Energy
Transitions
Commission

ETC Webinar
Clean Energy Supply Chains

September 12th, 2024

Energy Transitions Commission

Chair
Adair Turner

Knowledge partners

SYSTEMIQ

BloombergNEF

Energy

ACWA POWER
CWP GLOBAL
ReNew POWER
VATTENFALL
bp
IBERDROLA
PETRONAS
sse
octopus energy
Xlinks
LONGi
TES
ENVISION
nationalgrid
Schneider Electric

Industry

ARUP
SLR
Carbon Direct
ArcelorMittal
Heathrow
LanzaTech
SSAB
TATA STEEL
VOLVO
aspentech
Korea Zinc
RioTinto
SAINT-GOBAIN
TATA
Worley energy | chemicals | resources

Finance

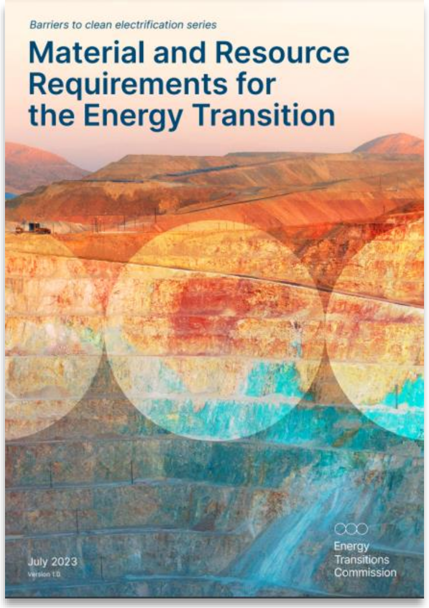
HSBC
Deep Science Ventures
17 96 LOMBARD ODIER LOMBARD ODIER DARIER HENTSCH
Legal & General
Rabobank
KIKO
European Bank for Reconstruction and Development
Rothschild & Co Asset Management
JUST CLIMATE
IMPAX Asset Management

Civil society

European Climate Foundation
teri
RMI ENERGY. TRANSFORMED.
WE MEAN BUSINESS COALITION
1911
DRC
LSE
Tara
SUSTAINABLE ENERGY FOR ALL
IESR Institute for Essential Services Reform
Quadrature Climate Foundation
UNITED NATIONS FOUNDATION
WORLD RESOURCES INSTITUTE

ETC Publications – Timeline 2017-2024

The ETC's 2024 webinar series

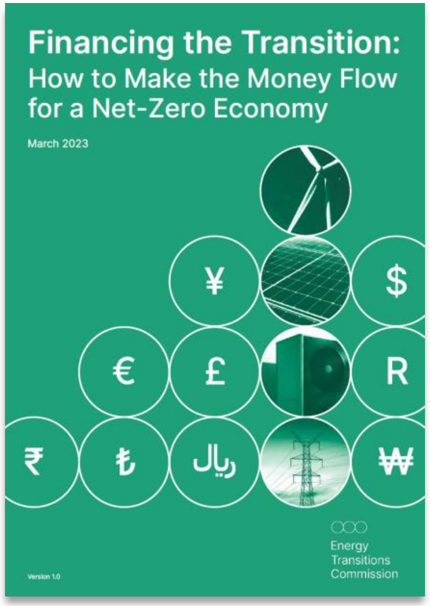

Barriers to clean electrification series

Material and Resource Requirements for the Energy Transition

July 2023
Version 1.0

Energy
Transitions
Commission

February 13th

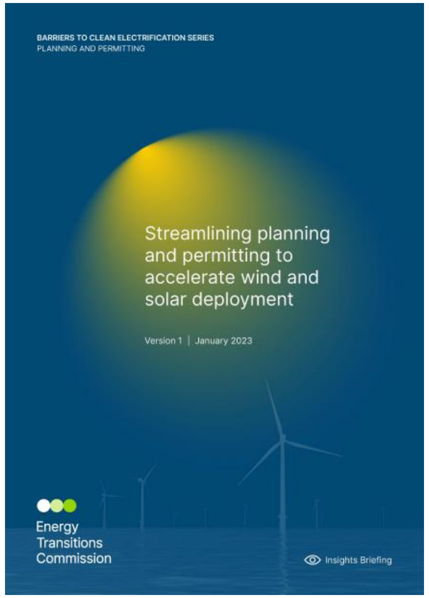

Financing the Transition:
How to Make the Money Flow for a Net-Zero Economy

March 2023

Version 1.0

Energy
Transitions
Commission

April 18th


BARRIERS TO CLEAN ELECTRIFICATION SERIES
PLANNING AND PERMITTING

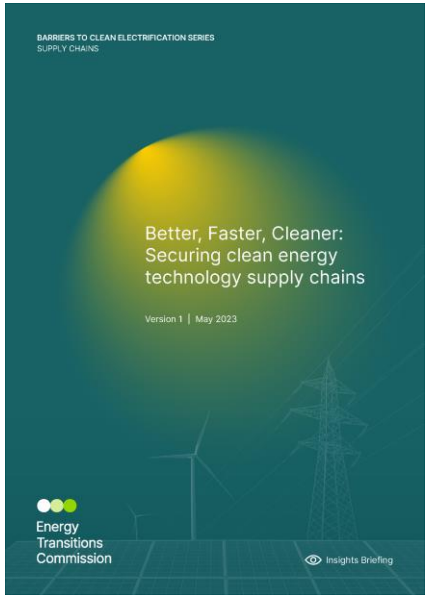
Streamlining planning and permitting to accelerate wind and solar deployment

Version 1 | January 2023

Energy
Transitions
Commission

Insights Briefing

July 11th


BARRIERS TO CLEAN ELECTRIFICATION SERIES
SUPPLY CHAINS

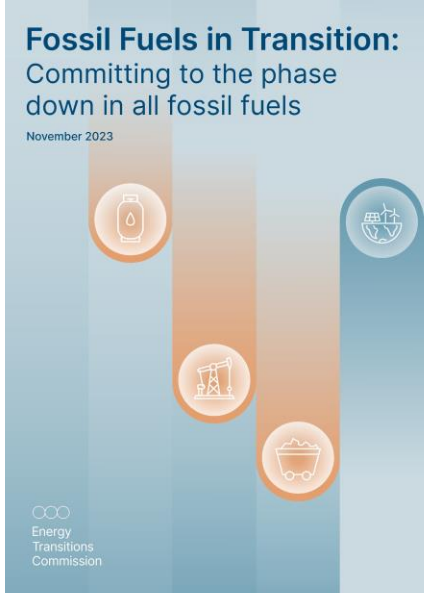
Better, Faster, Cleaner: Securing clean energy technology supply chains

Version 1 | May 2023

Energy
Transitions
Commission

Insights Briefing

September 12th


Fossil Fuels in Transition:
Committing to the phase down in all fossil fuels

November 2023

Energy
Transitions
Commission

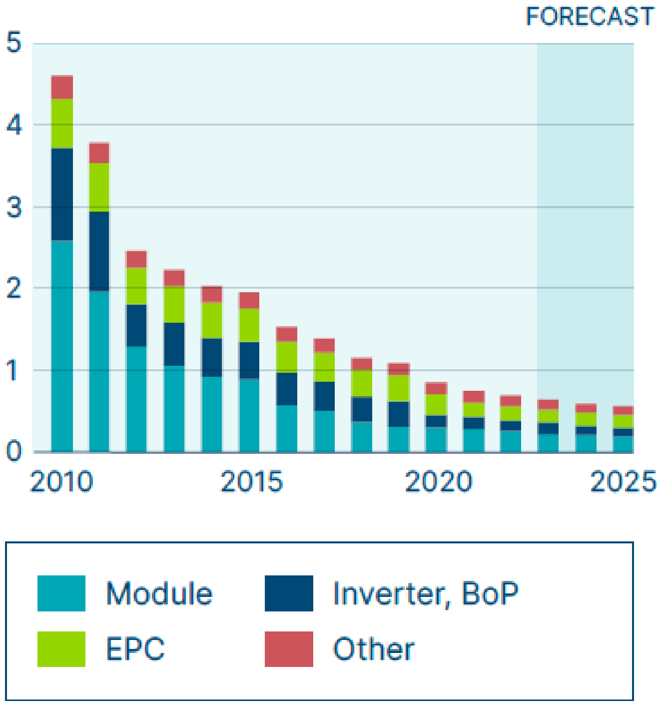
November 7th

The energy transition will require massive capacity additions of new technologies, by 2030 wind and solar grow ~2.5-4x and EV sales >6x from current levels

	Wind	Solar	Storage and EVs	T&D Grids	Electrolysers	Heat Pumps
Capacity in 2022	940 GW	1240 GW	10m EV sales, 90 GWh of stationary storage	70 million km	~0.2 MtH$_2$	~200m units
	x 2.5	x 4	x 6	x 1.5	x 100	x 3
Required size in 2030	2400–2600 GW	4900–5100 GW	60–80m EV sales, 1500 GWh of stationary storage	>100 million km	>20 MtH$_2$	~600m units

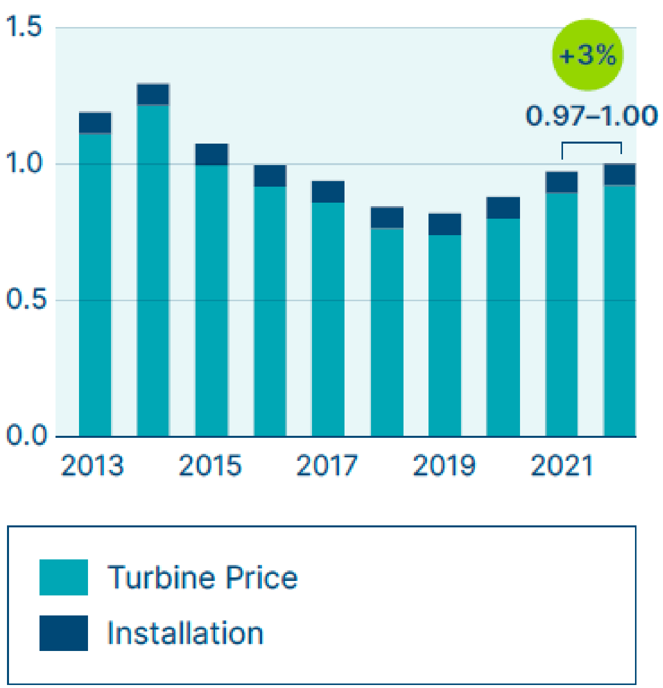
In recent years disruption in global supply chains has led to price rises for wind and batteries

Solar PV capex benchmark
2022 $/W(DC)



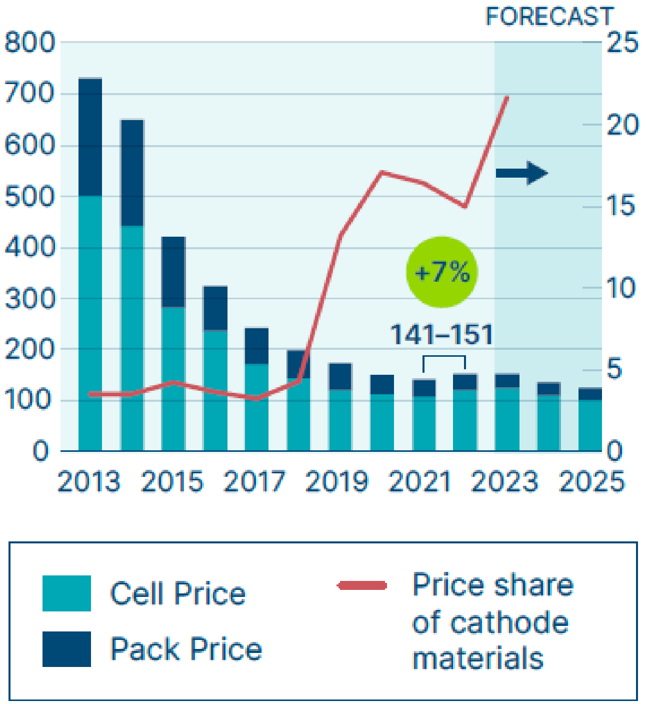
Solar: slowing of price reductions in 2022 due to tight supply for polysilicon and increased freight costs, alongside higher commodity prices, but expected to keep falling from 2023.

