



The future of offshore wind

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The Global Wind Energy Council (GWEC) is the representative trade association for the global wind power industry.

GWEC represents the wind power industry 900,000+ people in 80 countries

1,500+
members from
across the wind
energy sector

Including:

- Manufacturers
- Developers
- Component suppliers
- Research institutes
- National wind and renewables associations
- Electricity providers
- Finance and insurance companies

**GWEC's
membership has
installed over
70% of the
world's total
wind capacity**

GWEC helps create, build and assist wind power and renewables associations around world, and works with organisations such as:

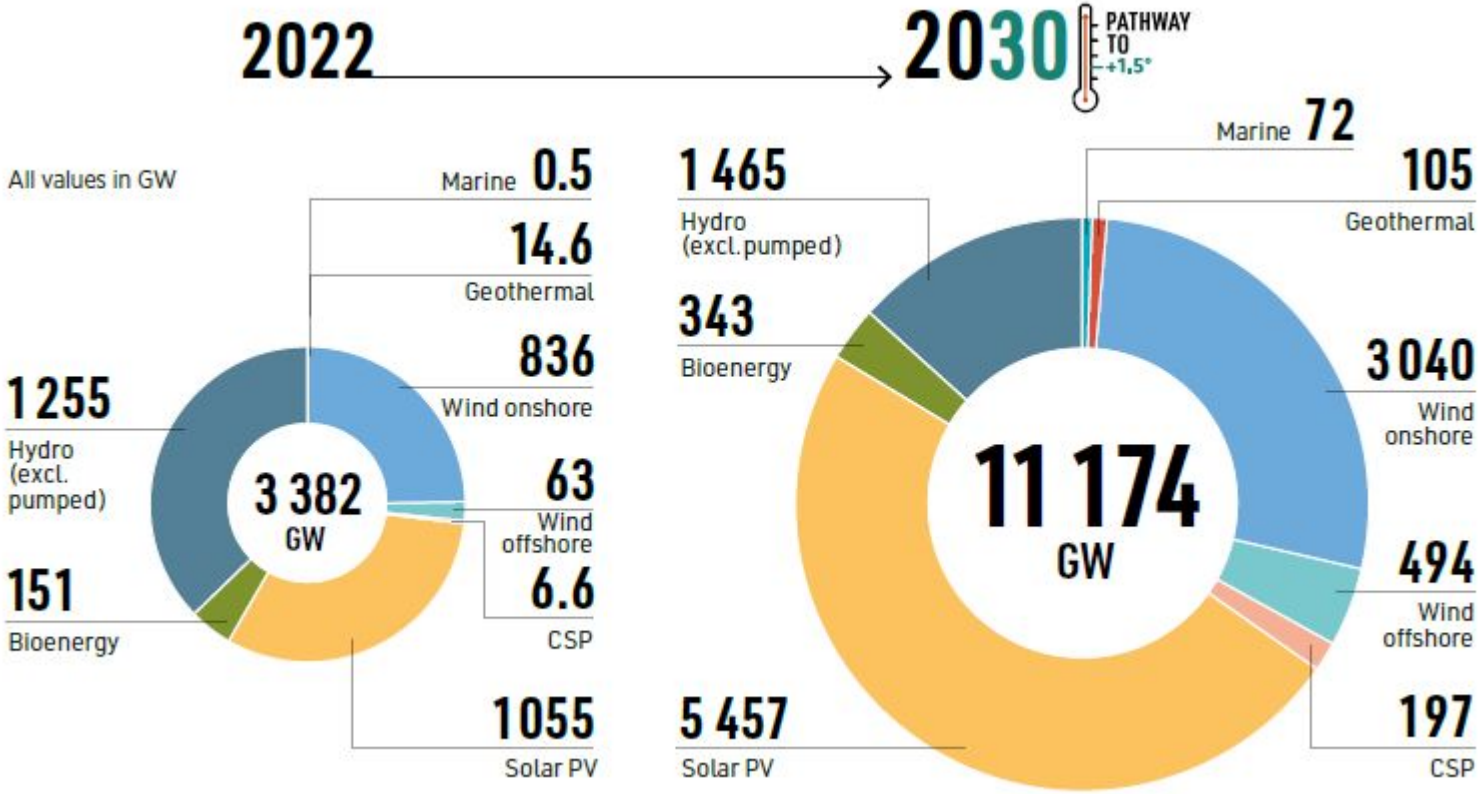
Wind Europe
American Clean Power Association
China Wind Power Association
CREIA
Africa Wind Power
ABEEólica
Ser Colombia
AMDEE
SAWEA
JWPA
ACER

