

# Offshore Wind and Renewable Hydrogen: Unlocking Potential

Dynamo Energy Hub

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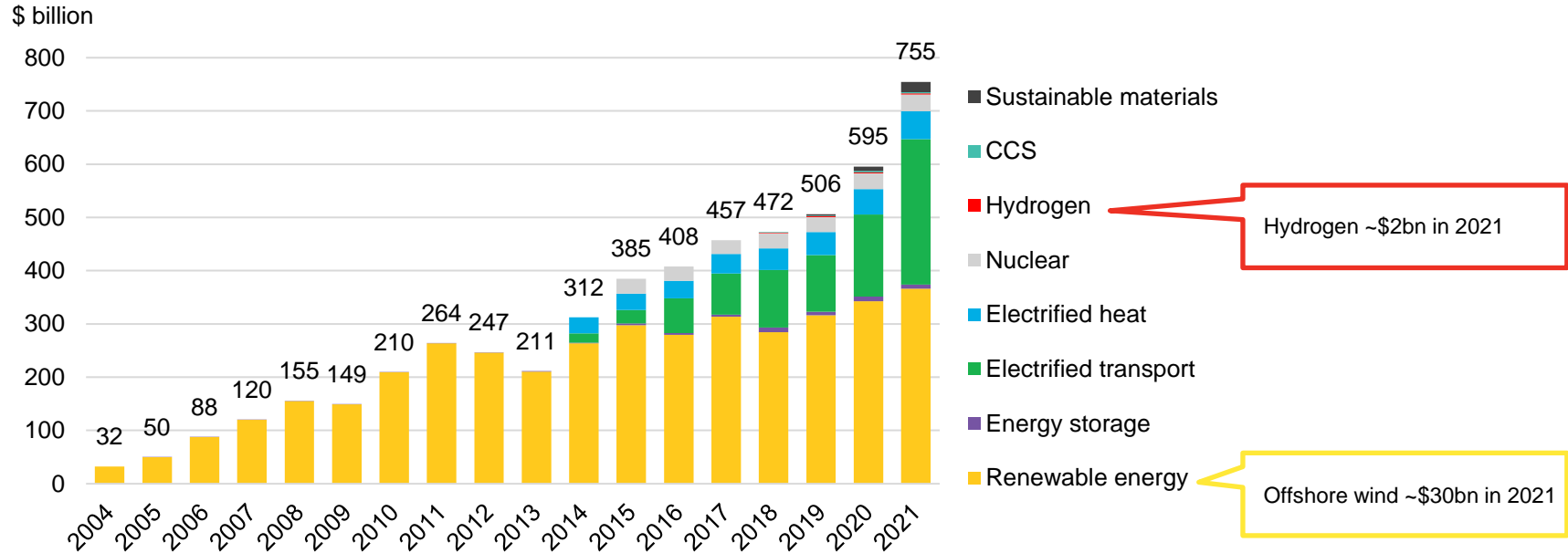
September 20, 2022