Wind turbine price by signing date
2022 $m/MW



Wind: cost increases driven by increasing prices of copper, aluminium and steel from 2020 onwards, alongside higher freight and shipping costs; however, **prices have been falling in China.**

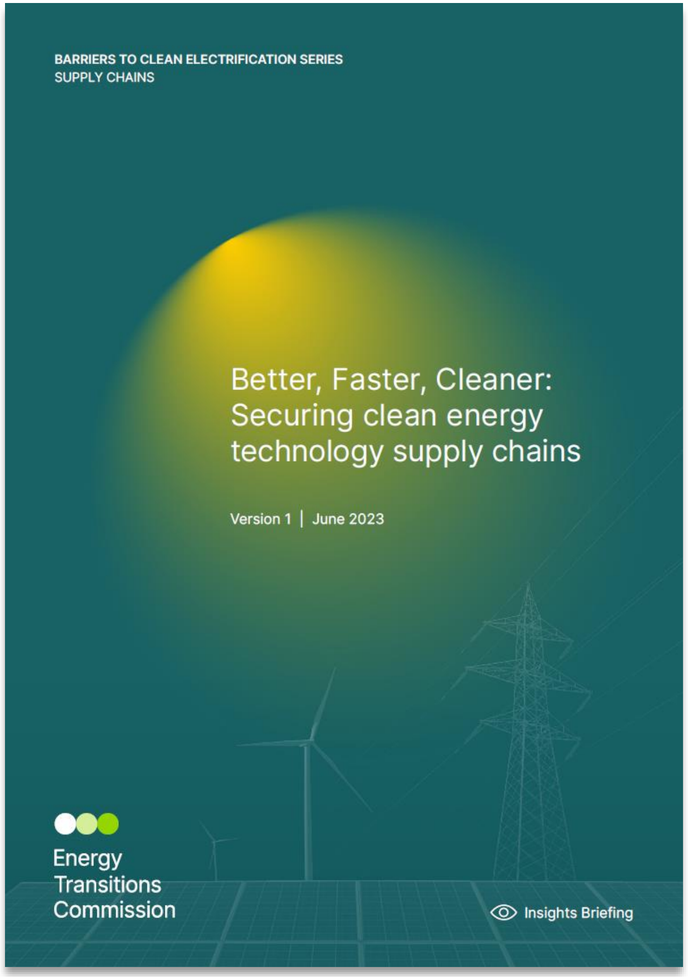
Li-ion battery survey price
2022 $/kWh (LHS); % of total price (RHS)



Batteries: first-ever price rises in 2022 as prices of cathode materials (Li, Ni, Co) have risen sharply in past year; will take several years to recover to previous trend.

Source: BNEF (2022), *4Q Global PV Market Outlook*; BNEF (2022) *Lithium-Ion Battery Price Survey*, BNEF, *1H Global Wind Market Outlook*, 2022; BNEF, *1H Wind Turbine Price Index*, 2022

Therefore the ETC looked at clean energy supply chains in 2023



BARRIERS TO CLEAN ELECTRIFICATION SERIES
SUPPLY CHAINS

Better, Faster, Cleaner:
Securing clean energy technology supply chains

Version 1 | June 2023

Energy Transitions Commission

Insights Briefing

June 2023

<u>Conclusion</u>: at the global level, there are no inherent barriers to the scale-up of clean energy supply chains.

However, three **cross-cutting risks** require **clear actions** from policymakers and industry:

1. There **could be tight markets for some key input materials**, notably for some raw materials (lithium, copper) as well as shorter-lived volatility or delays for some more complex components.
2. There are **specific environmental and social risks** especially relevant to solar PV and batteries.
3. There is a **high degree of concentration of production** across many steps of clean energy technology supply chains.

1. There are no inherent barriers to the scale-up of clean energy supply chains globally, but three key challenges must be addressed to avoid delays or higher costs

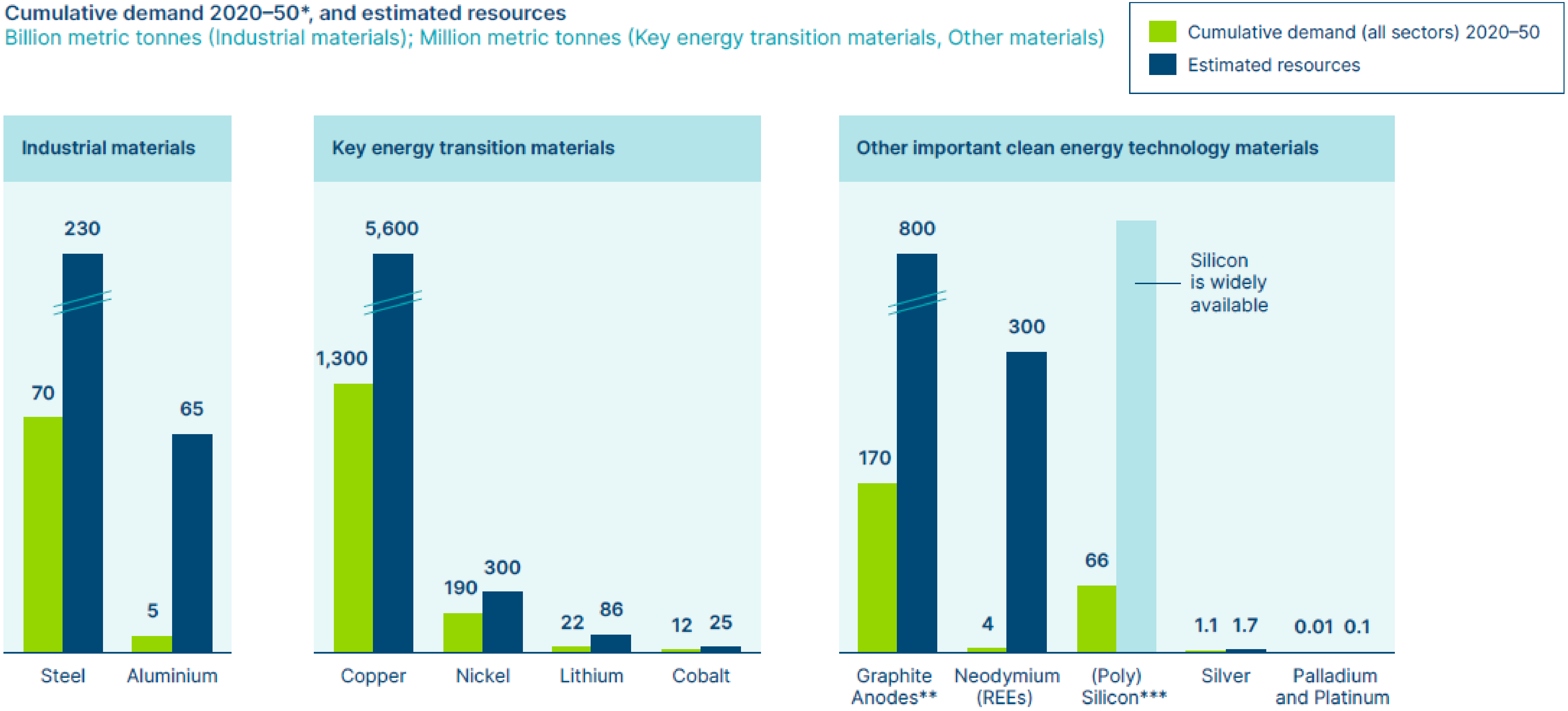
Three cross-cutting risks pose challenges over the short-to-mid term

1. **While sufficient mineral and metal resources are available globally, issues around scaling supply at a fast enough pace to meet demand could be a problem for some raw materials**, in particular lithium and copper, and for **complex components** within supply chains.

2. **Supply chains for solar PV and battery manufacturing are highly concentrated geographically at several stages**. Future growth expectations for these markets means that clean energy manufacturing is not a 'zero-sum game'.

3. **There are some wider environmental and social concerns around materials and mining**, such as around labour and human rights, carbon, and other local resources, that need to be addressed appropriately.

Mining: There are enough resources to meet total materials demand between 2020-50, including demand from both the energy transition and other sectors…



Cumulative demand 2020–50*, and estimated resources

Billion metric tonnes (Industrial materials); Million metric tonnes (Key energy transition materials, Other materials)

…But supply forecasts for copper and lithium show tightness through to 2030, raising risk of high input prices for clean energy technologies

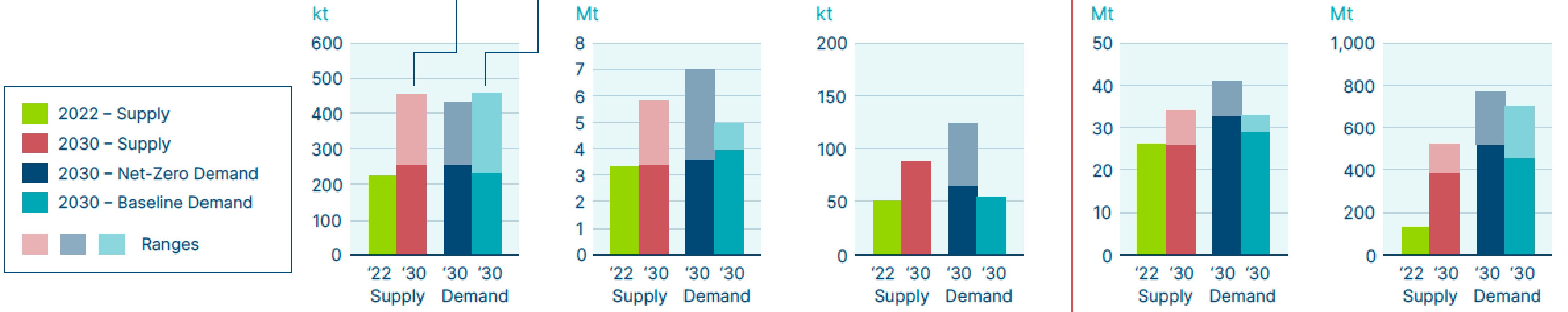
Demand and supply forecasts for key energy transition materials in 2030

Nickel, Copper = Million metric tonnes; Cobalt, Lithium, Neodymium = Thousand metric tonnes;

Supply should expand by 2030 – but large range of forecasts

Demand in baseline and net-zero outlooks easily overlaps supply

Even with supply expansions, future demand growth for copper and lithium would exceed supply in 2030



Cobalt

Demand forecasts falling sharply after shift to low-cobalt NMC.

Some uncertainty over stability of DRC supply.

Nickel

Rapid supply expansion in Indonesia.

Can shift to LFP batteries to reduce demand.

Neodymium

Rising but uncertain demand growth from wind + BEVs.

Supply can respond to high prices quickly.

Copper

Used in all clean energy technologies, demand difficult to substitute.

Supply expansion tricky due to ore grades, low investment.