**Coordinating
the voice of
wind power**



COP28 Outcome: Tripling of renewable energy and transition away from fossil fuels

Global installed renewable electricity generation in the 1.5 °C scenario, 2022 and 2030



- Political momentum for tripling renewable energy for a 1.5°C world is growing, with **offshore wind playing a key role.**
- In the latest report by COP28 UAE, IRENA and GWA, offshore wind must scale from **64.3 GW in 2023 to 494 GW by 2030** to achieve a Paris-compliant net zero by 2050.
- **Deployment must be increasingly distributed beyond core markets,** reflecting largely untapped resource potential.
- **Developing these new markets will require new approaches, including capturing the wider benefits of sustainable development** of the ocean.

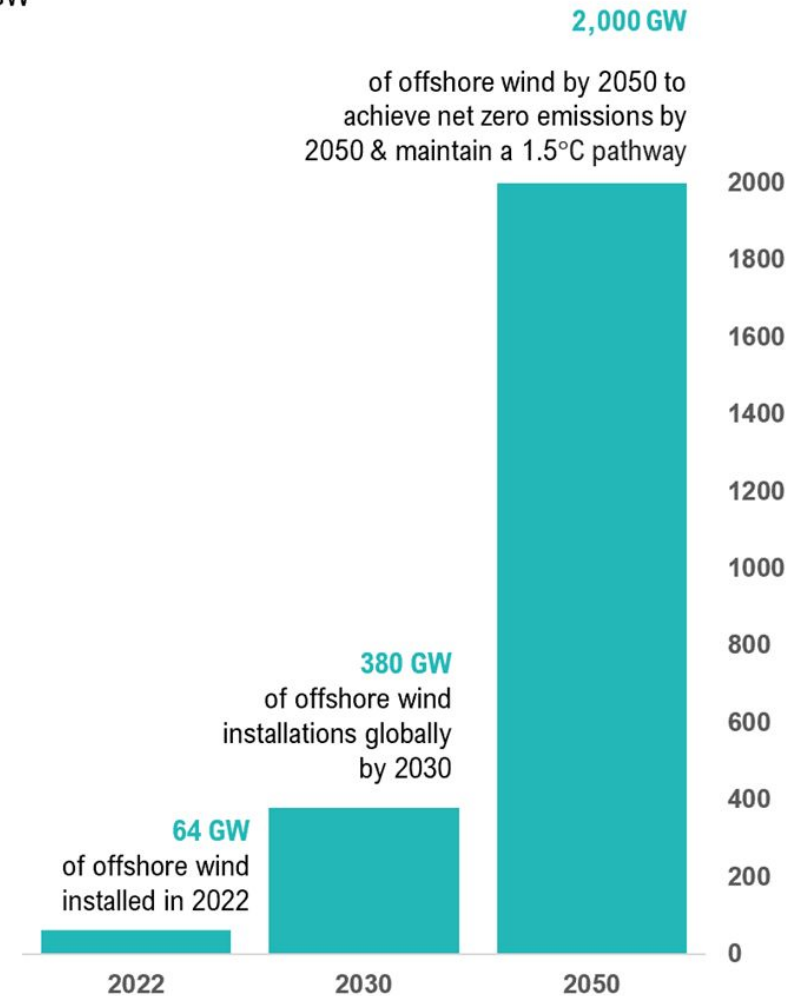
Source: COP28 UAE, IRENA, Global Renewables Alliance, 2023

Closing the Global Offshore Wind Gap by 2050

- **Political momentum** for tripling renewable energy for a 1.5°C world is growing, with offshore wind playing a key role.
- To achieve a Paris-compliant net zero by 2050, IRENA estimates that fixed and floating offshore wind must scale **from 64.3 GW to 380 GW by 2030**, heading towards **2 TW by 2050**.
- To meet this run-rate, **deployment must be increasingly distributed beyond core markets**, reflecting largely untapped resource potential.
- Developing these new markets will **require new approaches**, including capturing the wider benefits of sustainable development of the ocean