BloombergNEF

# Offshore wind and hydrogen are still a small fraction of energy transition spending

## Historical investment in energy transition technologies

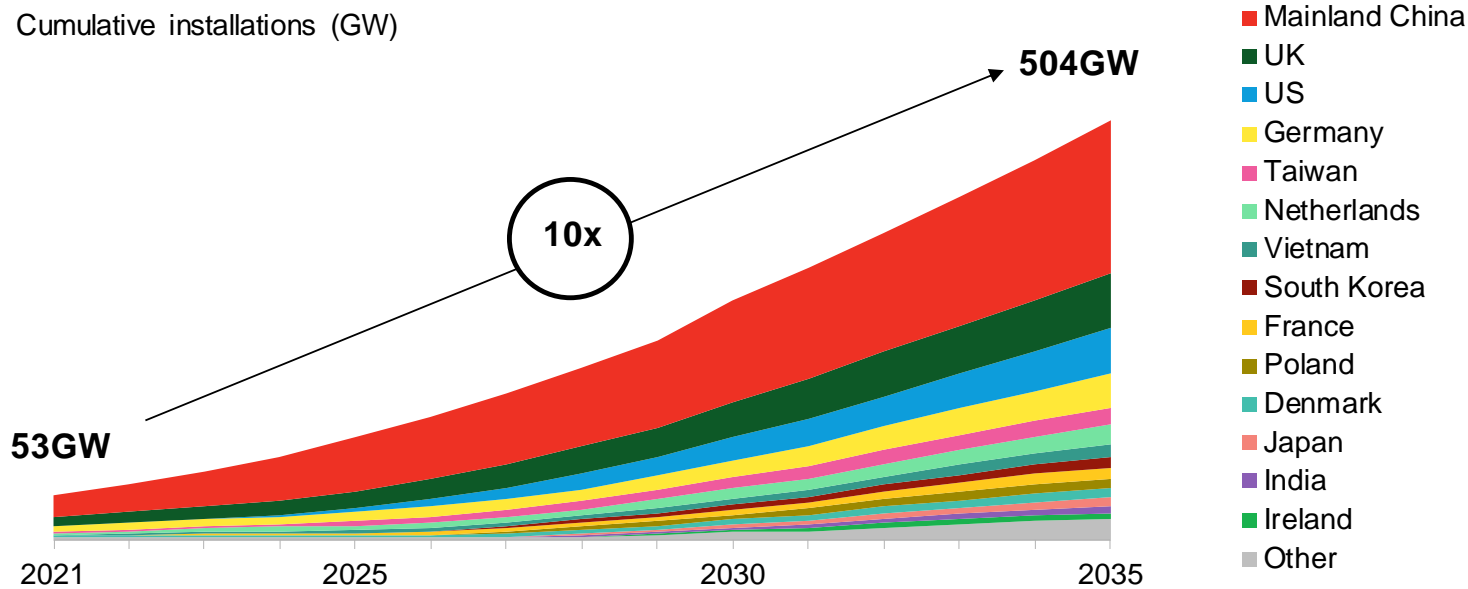


Source: BloombergNEF.

# Offshore wind is poised for 10x growth to 2035

## Global cumulative offshore wind installations

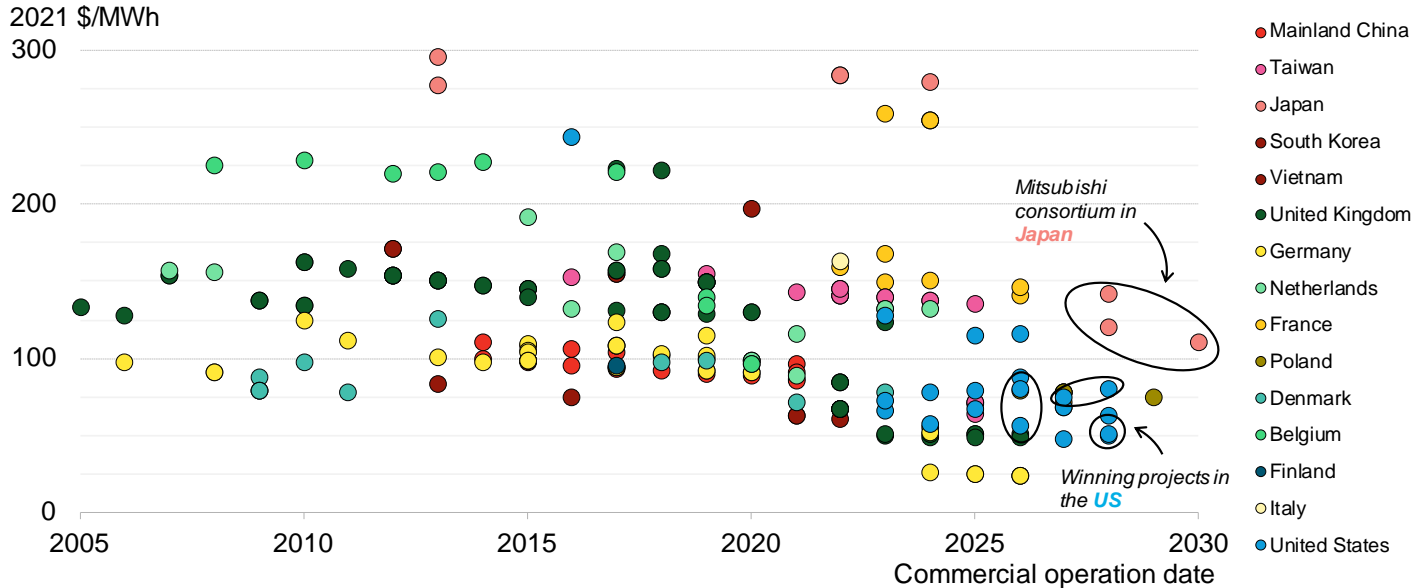
Cumulative installations (GW)



Source: BloombergNEF. Note: Other = Portugal, Italy, Finland, Lithuania, Latvia, Estonia, Greece, Norway, Sweden, Spain, Brazil, Belgium, Colombia. Cumulative 2030 installations are 287GW.