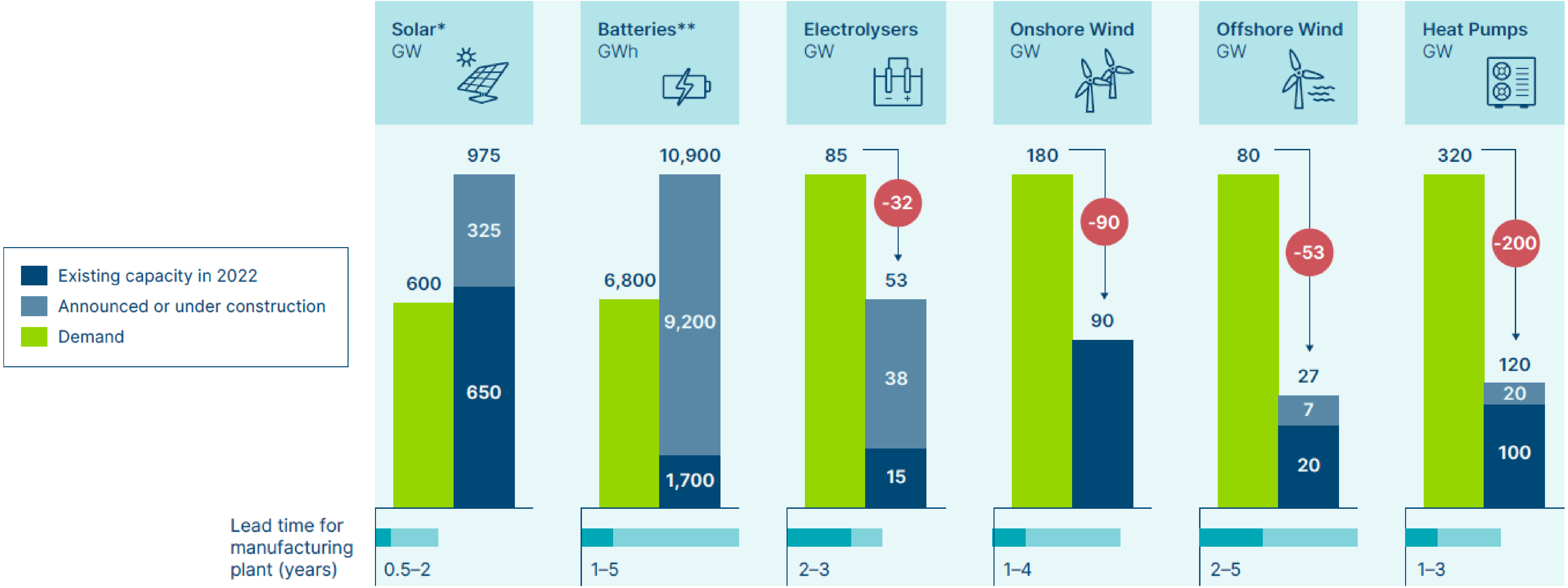
Lithium

No viable substitution across battery chemistries at the moment.

Supply expanding but not quickly enough – gaps likely through to 2030.

Manufacturing: Short manufacturing lead times mean that, at a global scale, manufacturing and assembly of clean energy technologies will not be a barrier to deployment…

Share of existing, announced and remaining gap to 2030 in manufacturing capacity for clean energy technologies
GW / GWh



…but supply chains for complex equipment or components could face short-term delays

Offshore Wind Installation Vessels

- Offshore wind projects can require multiple **vessels to carry out transport and installation**.
- Wind **turbines keep increasing in size**, with spans over 250 metres – vessel builders unsure about future vessel requirements.
- Potential **shortages of installation vessels beyond 2025 could hold back ~35 GW** of offshore wind.

High-Power Grid Transformers

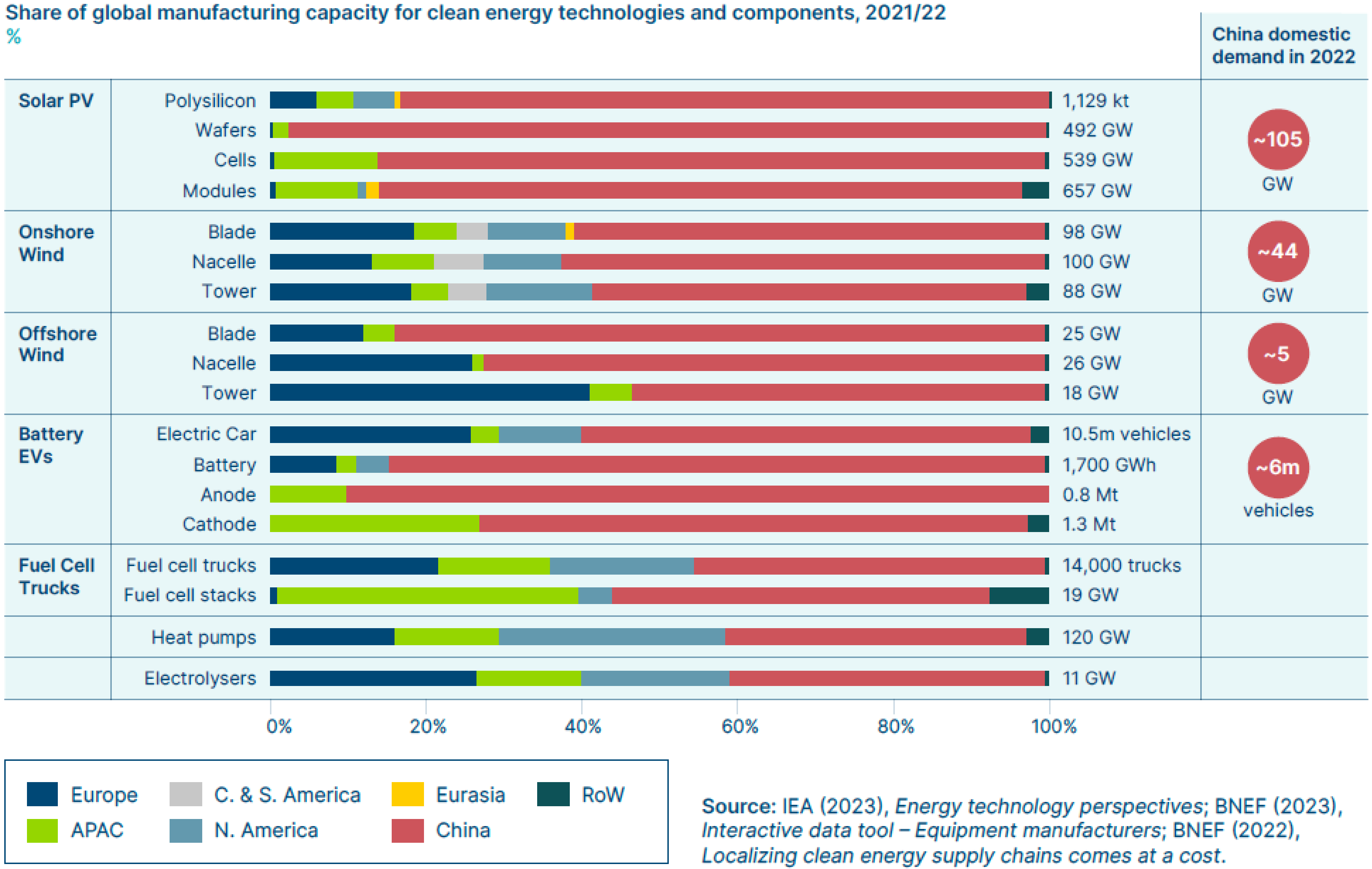
- High-power, large-scale transformers are **highly specialised, complex components** – often very labour-intensive.
- Seeing **rising costs and longer lead** times, especially in the US.
- Further potential constraints from **regulation of use of F-gases** in transformers, exacerbating shortages.

Battery Cathode Materials

- Capacity could be constrained by lack of refined materials – **highest risk is for class 1 nickel**.
- Building new manufacturing capacity requires **high-specification equipment** (e.g. kilns), can risk delays.
- Building up manufacturing capacity in Europe or N. America from very low base: **lack of experience of building and operating complex plants**.

Delays or high prices could materialise – but these would likely be resolved over short term (1-3 years), so do not pose a fundamental risk to energy transition

Clean energy supply chains are heavily concentrated – especially for batteries and solar PV

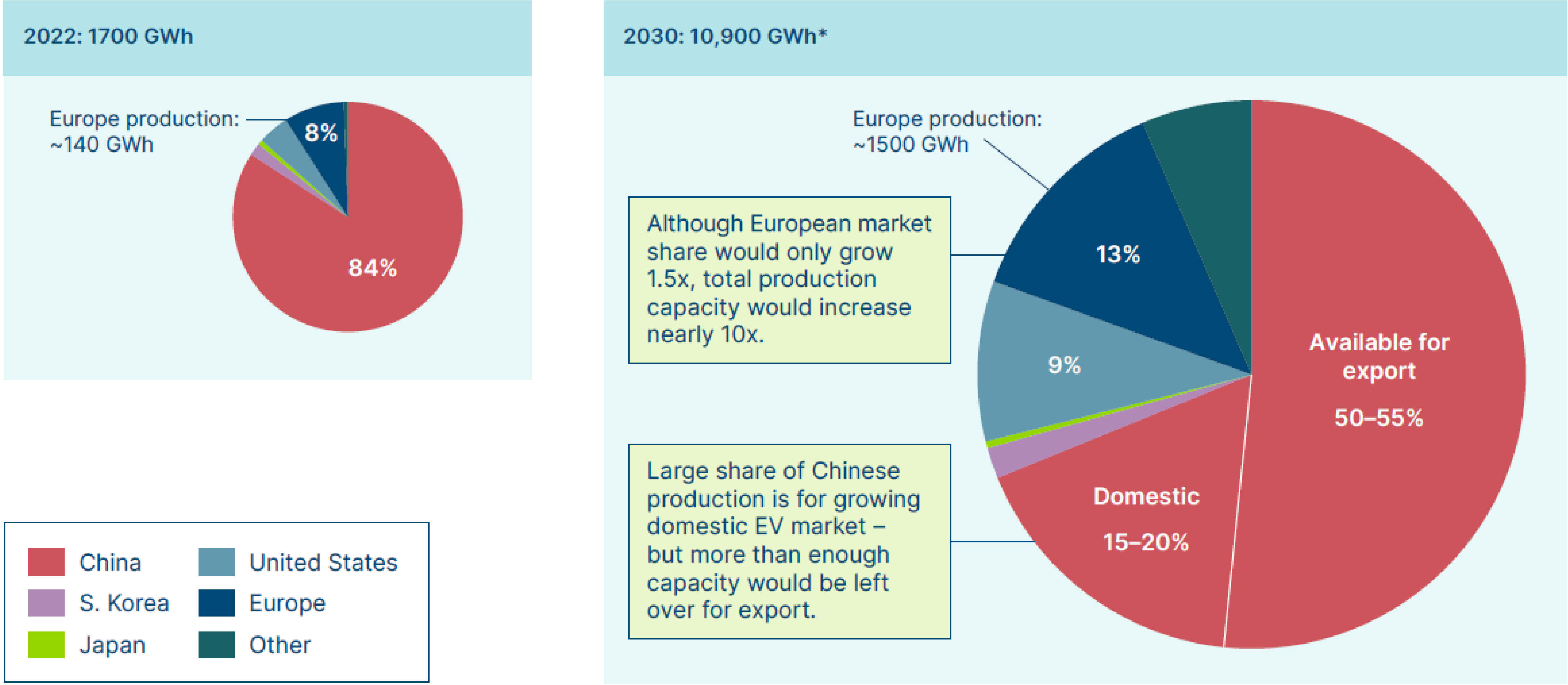

Share of global manufacturing capacity for clean energy technologies and components, 2021/22

%

Source: IEA (2023), *Energy technology perspectives*; BNEF (2023), *Interactive data tool – Equipment manufacturers*; BNEF (2022), *Localizing clean energy supply chains comes at a cost*.

Clean energy manufacturing competition does not need to be zero-sum: rapidly-expanding market presents opportunity for all major players

Country market share of battery production, 2022 vs. 2030
%



Although European market share would only grow 1.5x, total production capacity would increase nearly 10x.

