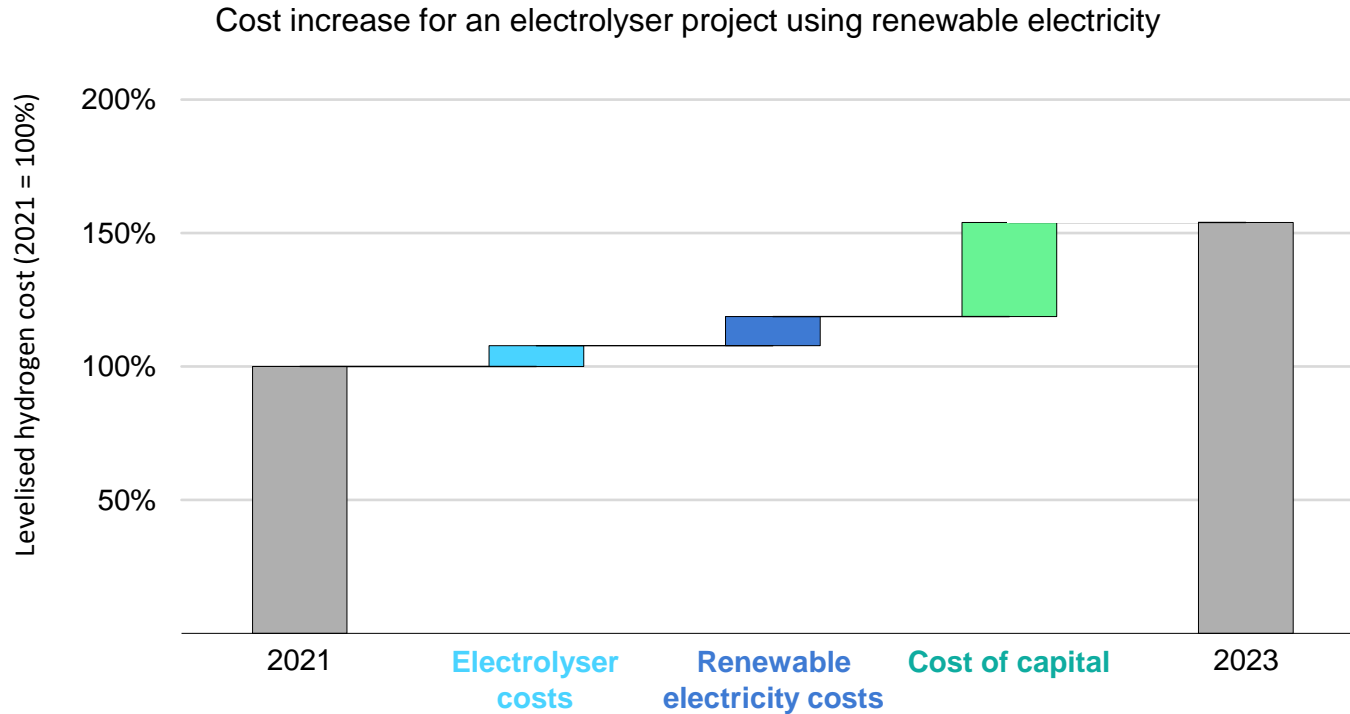


Production routes are evolving differently



Announced low-emission hydrogen projects of 38 Mt could meet government targets to produce 35 Mt by 2030. However, only 4% have reached final investment decision or are under construction.