# Cost reductions achieved in Europe are translating to bids in other markets

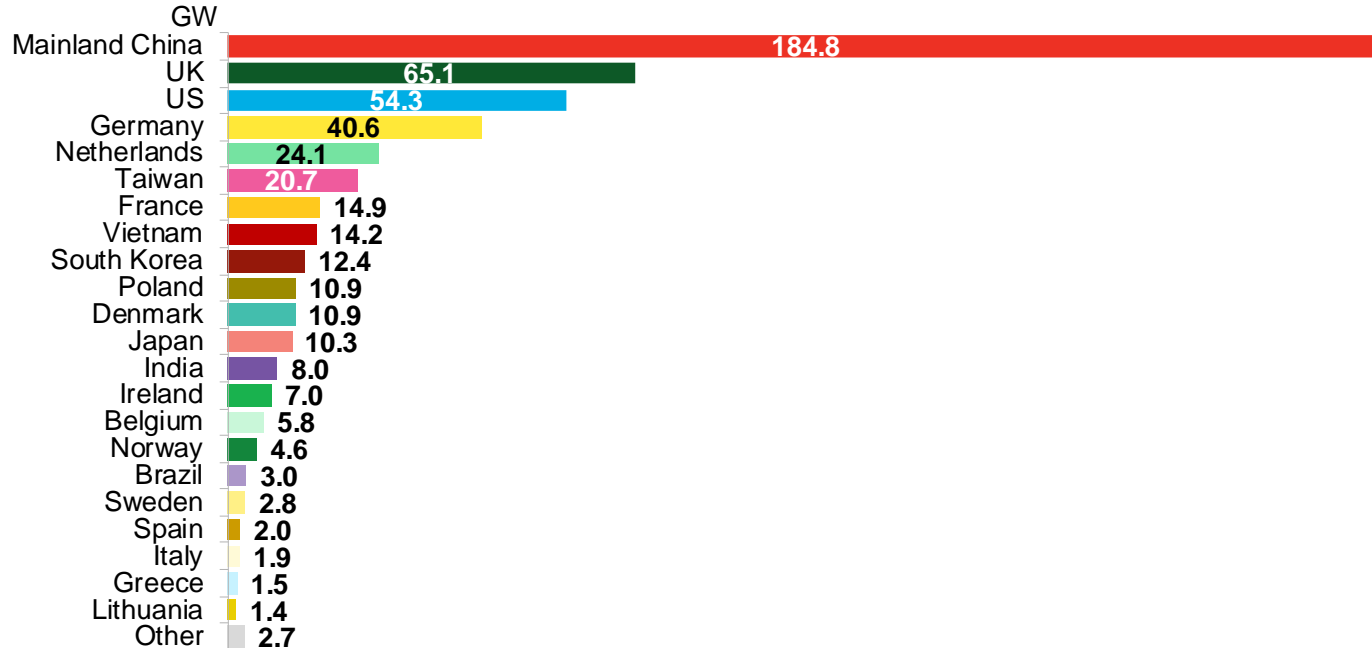
## Levelized offshore wind prices



Source: BloombergNEF. Notes: Levelized price takes into account tariff price and length, inflation, a merchant tail assumption and a 25-year project lifetime. It is the average inflation-linked tariff over the full life of the project. For a merchant tail or zero-subsidy project, we assume that the previous three-year average power price stays flat in real terms.