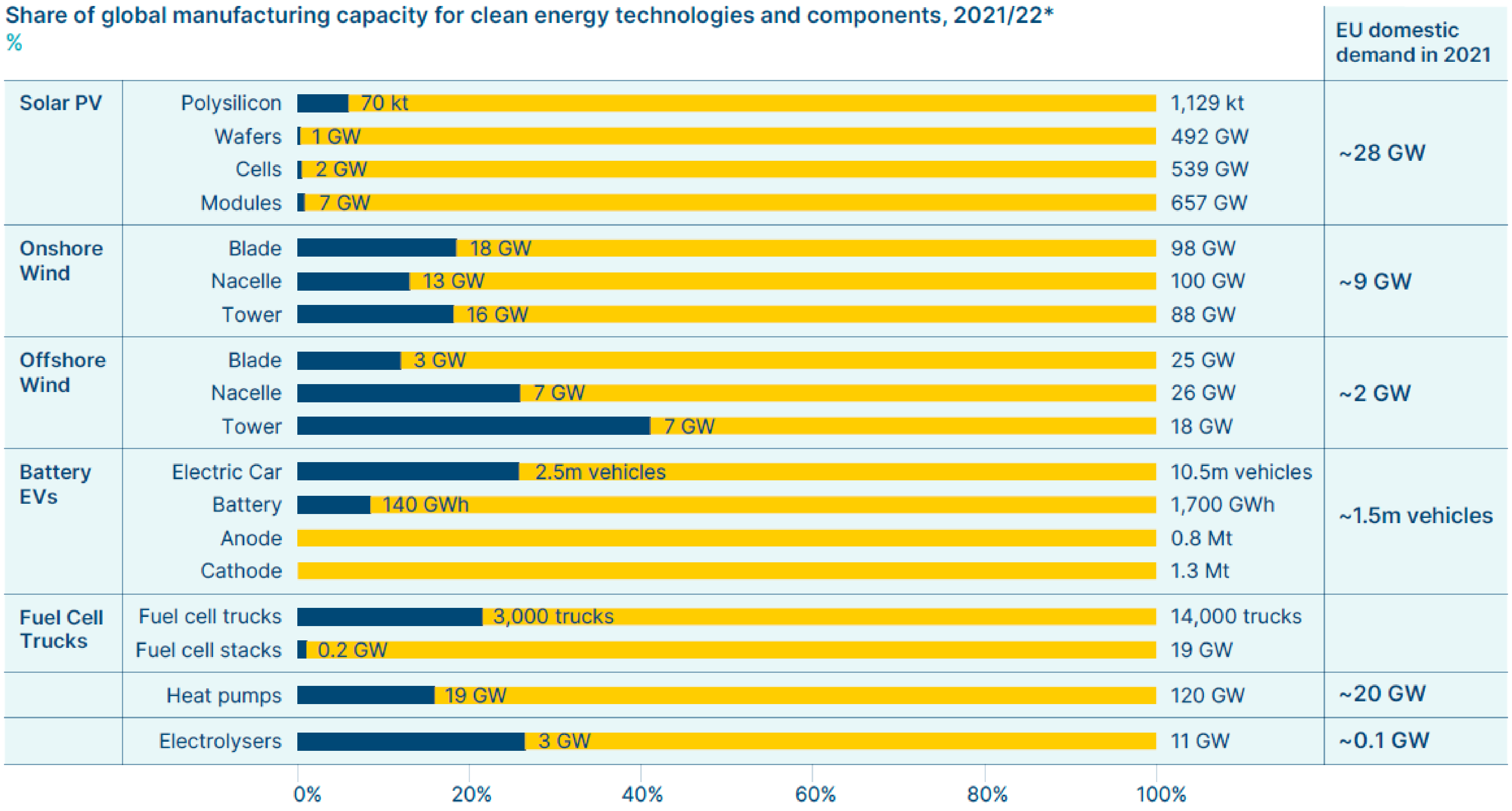
Large share of Chinese production is for growing domestic EV market – but more than enough capacity would be left over for export.

Note: *Announced capacity – it is unlikely that all announced projects would reach final investment decision.

Source: Systemiq analysis for the ETC; Benchmark Mineral Intelligence (2022), *Lithium-ion battery gigafactory assessment – August*; BNEF (2023), *Interactive data tool – Battery cell manufacturers*; McKinsey & Co. (2023), *Battery 2030: Resilient, sustainable, and circular*.

Europe is particularly exposed: domestic capacity is currently sufficient to meet demand for wind, heat pumps and electrolysers

Share of global manufacturing capacity for clean energy technologies and components, 2021/22*
%

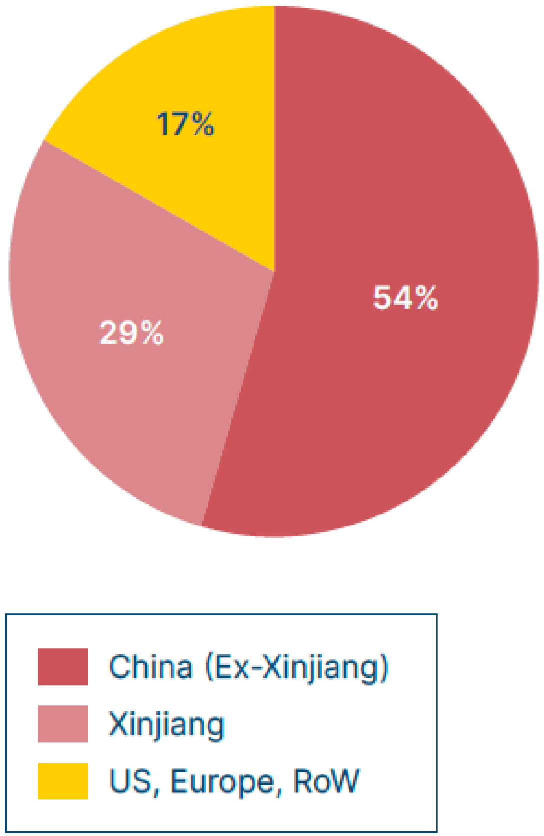


Note: *See also Exhibit 3.7 in main report for breakdown across further geographies

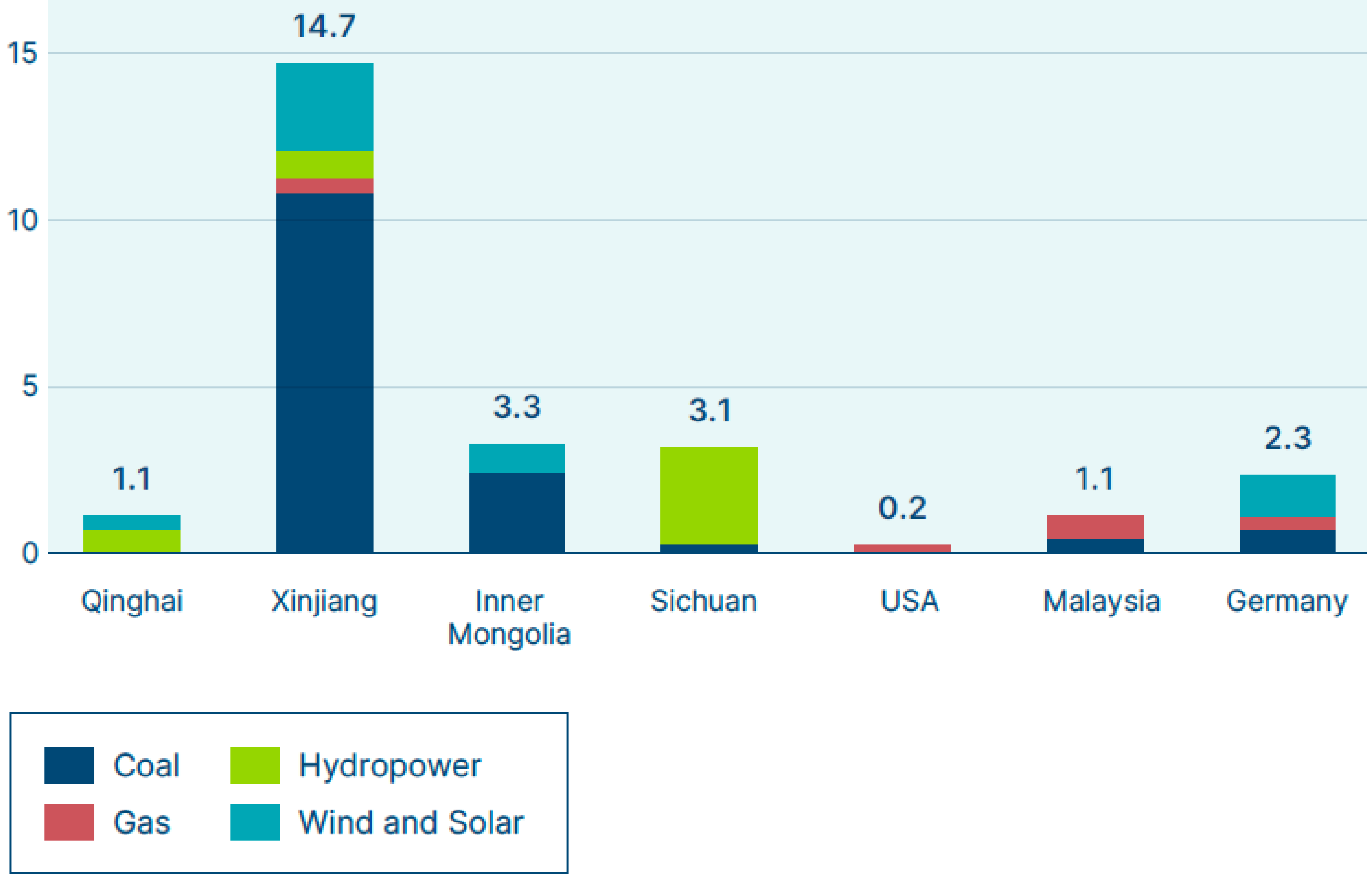
Source: IEA (2023), *Energy technology perspectives*; BNEF (2023), *Interactive data tool – Equipment manufacturers*; BNEF (2022), *Localizing clean energy supply chains comes at a cost.*

Polysilicon production in China currently relies on large amounts of coal power, especially in Xinjiang