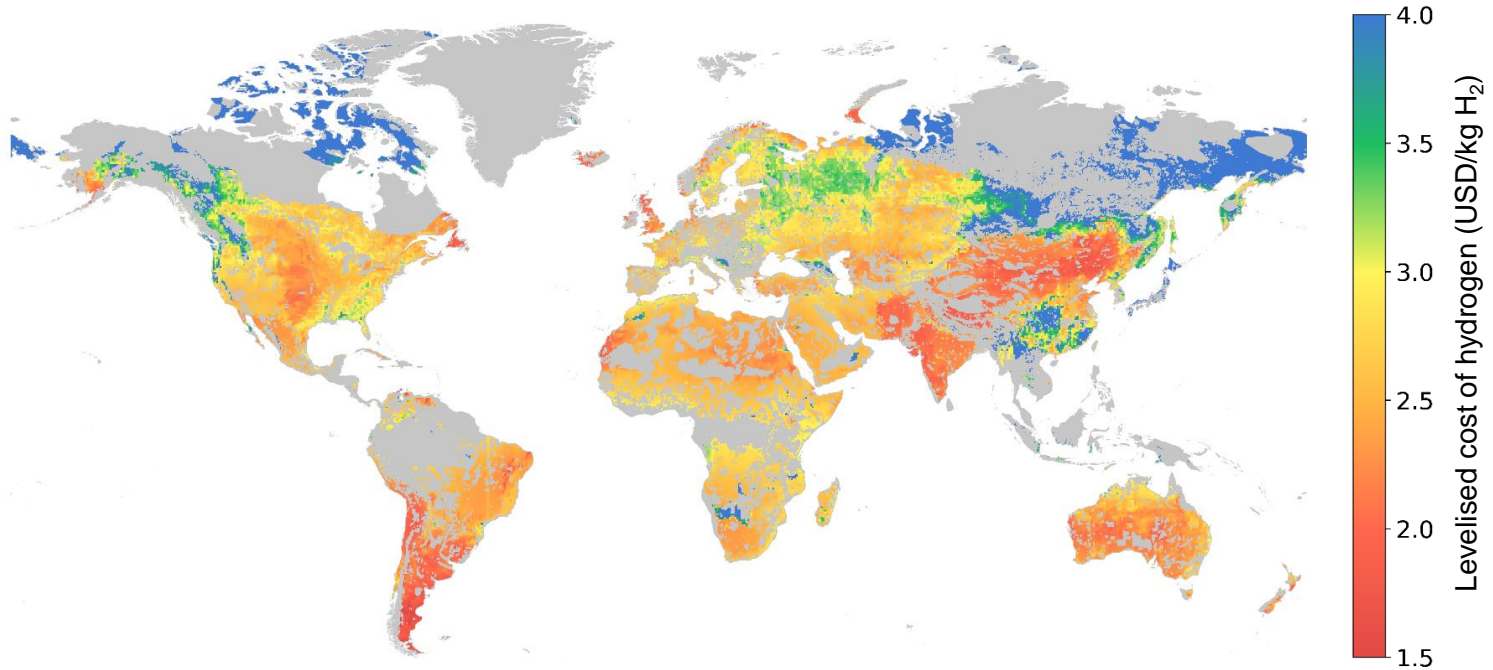
Costs for low-emission hydrogen projects are increasing



Inflation is having a strong impact on the costs of hydrogen production from proposed electrolyser projects, potentially impacting the economics of projects under development and delaying investment decisions.

Scaling up deployment will bring down costs for renewable hydrogen

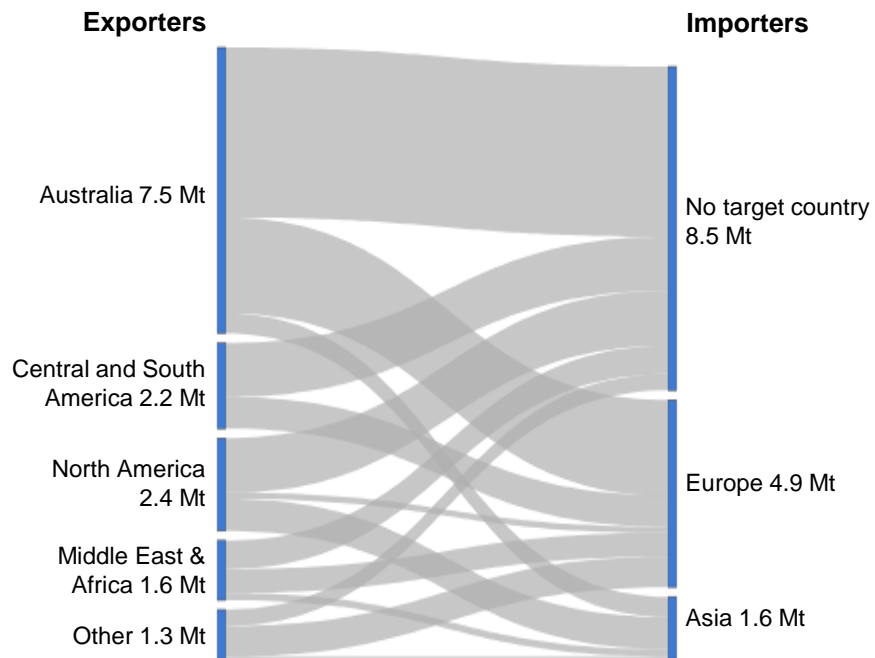
Hydrogen production costs from hybrid solar PV and onshore wind systems in the NZE Scenario in 2030