Closing the offshore wind gap by 2050

Unit: GW



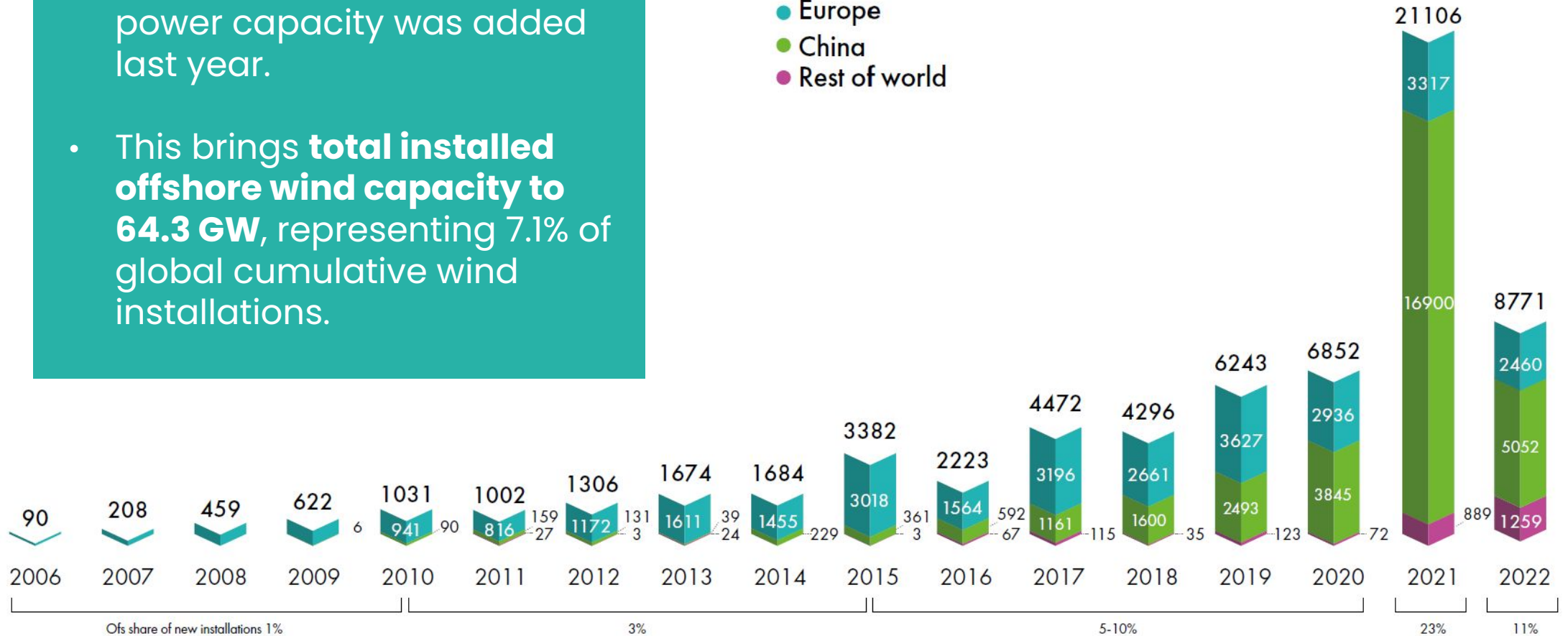
Source: GWEC Market Intelligence; IRENA World Energy Transitions Outlook 2022

2022 was the second-best year for offshore wind

- **8.8 GW** of new offshore wind power capacity was added last year.
- This brings **total installed offshore wind capacity to 64.3 GW**, representing 7.1% of global cumulative wind installations.