Global polysilicon production capacity share, 2022
%

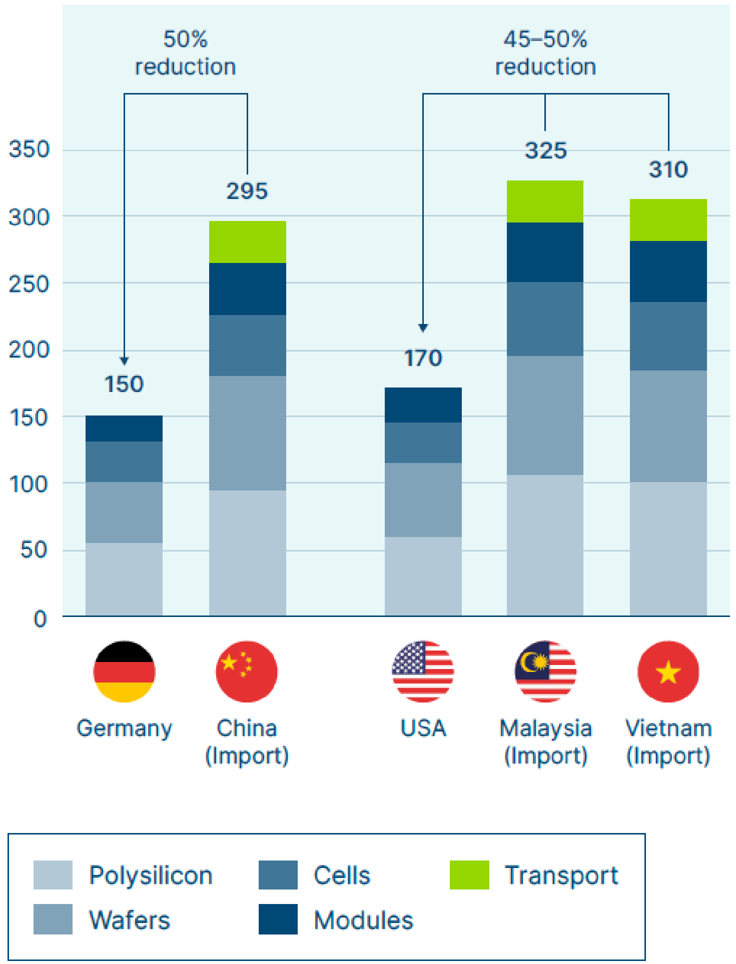


Polysilicon production electricity consumption, 2021
TWh

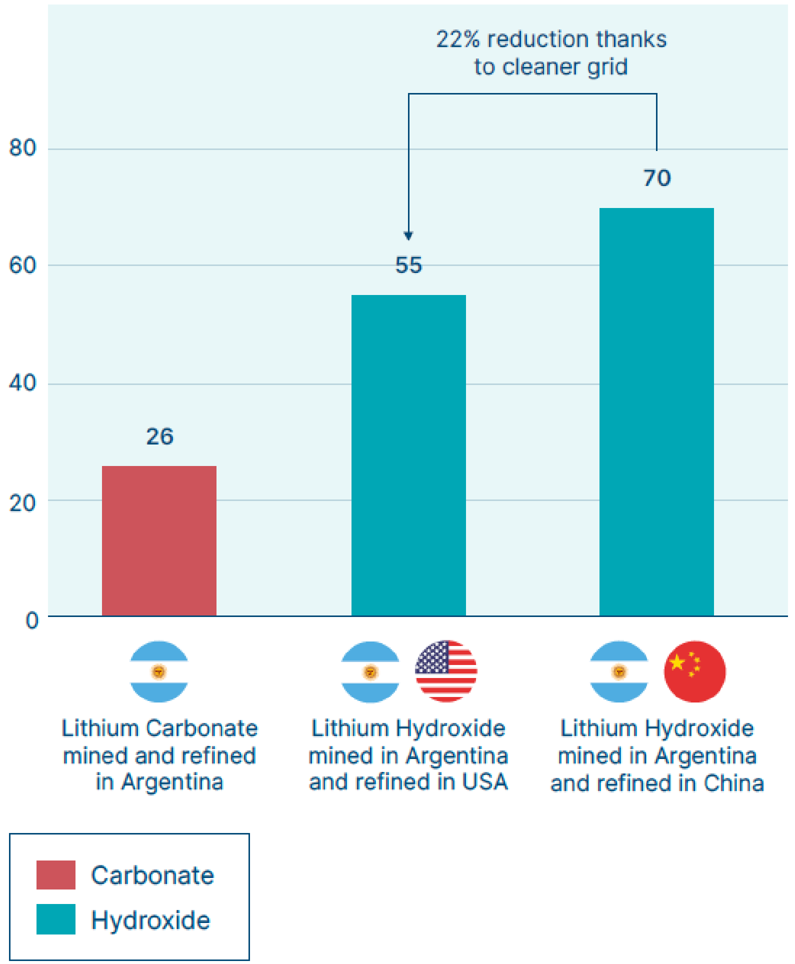


Source: The Breakthrough Institute (2022), *Sins of a solar empire*; Murphy and Elimä/Sheffield Hallam University (2021), *In broad daylight*; IEA (2022), *Special report on solar PV global supply chains*; BNEF (2023), *Interactive data tool – Equipment manufacturers.*

Production of clean energy technologies could be decarbonised by using low-carbon electricity in China, or by shifting production to countries with less carbon-intensive grids



Module manufacturing emissions intensity
tCO_2e/kW

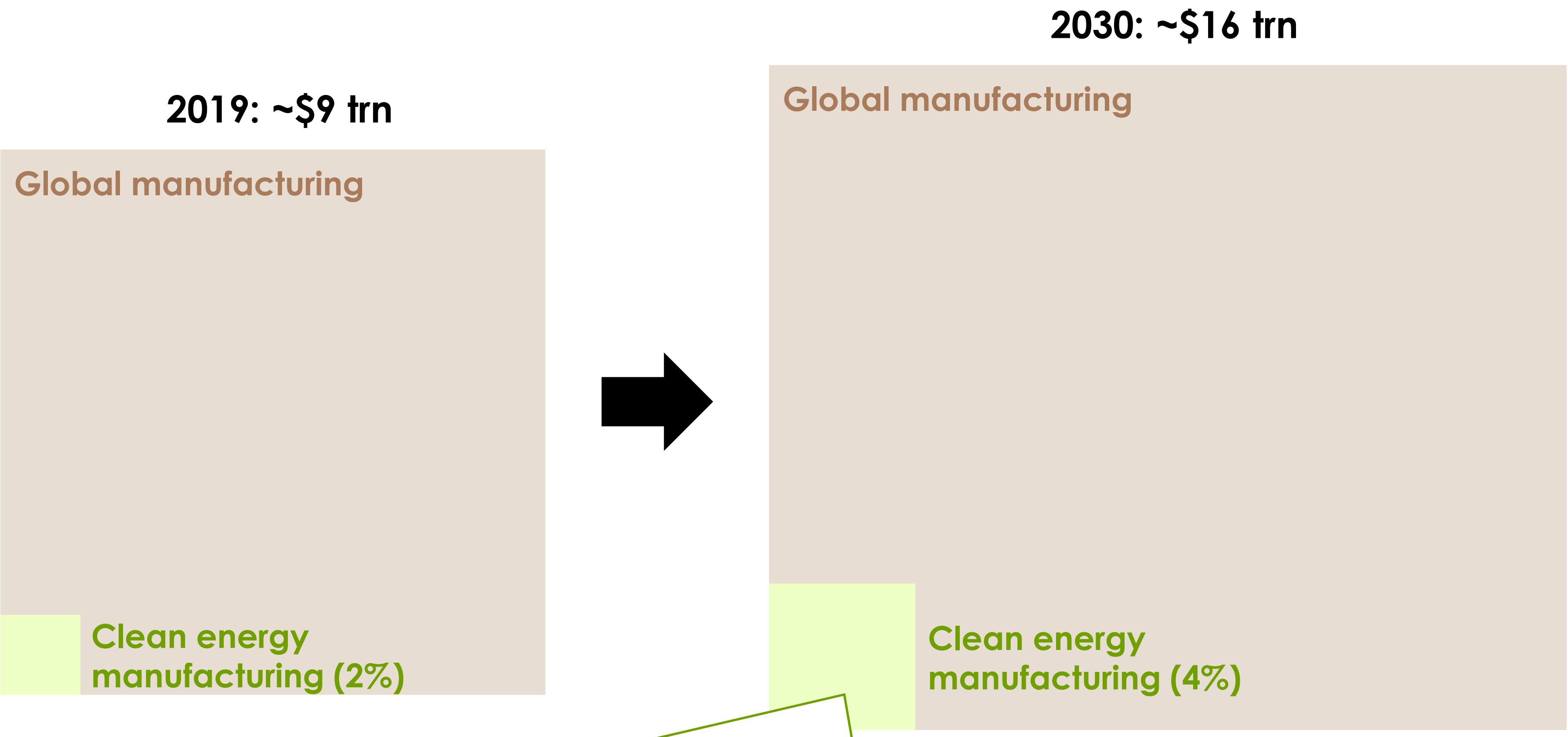


Life-cycle global warming potential of refined lithium products
tCO_2e/ton of contained lithium

Source: Minviro/Livent (2022), *2021 Sustainability Report*; Ricardo Energy (2020), *Determining the environmental impacts of conventional and alternatively fuelled vehicles through LCA.*

2. These challenges can be addressed, but might require strong trade-offs to build capacity rapidly – especially if localisation is prioritised

In theory, the growth in clean energy manufacturing presents a strategic and commercial opportunity for all



2019: ~$9 trn

Global manufacturing

Clean energy manufacturing (2%)

2030: ~$16 trn

Global manufacturing

Clean energy manufacturing (4%)

IEA: key mass-manufactured clean energy technologies* have a market of ~**USD 650 billion a year by 2030** – more than 3x today's level – if countries worldwide fully implement announced energy and climate pledges.

1) **Clean energy manufacturing** will become a bigger part of overall global economy
2) Overall global manufacturing / industry has to become cleaner and more **carbon-competitive**
3) Benefits to domestic **political economy of jobs**, productivity growth and export capacity

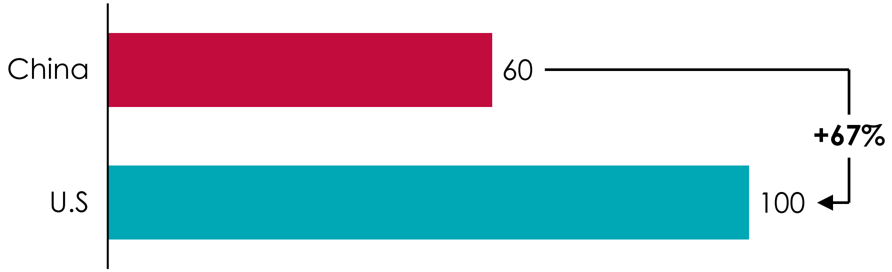
Yet policy measures and industrial policy are increasingly focused on localisation

China	• **Long-standing state support** for deployment and manufacturing of low-carbon technologies, especially solar and batteries • E.g. development of government **Five Year Plans**, large financial support from **China Development Bank**, early-stage Brightness Program for rural electrification using solar PV to **grow domestic demand**, **local government support** to establish industrial parks etc.
USA	• **US Inflation Reduction Act** passed in August 2022, includes tax credits for low-carbon electricity generation and domestic manufacturing • **Wider policy package** on clean energy technologies and industrial competitiveness, e.g. Infrastructure, Investments and Jobs Act, CHIPS & Science Act
EU	• Commission work on EU Green Deal, including **Critical Raw Materials Act, Net Zero Industry Act,** alongside more specific EU Battery Regulation and Supply Chain Due Diligence directives • Emissions Trading Scheme and proposals for **Carbon Border Adjustment Mechanism** to cover high-emissions manufacturing and industry
India	• **Production Linked Incentive** schemes to boost domestic manufacturing, including on **electric vehicles** (~$3.2 bn) and **solar PV module** manufacturing (~$2.4 bn) • **Import tariffs on solar modules** manufactured in China

Managing supply chain challenges – especially through localisation – will lead to strong trade-offs in certain cases

Cost vs. Industrial Strategy

Higher costs



Upfront capex investment for battery manufacturing plant
$ million/GWh p.a.

VS

Local value add

Employment

Geopolitical considerations

Feasibility of Local Implementation

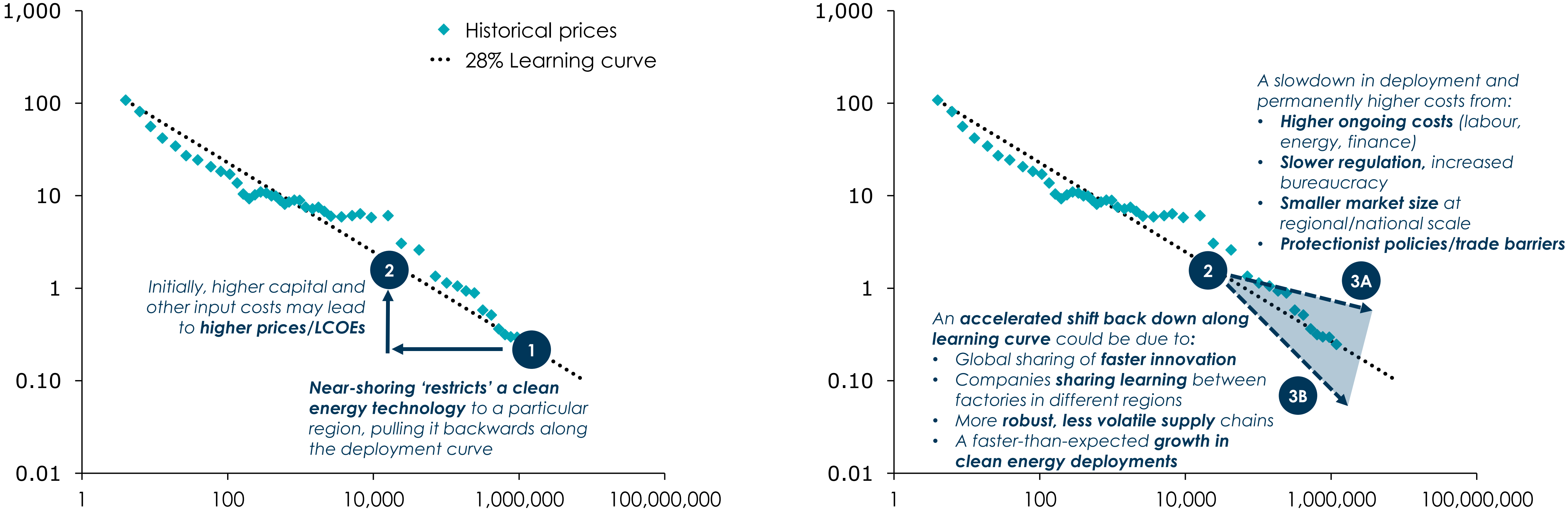
- Higher environmental and social standards
- Rules/quotas on local content requirements
- Slower permitting for new projects
- Lower risk appetite, driving financing challenges
- (Re-)Starting manufacturing or mining from a low base