# The US will take its place among leading markets in the next decade

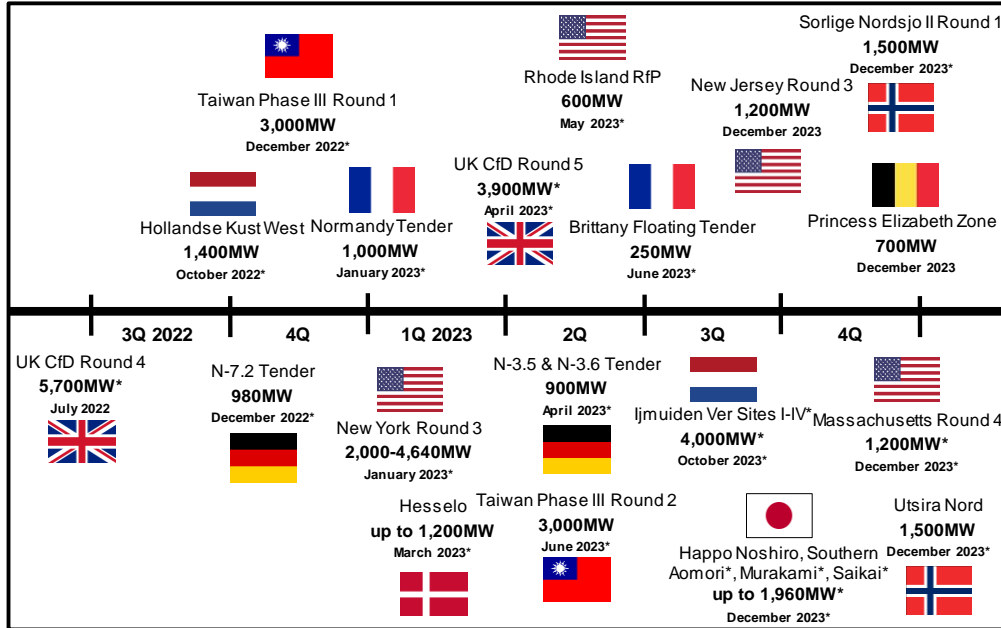
Offshore wind market ranking in 2035 (cumulative installations)



Source: BloombergNEF. Note: Shows countries reaching more than 1GW by 2035. Other = Colombia, Estonia, Finland, Latvia, Portugal.

# 2022 and 2023 will be busy years for offshore wind auctions

## Auctions scheduled for the next 18 months

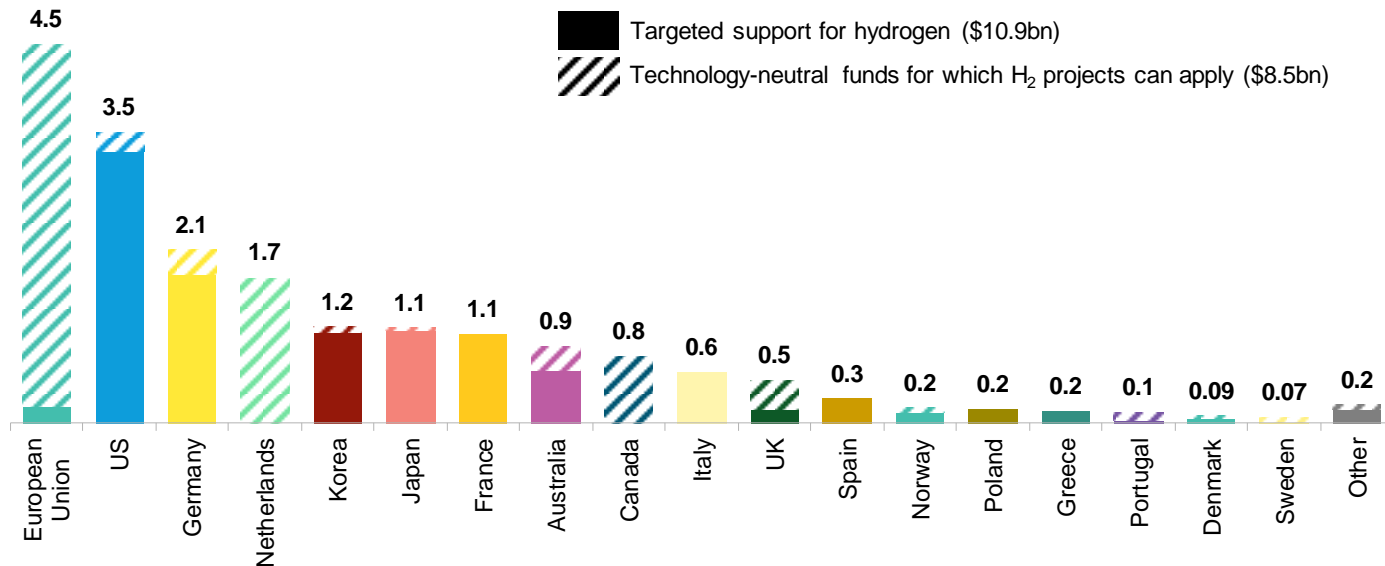


Source: BloombergNEF. Note: \* = BNEF estimate on awarded sites, capacity or date.