New wind power installations (MW), 2006–2022

- Europe
- China
- Rest of world

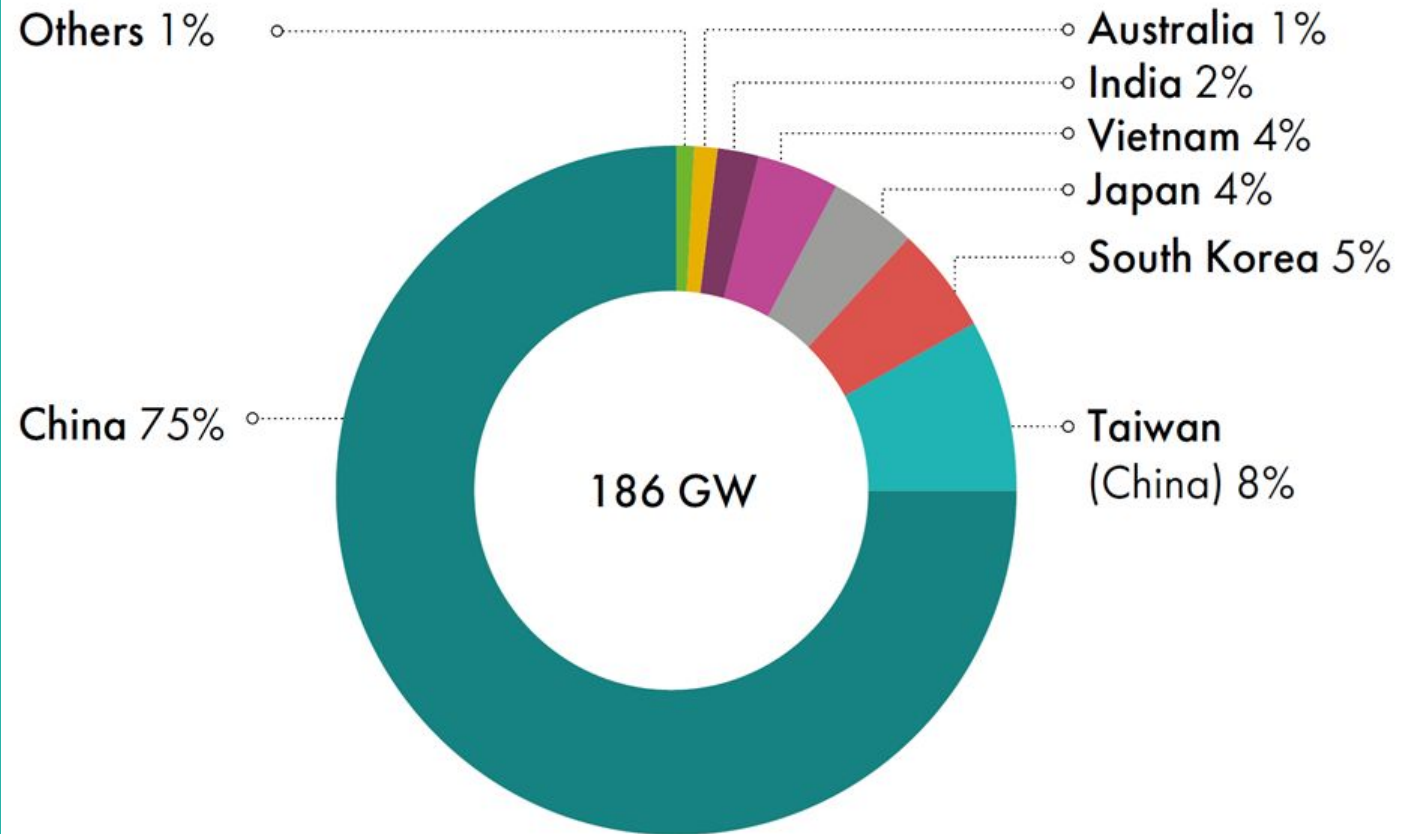


Source: GWEC Market Intelligence, March 2023

The next frontier: Asia-pacific to power global offshore wind growth

- **Total offshore wind installations in APAC in the next decade will make up 49% of global installations**
 - Growing demand for renewables
 - Increasing ambitions for offshore wind: New 2030 targets: Korea (14.3 GW); Vietnam (6 GW); India (37 GW)
- **The central challenge in APAC is realising this potential**
 - Nascent regulatory and permitting system
 - Lack of route to market
 - Investments in grids & infrastructure (i.e., ports)
 - Supply chain crunch
 - Existing knowledge gap
 - Local content limitations