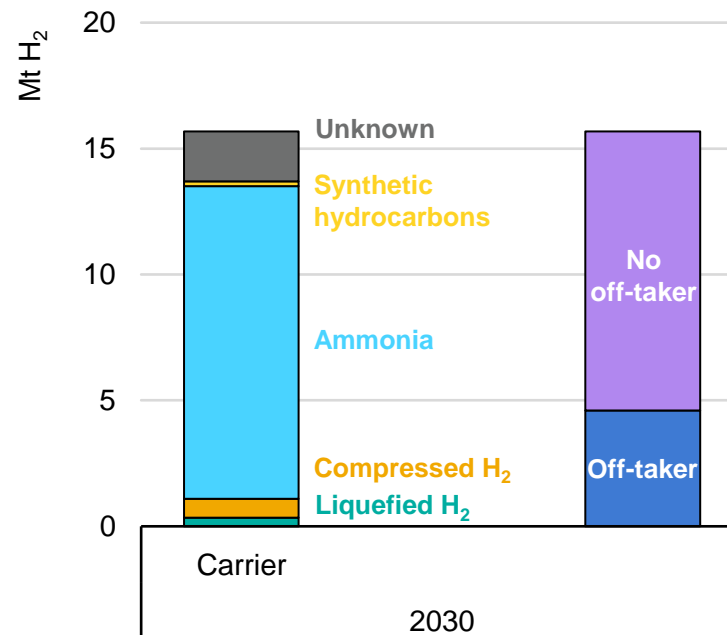
**Various regions around the world have excellent renewable resources for low-cost hydrogen production.
Costs could approach USD 1.5 kg H₂ by 2030.**