# Countries are starting to open the taps for hydrogen funding

## Annual budgets for national subsidies open to low-carbon H<sub>2</sub> projects, 2022-30

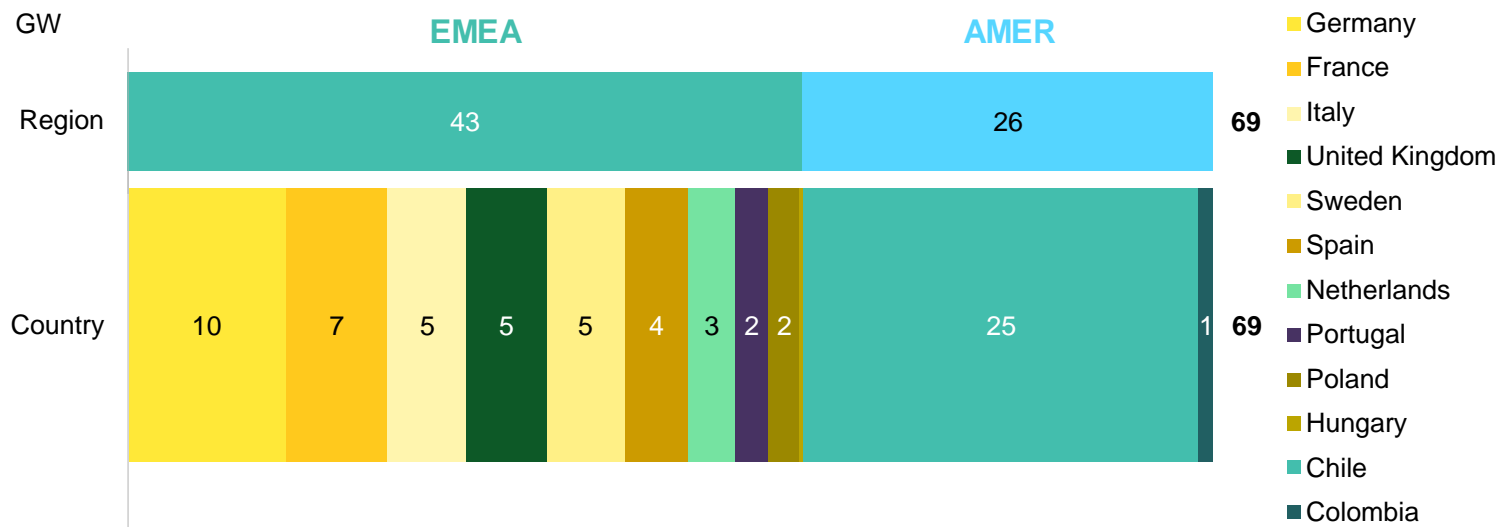
\$ billion (2021 real)



Source: BloombergNEF. Note: Includes subsidies announced and in force until 2030. Excludes sub-national funds and tax credits. Includes fuel cell funds. We annualize funding amounts. H<sub>2</sub> is assumed to access 15% of technology-neutral funds (such as the Netherlands' SDE++ scheme) and 40% of funds focused on industry decarbonization. We assume 37% of EU funding from key programs is for clean energy projects, and that H<sub>2</sub> is eligible for 15% of those funds.

# Roughly 70GW of electrolyzer targets are in place, with Chile and Germany leading

## 2030 electrolyzer targets by countries with hydrogen strategies



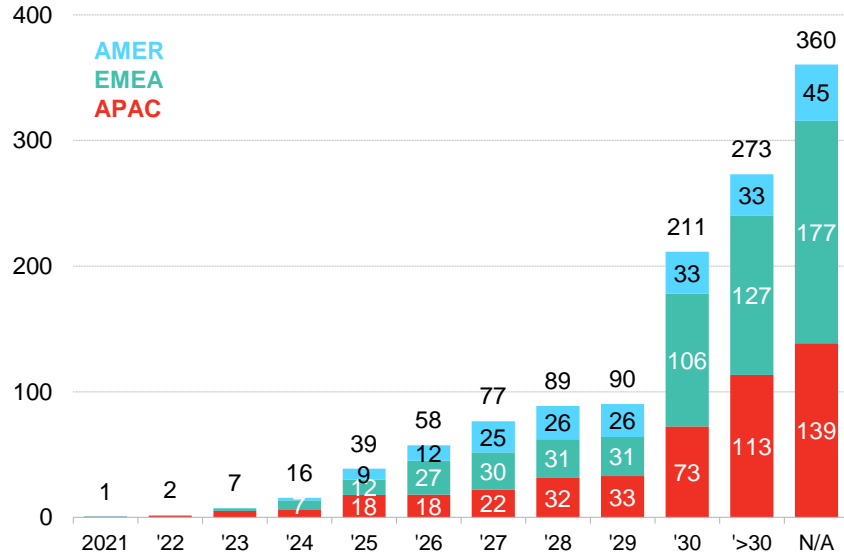
Source: BloombergNEF. Note: as of February 22, 2022. Where countries release a range, we used the lower end of the range.