Total offshore wind installation between 2023 – 2032



Source: GWEC Market Intelligence, March 2023

Numerous challenges are impacting the global wind energy supply chain today and leading to underinvestment

External

Increasing market volatility



Industry demand has in past been volatile, driven by phase in and phase out of support schemes

Volatility induced by macro events such as supply chain bottlenecks through COVID and inflation and raw material prices driven by the war on Ukraine

Developers canceling projects despite already secured offtake contracts

Regulators push for localisation



Ukraine invasion has made resilience of energy supply a top priority

Resilience of stock (energy producing equipment) also moved into focus, including in IRA, Net-Zero Industry Act, Critical Minerals Act and Chinese export restrictions

Local content requirements lead to sub-scale production plants that are decoupled from global learning rates

Internal

Policy signals hold back capacity adjustments



Many companies in the West are unable to make downwards capacity adjustments given the anticipated step-up of wind demand to meet climate targets, while cost-cutting exercises and chronic underinvestment has made supply chain scale-up challenging

In other markets like China, political-industrial interests are preventing consolidation which could alleviate inefficiencies

These situations foster profitability challenges for supply chain companies

Curse of rapid innovation



Race for larger WTGs has left insufficient time for thorough testing, resulting in serial defects in the field

Development costs has not been recuperated due to shortened product life cycles

Innovation on component and system level has not allowed for industrialisation of existing technologies



Global Challenges: Near Term

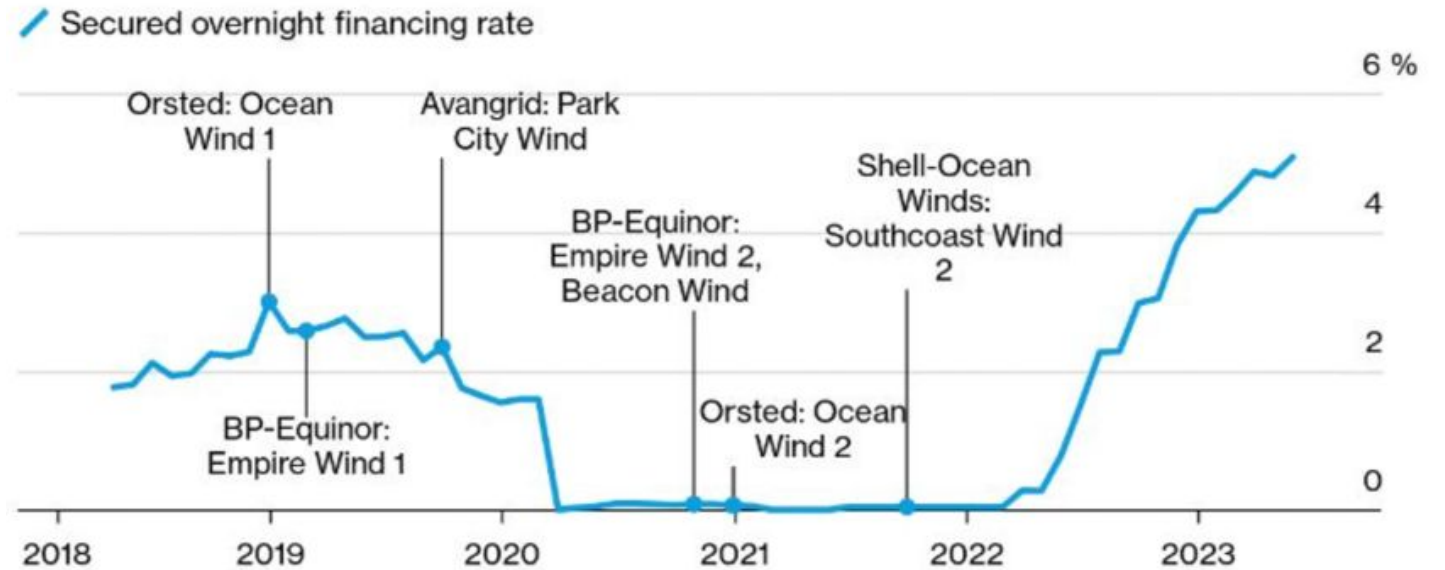
- APAC is poised for growth, but Europe and the US industries face acute **growing pains**.