Interest in hydrogen trade is growing, but barriers remain

Announced low-emission hydrogen trade flows in 2030



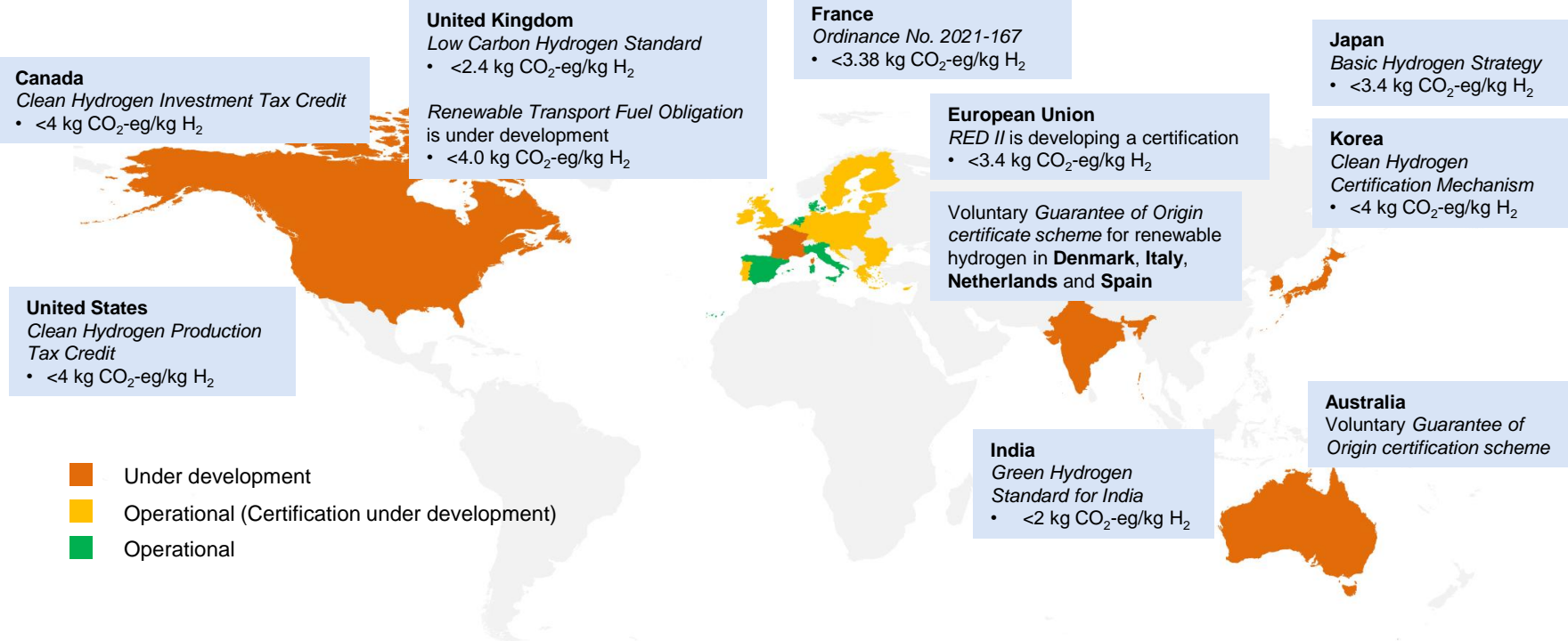
Low-emission hydrogen trade



Planned hydrogen exports could reach 16 Mt by 2030, though almost all projects are at early stages and less than one-third have identified a potential off-taker.

First steps on regulation and certification of hydrogen

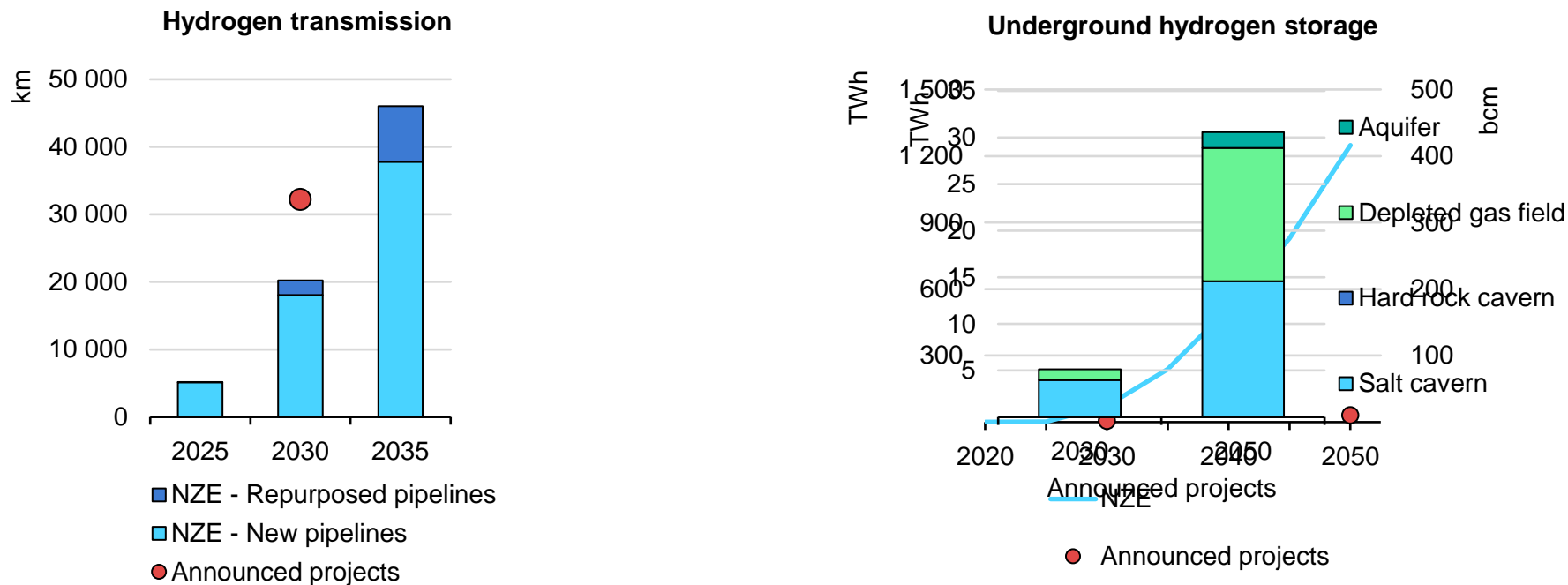
Selected existing and planned certification systems and regulatory frameworks for hydrogen and hydrogen-based fuels