# And the development pipeline is even bigger

## Cumulative electrolyzer pipeline

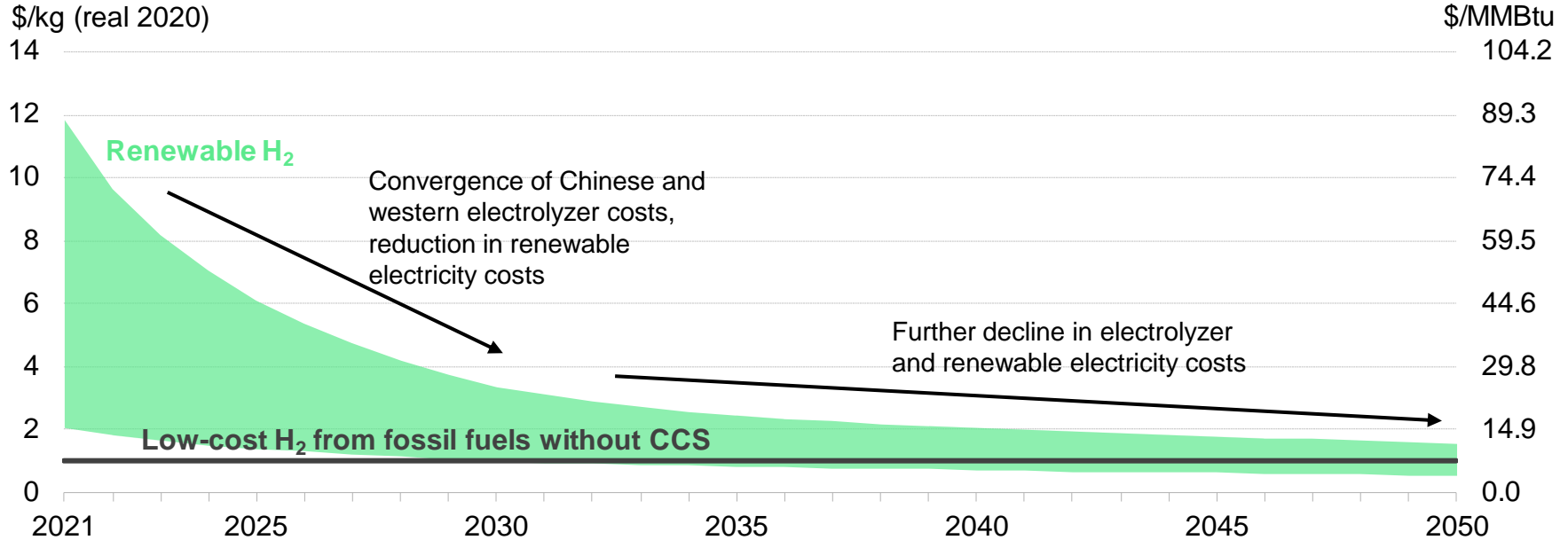
Gigawatts of electrolyzers



Source: BloombergNEF. Estimated using the methodology in BNEF Hydrogen Supply-Demand Model: Supply ([web](#) | [terminal](#)).