Challenge to implement and scale up local supply chains, especially across Europe and N. America

The challenge will be to ensure that any policy interventions on supply chains continue to move technologies down cost reduction trajectories

Solar Example: Initially, near-shoring dynamics can be seen as moving back and up a clean energy technology ‘learning curve’, which is why any such efforts must be accompanied by policies to ensure technology costs continue to go down

Solar learning curve: US$/W (Y-axis); MW (X-axis)



Initially, higher capital and other input costs may lead to ***higher prices/LCOEs***

Near-shoring ‘restricts’ a clean energy technology *to a particular region, pulling it backwards along the deployment curve*

A slowdown in deployment and permanently higher costs from:

- ***Higher ongoing costs*** *(labour, energy, finance)*
- ***Slower regulation,*** *increased bureaucracy*
- ***Smaller market size*** *at regional/national scale*
- ***Protectionist policies/trade barriers***

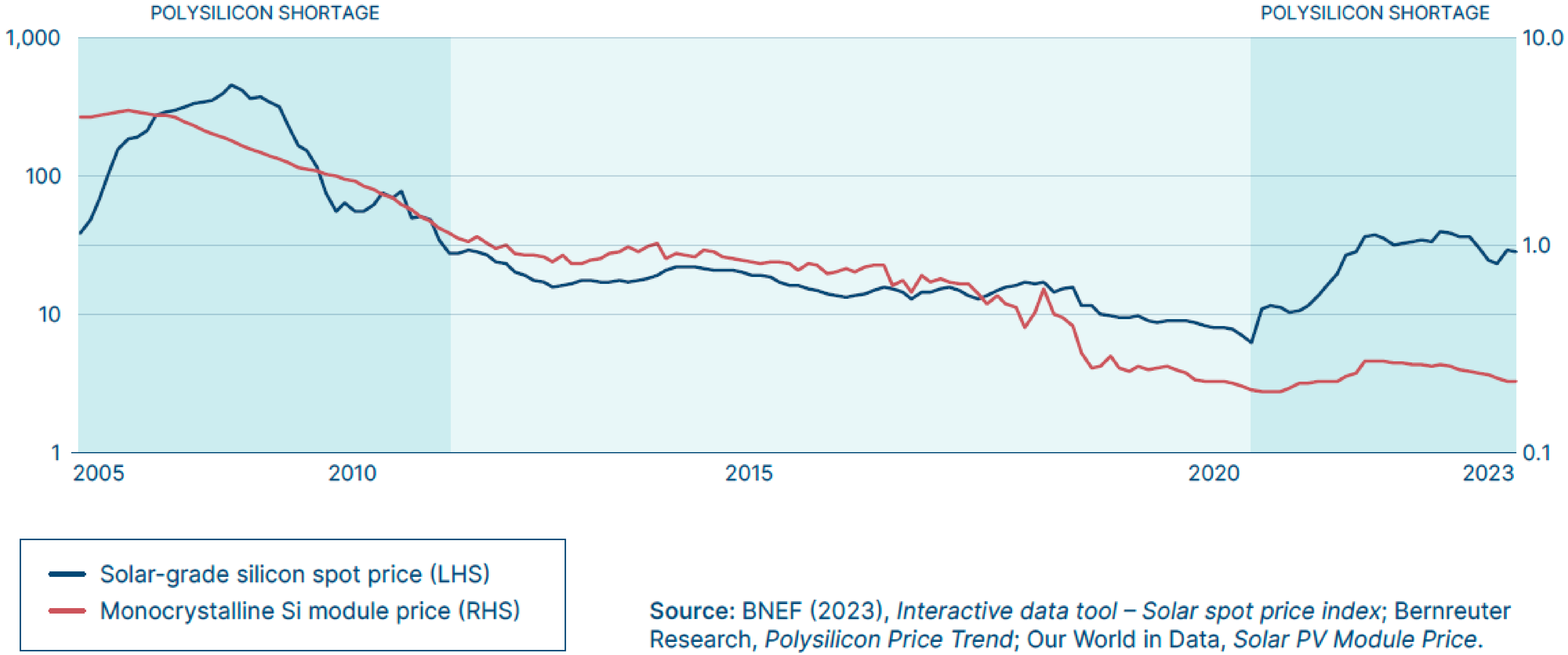
An ***accelerated shift back down along learning curve*** *could be due to:*

- *Global sharing of* ***faster innovation***
- *Companies* ***sharing learning*** *between factories in different regions*
- *More* ***robust, less volatile supply*** *chains*
- *A faster-than-expected* ***growth in clean energy deployments***

3. Innovation can address challenges very quickly, and is a constant cause for optimism

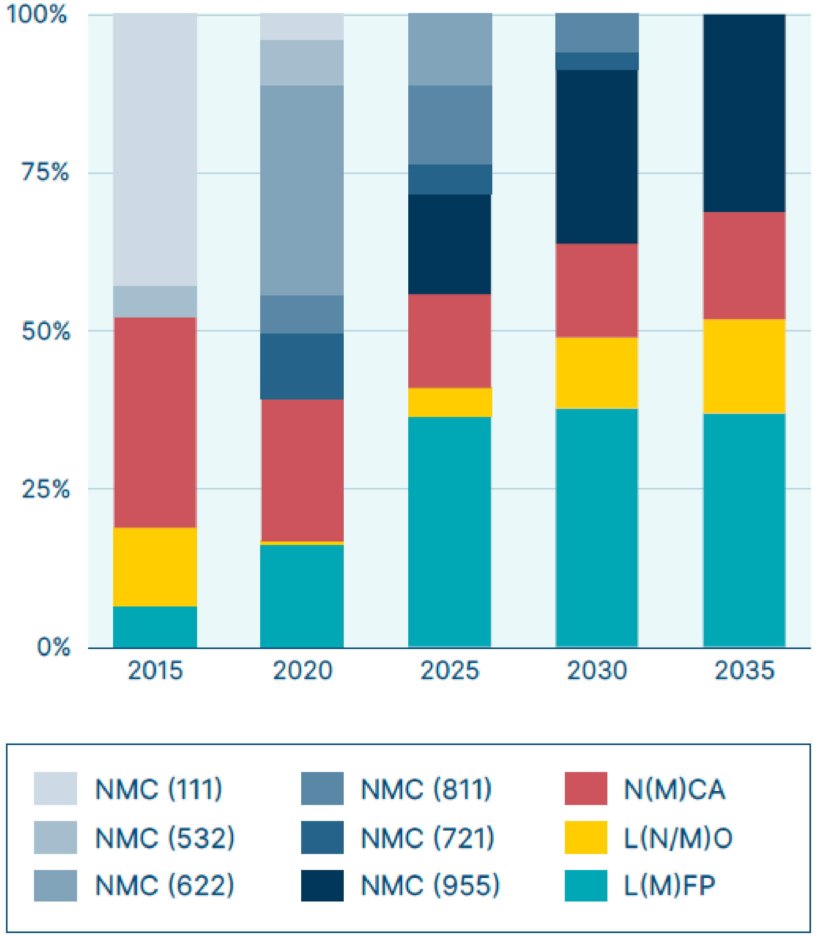
Although polysilicon shortages lead to short-term price cycles, solar module prices keep falling regardless

Solar-grade silicon spot price (LHS); Solar module price (RHS)
LHS = $/kg, log scale; RHS = $/W, log scale

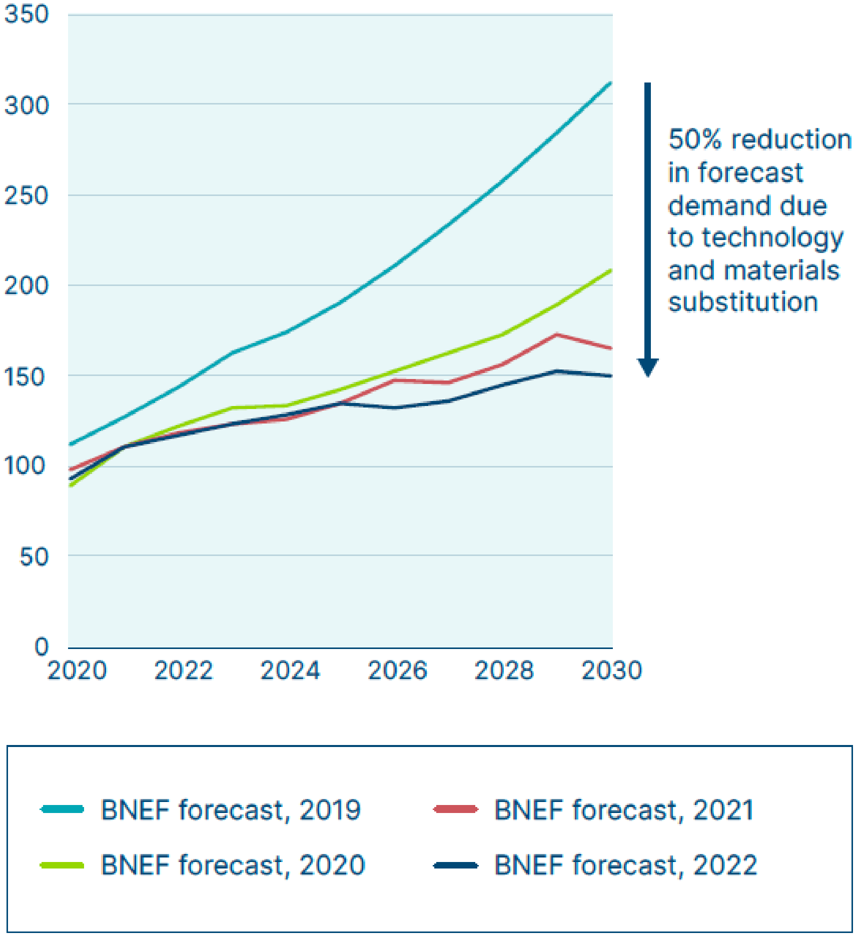


Source: BNEF (2023), *Interactive data tool – Solar spot price index*; Bernreuter Research, *Polysilicon Price Trend*; Our World in Data, *Solar PV Module Price*.

The Li-ion battery industry is shifting rapidly to lower cobalt and lower nickel chemistries, driving down demand projections



Passenger vehicle battery market share
%



Projected future cobalt demand
Thousand metric tonnes

50% reduction in forecast demand due to technology and materials substitution

Note: N = Nickel, M = Manganese, C = Cobalt, F = Iron, P = Phosphate

Source: BNEF (2022), *Long-term electric vehicle outlook.*

4. To avoid further disruptions, strong action is needed by industry and policymakers across three fronts

Addressing challenges requires strong actions from governments and industry

***Fundamental driver:* a strategic vision for the energy transition,** including net-zero targets, supporting sectoral targets (e.g. GW capacity deployment, ICE phase out ban dates), policies that send clear signals on the pace and scale of clean energy deployment, and clear volume needs (e.g. copper Mt).

①

Addressing supply-demand imbalances

- *Demand:* Accelerate improvements in **materials and technology efficiency**
- *Supply:* **Scaling recycling** and secondary supply
- *Supply:* **Expand supply from the mine site to manufacturing.**

②

Developing sustainable and responsible supply chains

- **Strong regulations on environmental and social impacts** of clean energy supply, starting with **carbon intensity.**
- **Use purchasing power to drive projects** with high environmental and social standards.
- **Define and adopt high-quality voluntary** environment and social standards.
- **Improve and require supply chain traceability**.