Mutual recognition of certificates and regulations can minimise market fragmentation. IPHE developed a methodology on hydrogen related GHG emissions, as a first step towards an International Standard by ISO.

The rise of infrastructure for hydrogen transport and storage

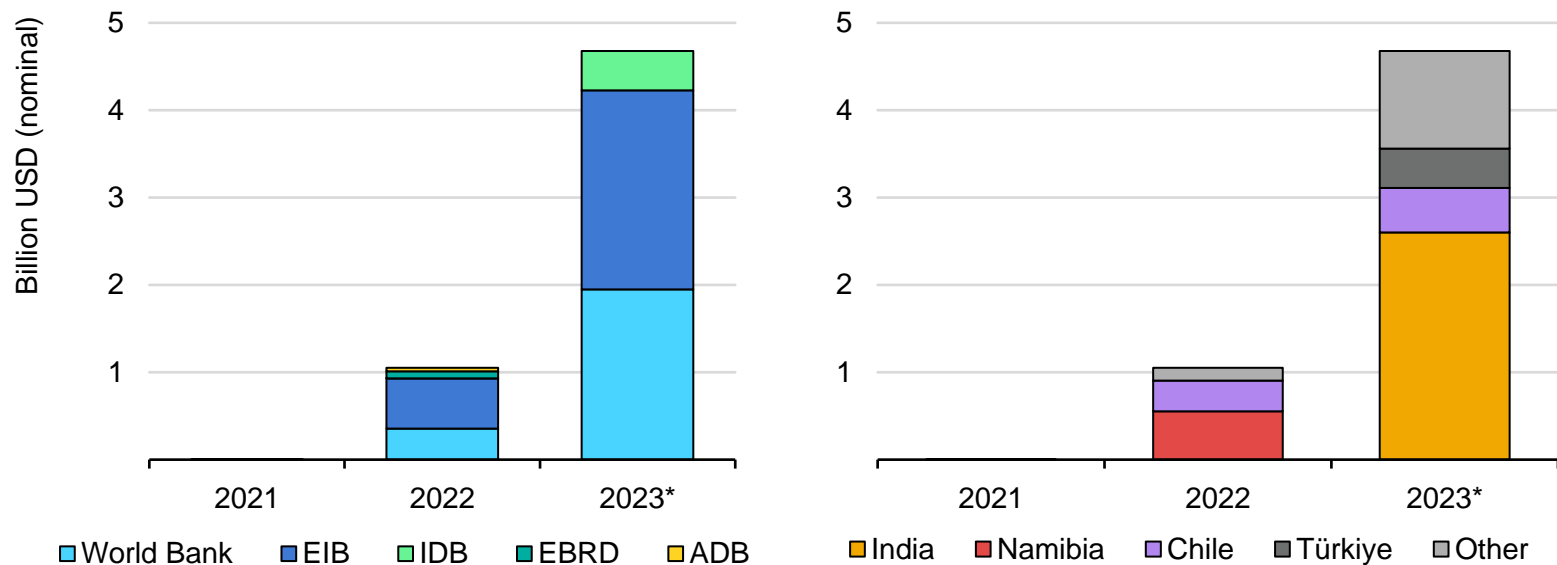
Global hydrogen transmission pipeline length and underground storage capacity in the NZE Scenario, 2020-2050