# Levelized costs of renewable hydrogen will fall rapidly with scale

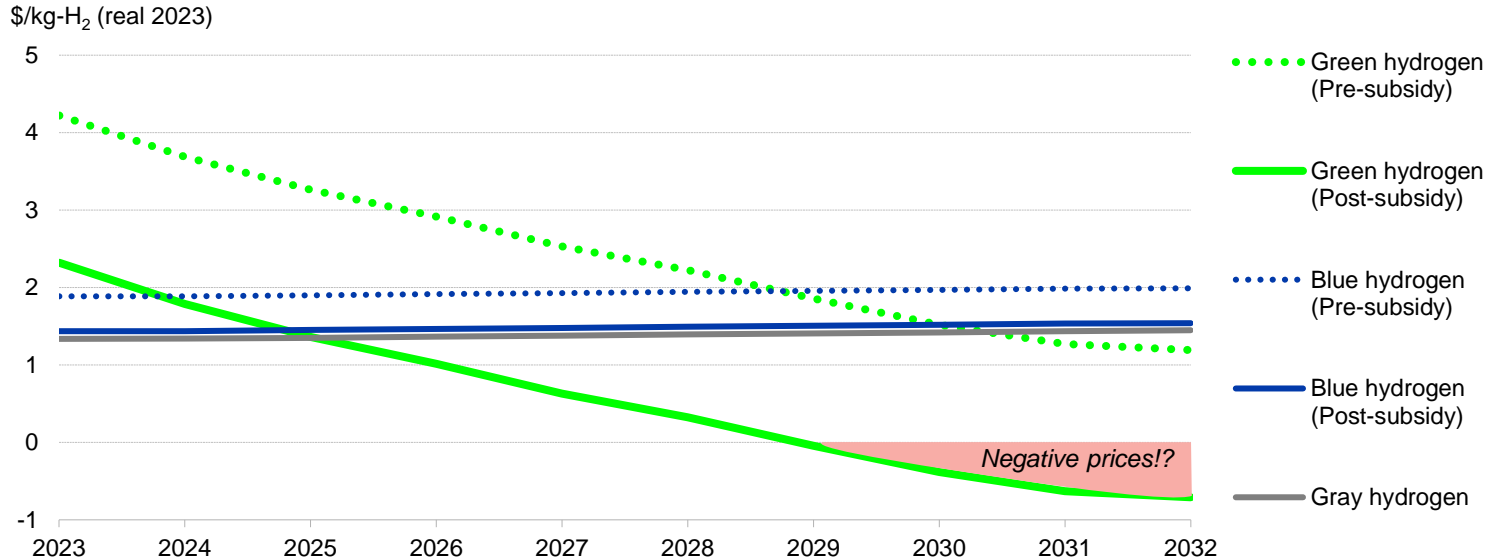
LCOH<sub>2</sub> from cheapest available renewable power in 29 countries



Source: BloombergNEF. Note: Assumes 2022 Chinese alkaline electrolyzer costs of \$0.25/W, Western alkaline electrolyzer costs of \$0.93/W and PEM electrolyzer costs of \$1.11/W. By 2030, costs are assumed to converge to those listed in Hydrogen: The Economics of Production From Renewables ([web](#) | [terminal](#)). Electricity costs derived from BNEF's 2H 2021 LCOE Update ([web](#) | [terminal](#)), mid scenario.

# The IRA tax credit will further accelerate cost reductions... or will it?

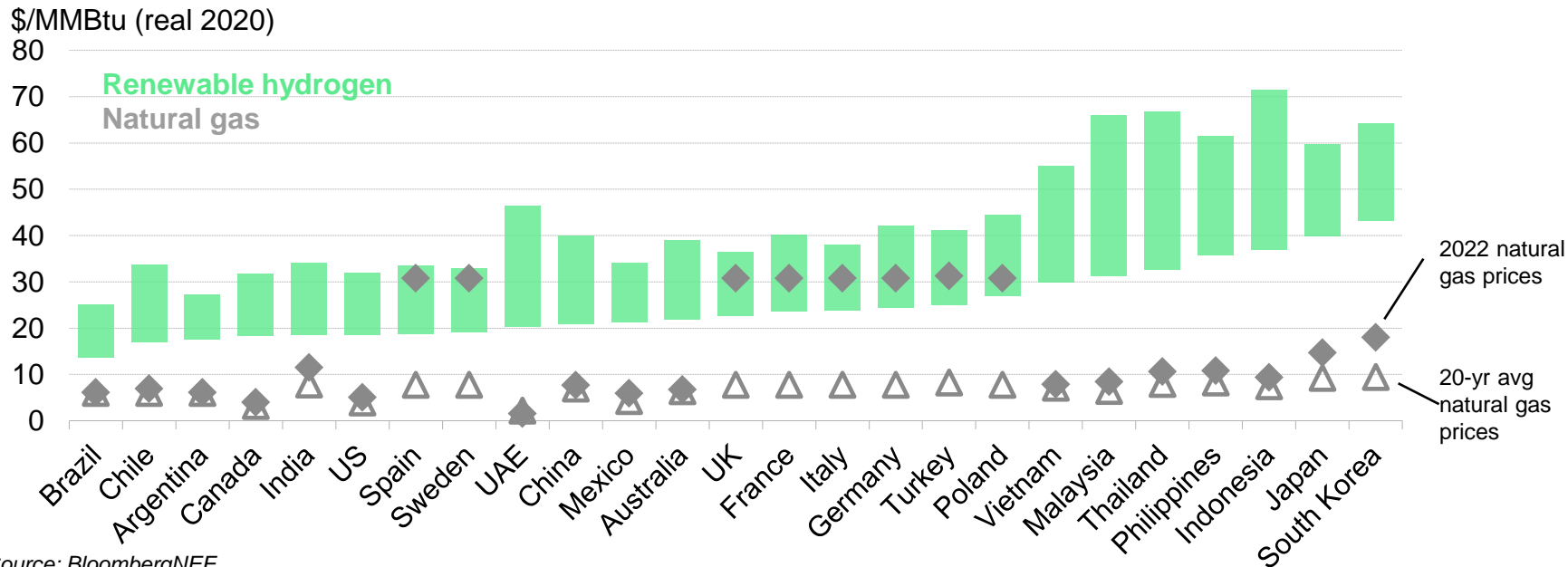
Effect of production tax credits on US levelized cost of hydrogen