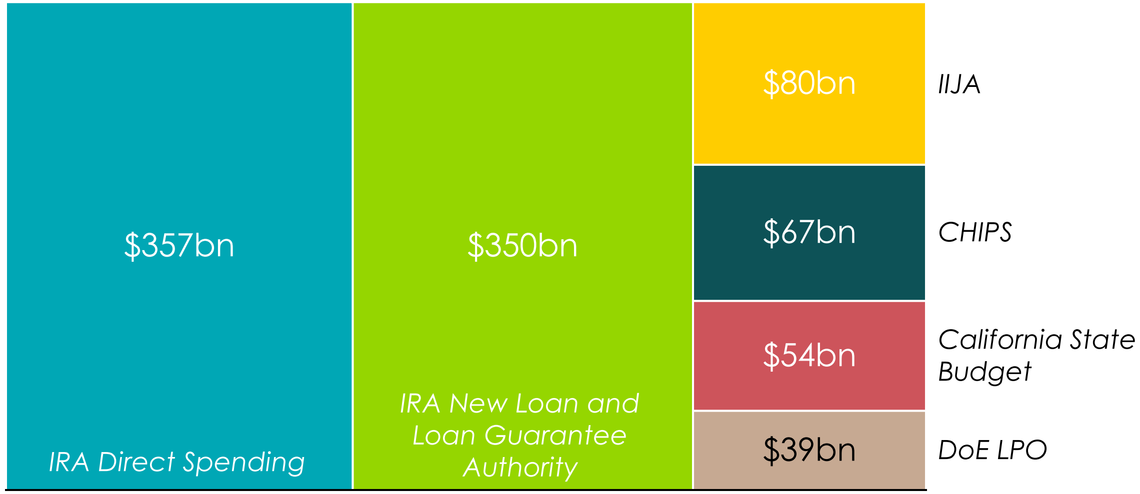
③

Ensuring diversified, resilient and secure supply

- **Adopt strategies to diversify supply** for mining, refining and manufacturing.
- **Where near-shoring is assessed as strategically beneficial**, develop a suite of actions to **maximise benefits of near-shoring** of value chains, including alignment of near-shored industries with domestic growth areas.

Although available funding is similar across the US and EU, there is a lack of access, coherence and clarity for European spending

US: $1trn of spending across federal and state govs.



- Overall funding could reach **~$1trn** across various packages
- Total of **~$35bn available for clean energy manufacturing**
- Significant **tax credits for investment and production**, across electricity and hydrogen
- Strong consumer credits available (e.g. for EVs, heat pumps, batteries)
- **Clear, easy-to-access incentives** and a technology-neutral approach

EU: Similar spending level, but more complex and fragmented

Green Deal Industrial Plan:

Net-Zero Industry Act	**Critical Raw Materials Act**	**Other EU and member-state level policy**
• 40% of 2030 clean tech capacity additions met by domestic manufacturing • Enabling policies to streamline permitting and finance	• 10% of 2030 materials demand met by domestic mining • 40% met by domestic refining • 15% met by recycled materials • Max 65% of supply from one country	• REPowerEU • InvestEU • Introduction of CBAM • Ongoing debate on use of ETS revenues • Member-state EV tax credits, subsidies etc.

- Overall funding available could be up to **~€800bn,** comparable to US
- Total of **~€37bn available for clean energy manufacturing**
- ***Sources of funding are more fragmented and disparate***
- **Lack of coherent vision** and messaging across policy packages

What has happened recently?

The technologies which are deploying fastest are those most susceptible to mass production and easy deployment

Continued focus needed on addressing possible supply chain barriers for more complex technologies

Fastest progress

Solar PV, EVs and batteries

- Mass produced in large-scale, replicable factories
- Easily transported
- Easily deployed / installed

Heat pumps

- Mass produced in large factories
- Easily transported
- Complex installation

Wind

- Turbines supply chains very complex, scale of production is orders of magnitude smaller than PV/batteries
- Higher degree of customisation for projects
- Transport and installation more complex

Electrolyser and green H_2

- Can be mass produced, but balance of system costs and specific project complexities important

CCUS

- Customised engineering design and deployment

Large-scale nuclear

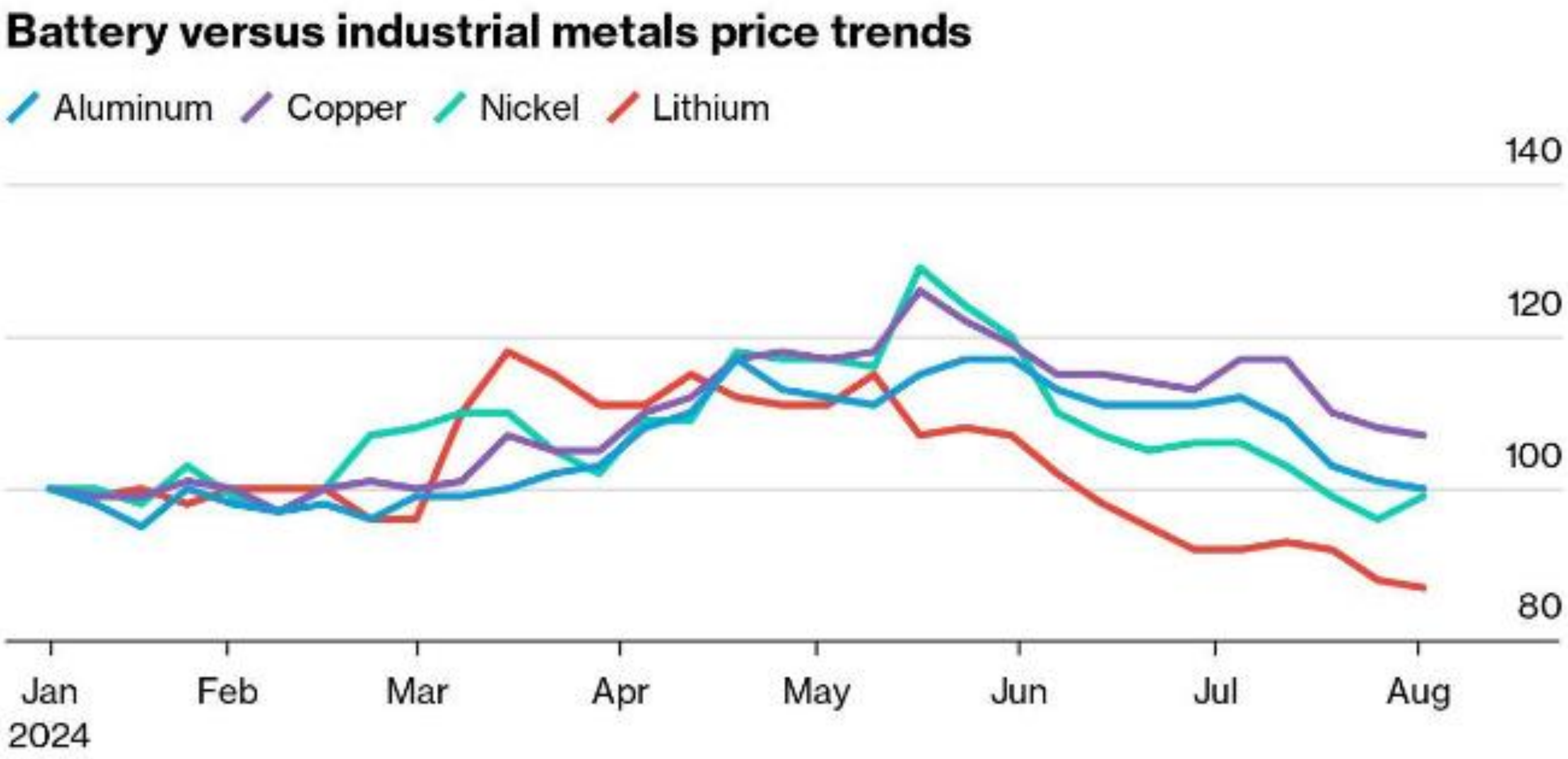
- Hugely complex large-scale systems

Key issue: opportunity for standardised and/or smaller scale units?

- *Standardised CCUS units?*
- *Small modular nuclear?*

Slower progress

Raw materials: Over 2024, copper prices higher while lithium prices softening



-13%

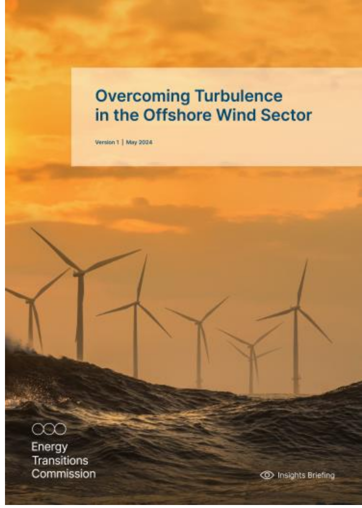
Lithium price change compared to the beginning of 2024

7%

Copper price change compared to the beginning of 2024

Source: BloombergNEF, London Metal Exchange, Asian Metals Inc
Note: Indexed value, January 5, 2024 = 100

ETC offshore wind paper found interest rates, not supply chains likely key to sustained cost increases



Overcoming Turbulence in the Offshore Wind Sector

Version 1 | May 2024

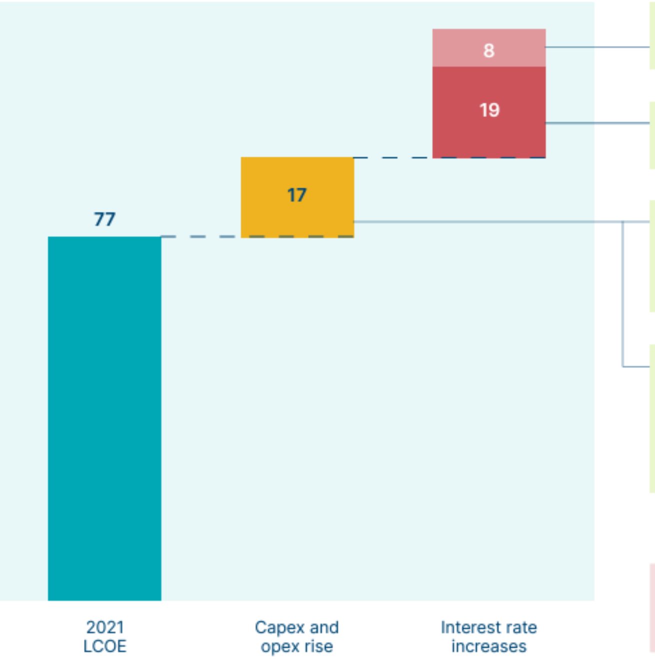
Energy Transitions Commission

Insights Briefing

The largest cost effects will prove temporary, but somewhat higher prices could persist over the medium term

Exhibit 2.5

US offshore wind LCOE progression from 2021–2023
$/MWh, 2021 nominal prices



Likely semi-permanent increase in real interest rates (indicated by increased real gilt yields).

Nominal rises in interest rates not an issue as long as contracts are inflation linked.

Steel costs are 90% of turbine materials cost. Steel prices increased by 200% between 2020 and mid-2022 and are forecast to return to 2019 averages by 2024.

Other key materials forecast to remain above 2019 averages for coming years, but make up lower proportion of turbine cost.

Required higher returns by OEMs could help sustain capex increases.

BUT... Whilst these cost declines appear positive long-term, they do not help companies which bid in 2021/22 and had to contract supply orders in 2023.

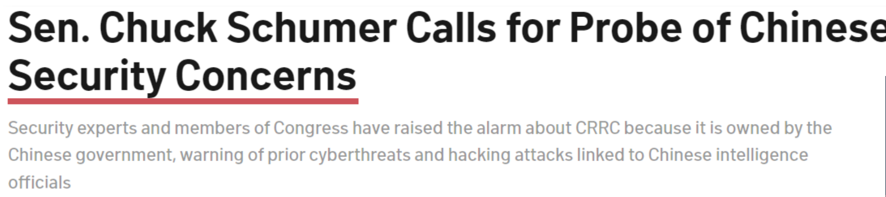
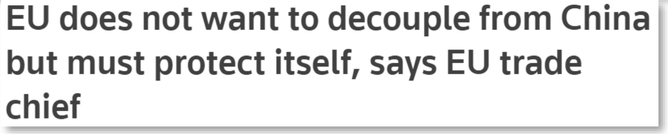
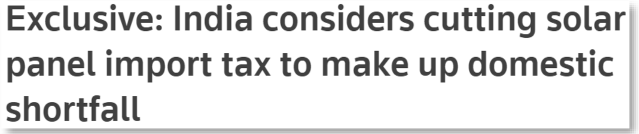
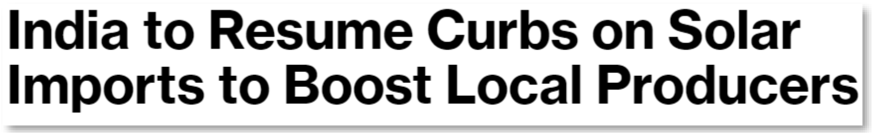
Source: Systemiq analysis for the ETC; BNEF (2023), *The $49 Million Fine That May End More US Wind Deals*; BNEF (2023), *Transition metals outlook*; BNEF (2023), *Industrial Metals Outlook 2H 2023: Heading Into the Storm.*

Note: Real cost effects estimated by modelling a 2% real interest rate rise, from 5% to 7% based on a project cost of $1.8 bn for a 1 GW wind farm with 30% equity, 70% debt. Nominal increases are the net of BNEF interest rate increases minus the real effect.