The long lead times associated with infrastructure projects mean that while the announced length of hydrogen pipelines is in line with needs, underground storage requires urgent and accelerated action

Multilateral financial commitments are growing

Financial commitments to hydrogen by multilateral development banks, by source and partner country, 2021-2023*

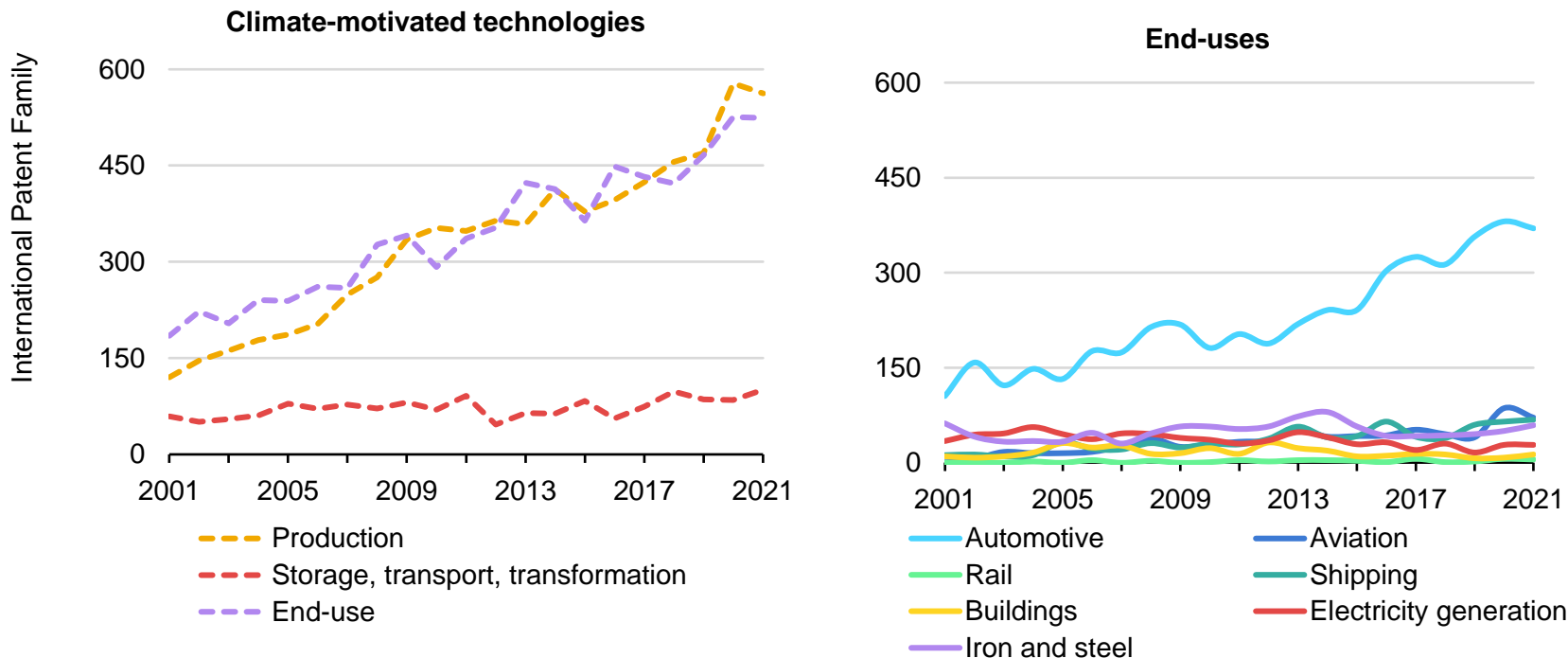


2023*: year to July 2023 only

Multilateral development banks are increasing financial commitments with EMDEs in the area of hydrogen