BloombergNEF. Note: This modeling uses project level assumptions available in BloombergNEF's H2val. Green hydrogen calculation assumes production tax credit of \$3/kg taken over equal production in each year. Blue hydrogen calculations assume projects choose 45Q credit.

# The energy crisis has made green hydrogen temporarily competitive in some markets

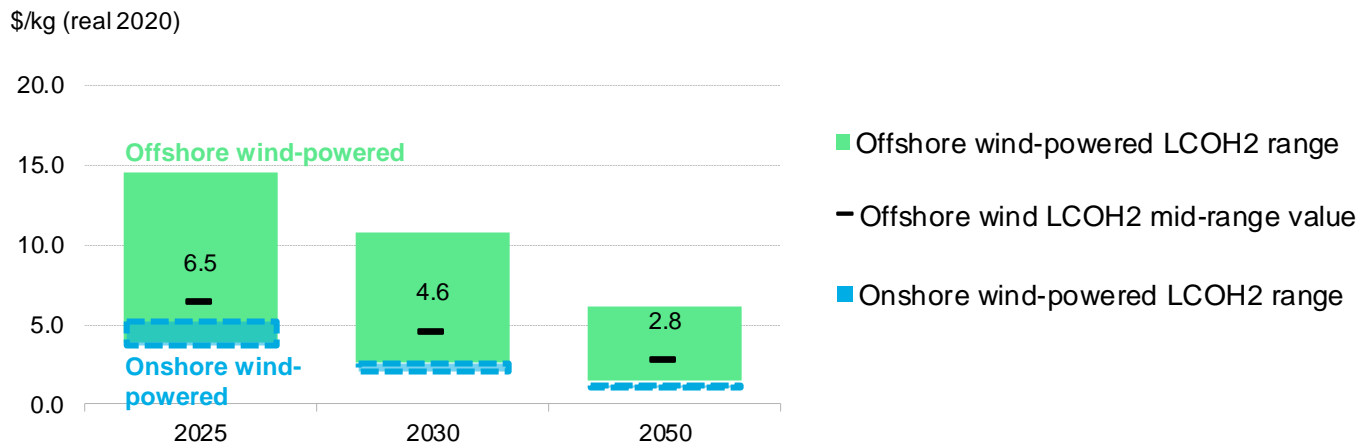
## Levelized cost of hydrogen range, versus natural gas prices in 25 countries, 2022



Source: BloombergNEF

# Offshore wind-to-hydrogen may not be cheapest, but can play a role

Levelized cost of hydrogen range for electrolyzers powered by offshore or onshore wind  
(assuming an onshore electrolyzer)



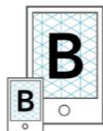
Source: BloombergNEF. Note: All hydrogen cost estimates are calculated based on western proton exchange membrane (PEM) electrolyzer costs. The green range represents the calculated LCOH<sub>2</sub> from offshore wind based on a wide range of assumptions: transport distance ranging between 10km and 300km, offshore wind capacity factor ranging between 35% and 60%, electrolyzer/wind farm size ranging between 100MW and 3GW. The blue range represents the LCOH<sub>2</sub> for onshore wind-powered systems, also using PEM electrolyzers. They represent the typical onshore wind LCOH<sub>2</sub> range for the U.K., Germany, and the Netherlands assuming wind capacity ranging between 30% and 50%.

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