- **Only a third of this new projected new volume will be added** in the first half of the next decade (2023-2027) due to near term challenges.

- **Triple threat:** supply chain inflation + rising interest rates + policy risk

- GWEC forecasts **supply chain bottlenecks in every region of the world except China**.

Financing rates at the time of bid submission



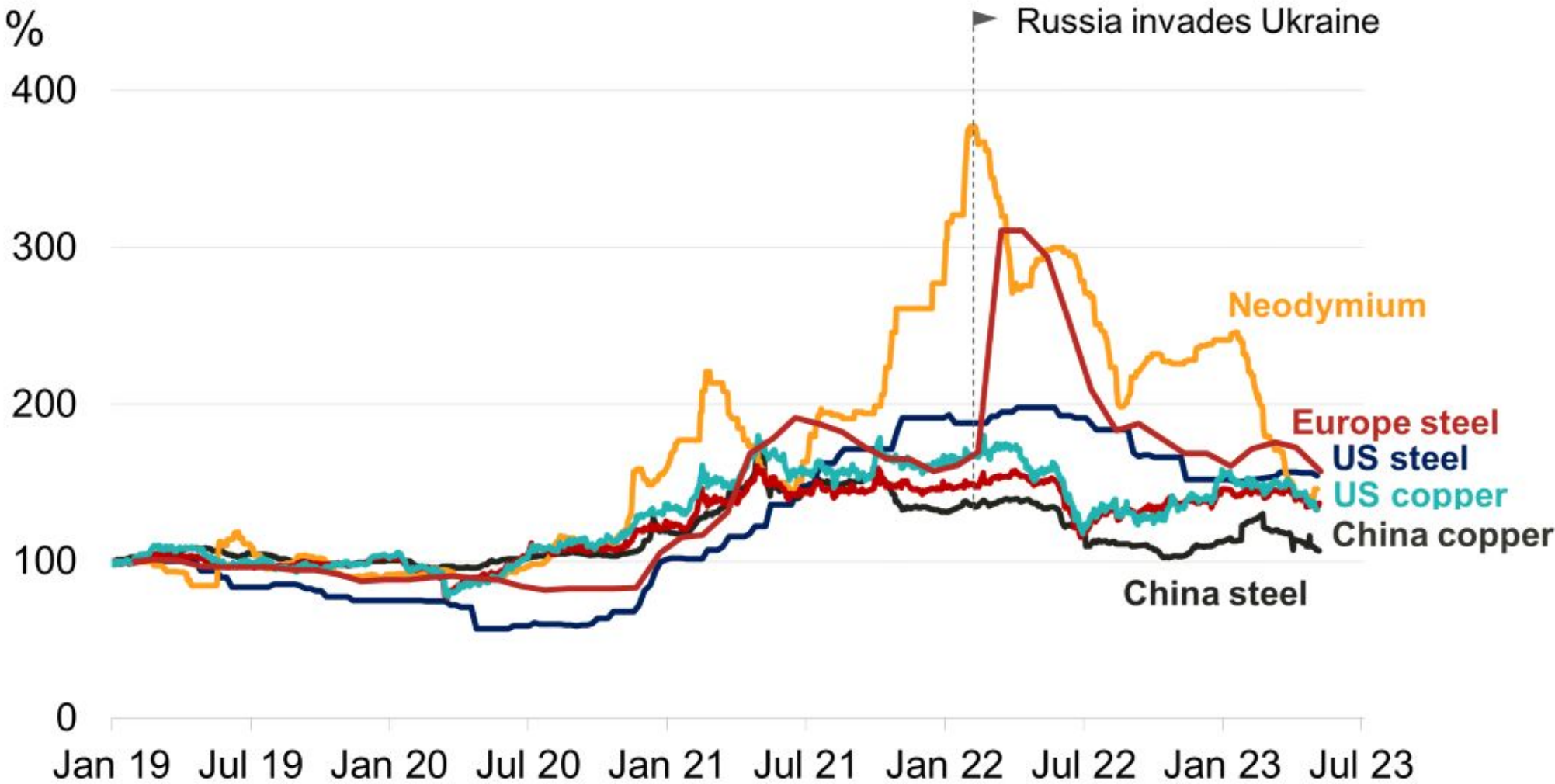
Source: Bloomberg, BloombergNEF

Note: Labels represent bid submission dates in select state solicitations where renegotiation has been sought.