Patenting on key hydrogen demand applications remains low

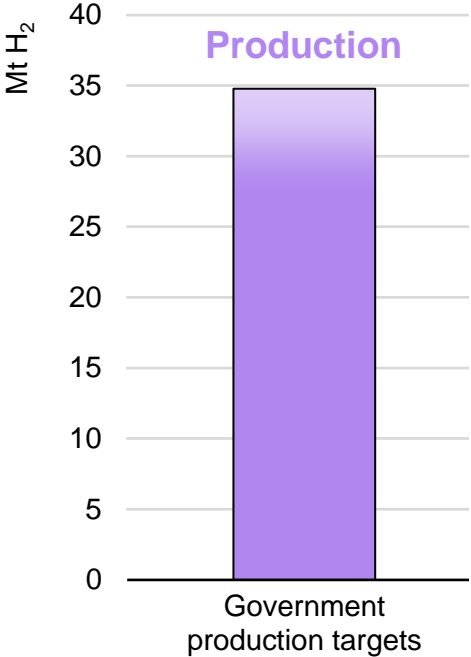
Patenting trends on hydrogen technologies, 2001-2021



Global hydrogen patenting surges, but patenting activity remains remarkably low for key hydrogen-consuming technologies (with lower TRL levels) in sectors in which emissions are hard to abate

Demand creation is falling behind production ambitions

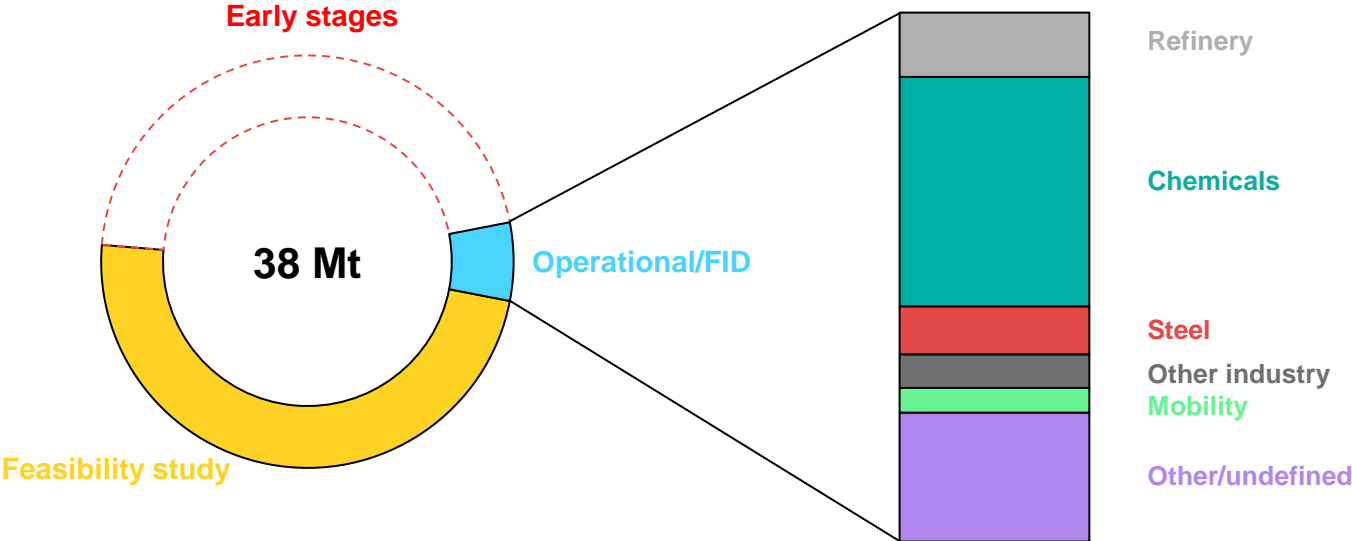
Low-emission hydrogen production targets compared with potential demand



Actions from governments, international co-operation initiatives and the private sector fall short of production ambitions

Existing applications are forging ahead to adopt low-emission hydrogen

Low-emission hydrogen production from announced projects by demand sector, 2030



The majority of the low-emission hydrogen production projects having reached FID are linked to existing applications of hydrogen

1. **Implement support schemes** for low-emission hydrogen production and use
2. **Take bolder action to stimulate demand** for low-emission hydrogen, particularly in existing hydrogen uses
3. **Foster international co-operation** to enable hydrogen certification and mutual recognition
4. **Address regulatory barriers**, particularly for project licensing and permitting
5. Support project developers to **keep momentum during the inflationary period** and to extend regional reach

- Updated “Hydrogen Production Projects Database” and new “Hydrogen Infrastructure Projects Database” – now online

<https://www.iea.org/data-and-statistics/data-product/hydrogen-projects-database>

Ref	Project name	Country	Date online	Discontinuation date	Status	Technology		Type of electrolysis (for electrolysis projects)	Type of dedicated renewables (type of renewable)	Product	End-use	Announced size	Normalised capacity			IEA production potential normalised capacity (TWh _{hydro} /H ₂ /hour)	Refs
						Technology Comments	Other electrolysis						MWh	MWh	kg H ₂ /y		
1823	Pego coal plant transition	PRY			Feasibility study	Other Electrolysis	Unknown POC	Dedicated renewable	Solar PV	H ₂		0.5MWh or 1.5 t H ₂ /y	0.5	181	0.1		181 [973]
1824	Seahyge	FRA	2023		Operational	PEM		Dedicated renewable	Offshore wind	H ₂		1MWh, 400 kg H ₂ /y	1	182	0.1		182 [974][984]
1825	Rajasthan pilot plant	IND	2021		Operational	Other Electrolysis	Unknown POC	Dedicated renewable	Solar PV	Ammonia	1	5 t H ₂ /day, 5MWh	5	183	0.9		[975][986]
1826	OCF Group demo project	MAR			FID/Construction	Other Electrolysis	Unknown POC	Dedicated renewable	Unknown	Ammonia	1	4 t H ₂ /day production					[978][989][1026]
1827	Holoz rolling project	SWE	2023		Operational	ALK		Grid		H ₂	1	17MWh	17	3636	2.9		[979][985][987][999][1080]

Ref	Project name	Country	Country	Country	Country	Country	Country	Partners	Announced start date	2020	2030	Repurposed to New	Status	Pipeline type	Announced size	Length km	Length_new/IEA estimated	Length_rep/IEA estimated	Operating Pressure bar	Refs
PIP-19	Spanish Hydrogen Network: Astiz 2 (Via de la Plata astiz, Puertollano and Coruña-Zamora connections)	ESP						Enagás	2020	2030	Repurposed to New	Feasibility study	Onshore		1500 km	1200.0	200.0			[218]
PIP-20	Cantanhede-Figueira da Foz	PRY						REN	2020	2030	New	Concept	Onshore	81 GWh/day	40 km	40.0	0.0			[219]
PIP-21	Cantanhede-Mangualde-Celorigo-Monforte	PRY						REN	2020	2030	Repurposed to New	Concept	Onshore	81 GWh/day	375 km		375.0			[219]
PIP-22	Hyfen	FRA						GRTgaz	2020	2030	Repurposed to New	Concept	Onshore	200 GWh/day	1200 km (700 km repurposed)	500.0	700.0			[220]

- Two new interactive web tools – coming up:
 - “Hydrogen Production Projects Database Explorer” allows to explore the content of the database through a map.
 - “Levelised Cost of Hydrogen Maps” visualise global hydrogen production costs from renewables and allow to explore the impact of key parameters on costs.

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