BloombergNEF

Source: Bloomberg, 2023

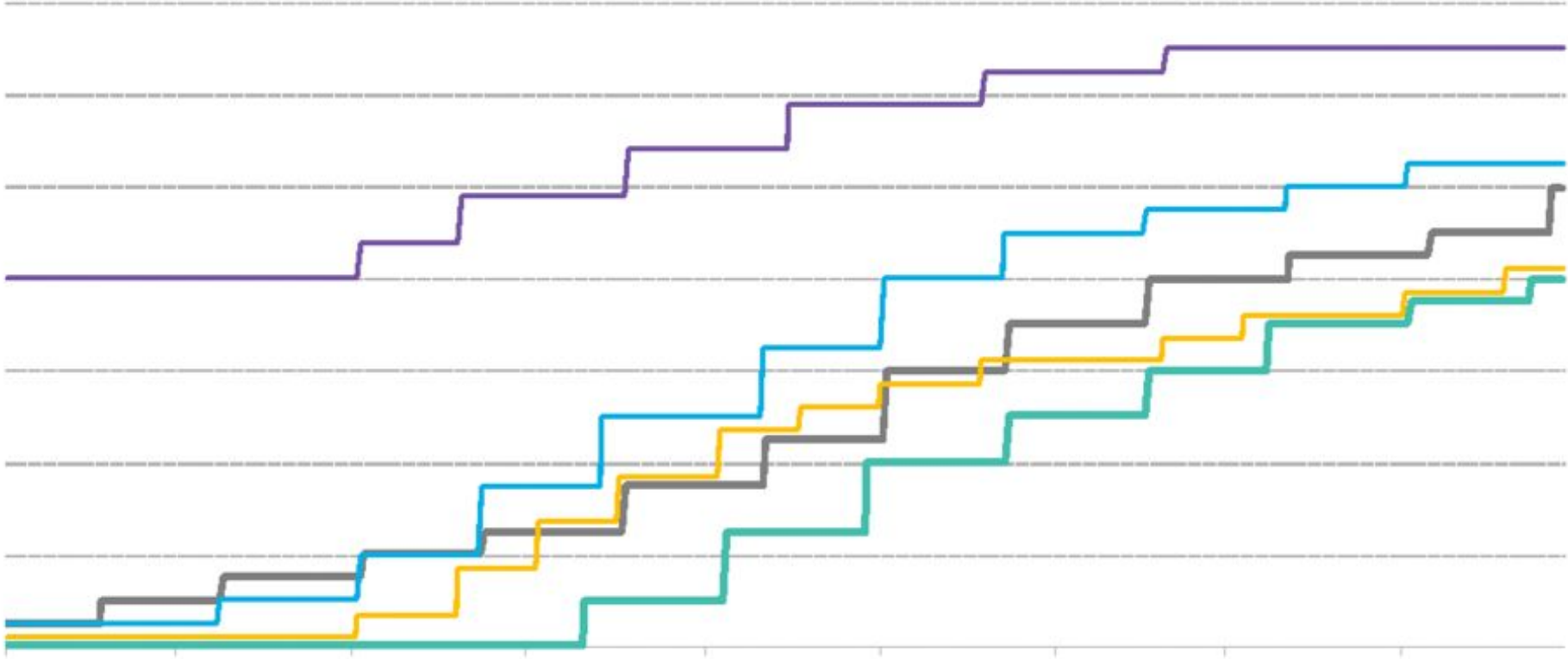
Materials prices remain elevated vs pre pandemic but have come down from their peak



Source: Bloomberg, 2023

Rising interest rates are also raising costs across the value chain

Central bank interest rates



Source: Bloomberg, 2023

The wind growth outlook towards 2030 is falling short of net zero – supply chains must scale up

Turning supply chain bottlenecks into opportunity for industrial growth

- China leads the global market for material refining (steel, aluminium, rare earth materials), and manufacturing of key wind components like gearboxes (80%), converters (82%) generators (73%) and castings (82%). Its market share for finished WTGs remains low.
- **Other markets have opportunity to expand leadership and supply chain will generally benefit from building out regional manufacturing hubs to ensure**
 - more resilient access to needed components while
 - ensuring continued trade and global interlinkages to enable flexibility and address demand volatility

Theme	Critical materials					Key components								Assembly		Offshore wind enablers			
Subject	Rare Earths*	Steel Plate*	Copper	Concrete	Carbon Fiber*	Gearboxes*	Generators*	Blades*	Power Converters*	Castings*	Towers*	Foundations*	Cables*	Onshore nacelles*	Offshore nacelles*	Installation vessels*	Ports*	Workforce	
Global level criticality																			
Time to action **	Europe	2023	-	-	-	2025	2024	2024	2024	2024	2023	2025	2025	2025	2024	2024	2025	2023	2023***
	North America	2023	-	-	-	2025	2023	2023	2023	2023	2023	2023	2023	2024	2023	2023	2023	2023	2023***
	China	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

No global bottleneck risk Immediate global bottleneck

* Deep dive analysis provided ** Time to action denotes time when new capacity construction must be started to avoid bottlenecks in each region without trade

*** Workforce with major challenges, addressed in GWEC & GWO: Global Wind Workforce Outlook 2023-2027

The world is heading towards four plausible futures, each with major wind industry impact

	Open Door	Increased Barriers	Economic Downturn	Global Escalation
	<p>Push for collaboration facilitates more global approach to ensure resilient supply chains and strong, stable demand</p> <p>Social and power market transformation delivering against 1.5° target with large global coverage</p>	<p>More regional crises lead gov. to focus on short term aids targeting consumers and industry</p> <p>Continued progress towards net zero in developed markets with focus on local production and investment; emerging markets see little progress</p>	<p>Economic crises shift focus away from decarbonisation and makes investment into wind challenging</p> <p>Affordability prioritised over sustainability, minimises investments in mitigation; inability to pay cost of adaptation</p>	<p>International economic and conflict crises lead to restructured areas of influence; net zero efforts largely cease</p> <p>Availability is highest priority in energy. The world reduces efforts to tackle climate change; rich economies focus on adaptation</p>
Policy	Free trade focus, building multiple price-competitive regions with backward integration	Focus on protecting domestic players and limiting imports; trade conflicts lead to less decarb. focus	Low industrial activity leads to select player support, insolvencies and likely consolidation / mergers	High domestic resilience focus; only larger economies perform well while conflict limits trade
ET focus	Renewable demand growth due to emission taxes and fossil tech phase out; shared standards for trade	More focus on local quick-win solutions and energy flow resilience rather than decarbonisation	Focus on power access and price rather than decarbonisation; less investment into CAPEX-heavy tech	Availability risk from unreliable trade. Chinese mineral restrictions and price uncertainty raise costs

ET = Energy Transition

Source: GWEC, BCG, 2024

A turning point for offshore wind

- **Policymakers are forging ahead with new legislation, regulation, investment strategies, and international alliances (like GOWA) to spur renewables**
- **New initiatives like Ocean Energy Pathway (OEP) are being created to accelerate offshore wind globally**
- In this competitive environment, markets need **attractive policies to attract investment**
- To secure next stage of global growth, industry **needs ambitious + stable policy couple** coupled with **adequate market pricing**
- **Restrictive trade and investment policies may increase cost** and may risk delaying the global energy transition



Unlocking the next stage of OFW growth

➤ **Get volume to the market**

Long-term roadmaps and project pipeline per year for leasing and tenders supported by streamlined permitting and consenting process.

Large scale projects enable economic of scale and allow investors and developers to prioritise and allocate resources for project development and supply chain build up.

➤ **Rethink market design to capture wider benefit of offshore wind**

Stop race to the bottom tender mechanisms and prioritise sustainable cost reduction mechanism that enables the wider benefit of offshore wind.

➤ **Strengthen regional and international supply chains**

Introduce industrial strategy supported by incentivised-based policies to catalyse local supply chain development and strengthen regional supply chain resilience through active cooperation.

➤ **Prioritise infrastructure development**

Invest and finance grid and transmission as early as possible.

Identify and plan for floating wind priority ports as floating wind projects requires larger areas and deeper water than fixed-bottom offshore wind.

THANK YOU

Does anyone have any questions?

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