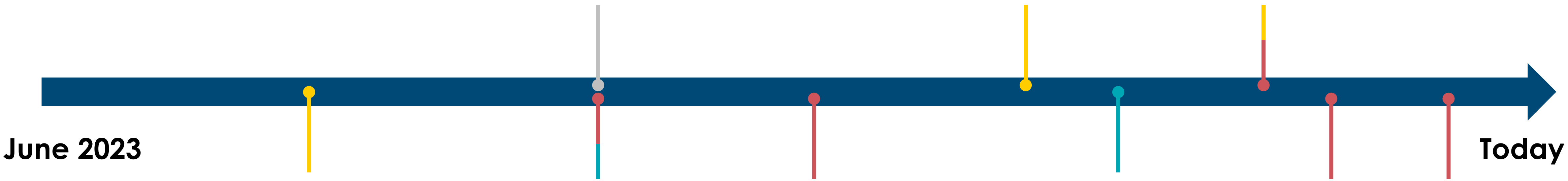
To address remaining supply chain barriers, policymakers & industry need to:

- **Set clear targets to drive volume deployment**, and foster **harmonisation of components size**, bringing certainty to the supply chain
- **Address specific supply chain bottlenecks** e.g. via guarantees and subsidies for **new installation vessels** to carry larger turbines
- **Balance** the desire to encourage **local supply chain content** with the need to achieve **high production volumes** on a multi-country/regional level.

Public discourse on location and re-balancing continues, varies significantly across key geographies

	Concerns on national security risks dominate US government public discourse for challenging supply chain status quo	 Sen. Chuck Schumer Calls for Probe of Chinese Rail Tech Amid Security Concerns Security experts and members of Congress have raised the alarm about CRRC because it is owned by the Chinese government, warning of prior cyberthreats and hacking attacks linked to Chinese intelligence officials  Biden administration will investigate national security risks posed by Chinese-made 'smart cars' Officials are concerned that features such as driver assistance technology could effectively be used to spy on Americans.  US House committees investigate Ford Chinese battery partnership
	The EU's approach is more concerned with **accelerating clean tech deployment whilst ensuring fair-trade practices**	 European Commission wary of trade measures to protect solar industry The European Commission has warned about the potential impact of trade measures on Europe's renewable energy rollout, but has shied away from outlining emergency measures to address the continent's solar manufacturing crisis.  'Everything has changed': foreign auto groups embrace local technology in China  Mercedes-Benz boss urges Brussels to cut tariffs on Chinese EVs  EU does not want to decouple from China but must protect itself, says EU trade chief
LATAM	LATAM countries **welcoming** of Chinese tech., **unsettling neighbours**	 'Global China' is a big part of Latin America's renewable energy boom, but homegrown industries are key Lithium, essential for EV batteries, could be South America's white gold.  Chinese green technologies are pouring into Latin America That is prompting anxiety in the United States about security, coercion and competition
	India **between** protectionism and deployment	**May 2023:**  Exclusive: India considers cutting solar panel import tax to make up domestic shortfall **March 2024:**  India to Resume Curbs on Solar Imports to Boost Local Producers

Key policy developments in clean energy supply chains since the publication of the ETC’s June 2023 Report



June 2023

August 2023
The US reinstates import tariffs on PV products, effective June 2024

October 2023
EU CBAM enters into application in its transitional phase

October 2023
❑ *EU Commission launches an anti-subsidy investigation into the imports of EVs from China*

❑ *EU adopts Wind Power Action Plan to address industry headwinds*

December 2023
US Treasury released new guidance on what constitutes Foreign Entities of Concern, with impact on access to subsidies for purchase of EVs

March 2024
EU rejects calls to impose import duties on Chinese solar

April 2024
EU Commission launches inquiry into Chinese suppliers of wind turbines

May 2024
US announces it will quadruple tariffs on Chinese EVs to 100%, triple tariffs on Chinese lithium-ion EV batteries to 25% and double tariffs on Chinese solar cells to 50%

July 2024
EU imposes tariffs on individual Chinese EV manufacturers

August 2024
Canada launches 100% tariffs on Chinese EVs

Today

Solar PV
Wind
Batteries

Additional tariffs aimed at Chinese EV imports, as EU Commission provisionally concludes China value chain benefits from unfair subsidisation

China small EV leadership

China EV OEMs ahead of European in quality and cost, especially small affordable EVs, e.g.

- BYD Dolphin € 29000
- BYD Seagull $10-12000 (in China)

Large scale Chinese exports to Europe beginning

CEO of Stellantis Europe

> The Chinese "*can reduce the price much lower than you even think in your wildest dreams*"

> Many brands sell similar EVs in China for roughly half the price in Europe. They can absorb higher tariffs, cut prices and still make high profits

EU policy considerations

Need for cheap EVs to prevent political backlash against 2035 ICE sales ban

Industry split – Mercedes Benz and VW opposed to tariffs

- Creates good competition
- Fears of China retaliation on EU exports

Anti subsidy investigation – on rules-based approach – with differentiation by specific producer

Additional* tariffs of 17-38 % introduced e.g.

- **BYD + 17.4%**
- **SAIC + 38%**

But no opposition (so far) to Chinese EV / battery companies manufacturing in EU e.g.

- **BYD in Hungary**
- **CATL in Germany**

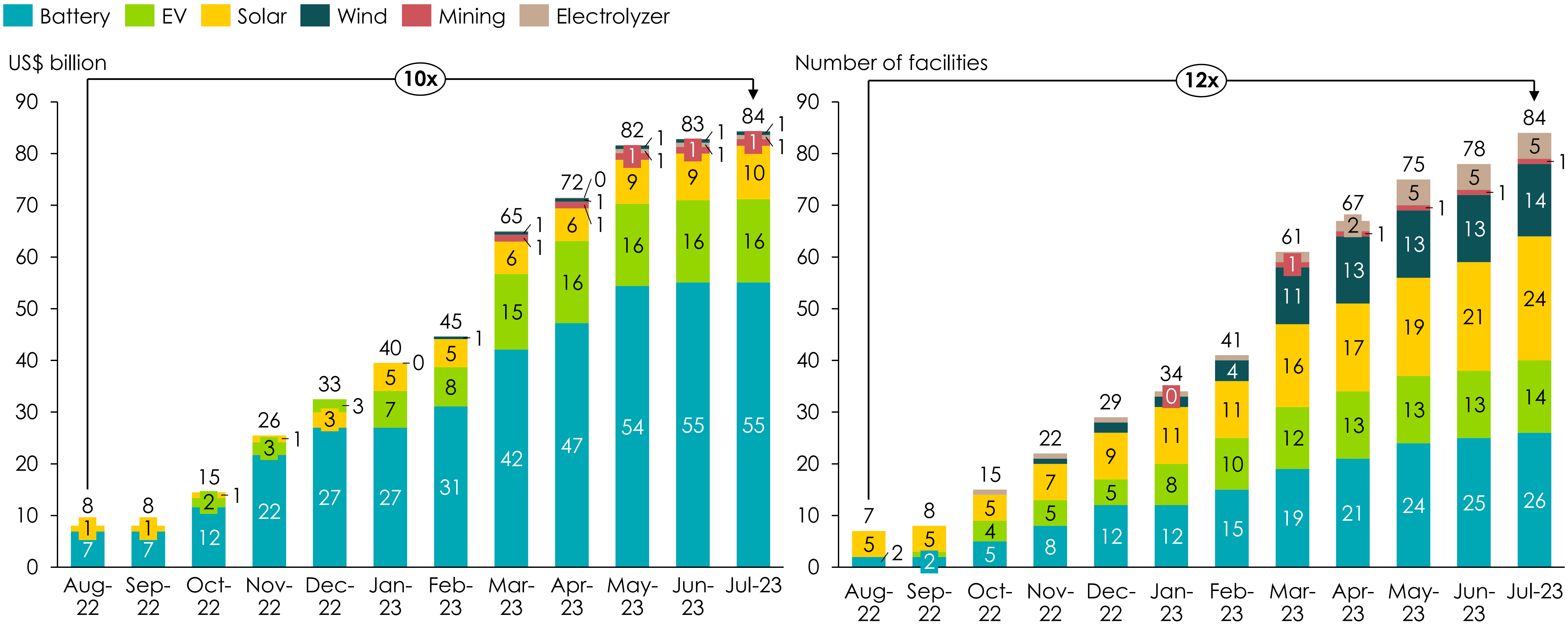
*Note: * in addition to standard 10% already in place. Tariffs were the result of invest. SAIC = Shanghai Automotive Industry Corporation*

Source: European Commission (2024) Commission investigation provisionally concludes that electric vehicle value chain in China benefit from unfair subsidies

US: passage of the IRA has led to an unprecedented boom in clean-tech manufacturing investments

Investments in clean-tech manufacturing capacity since passage of IRA (Aug. 2022)

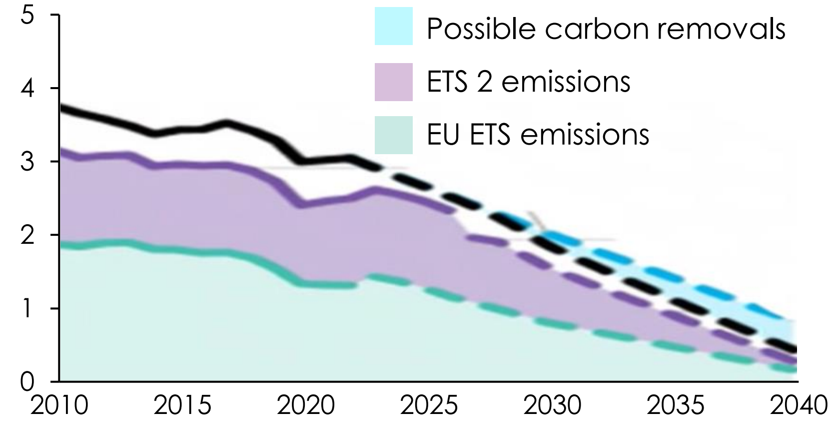
LHS: value of investments in US$ billions; RHS: number of facilities



EU CBAM should be a major driver of industrial decarbonisation domestically and abroad

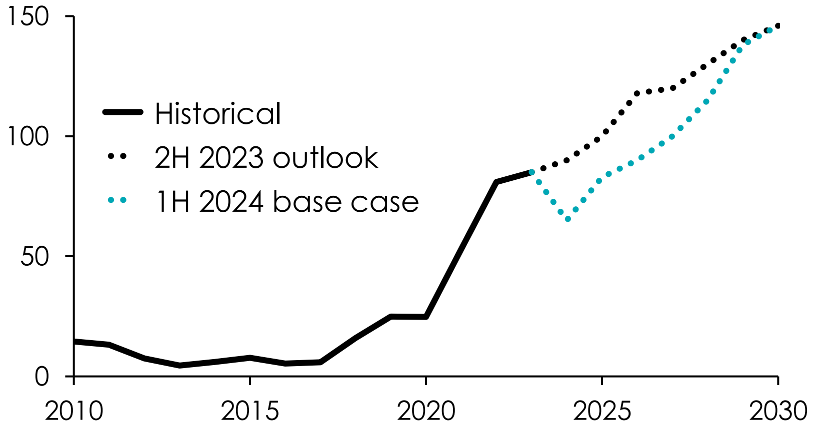
EU ETS emissions caps and possible 2040 target

Billion metric tons of CO2e



Historical and forecast price of EU emission allowances

EUR/metric ton, nominal



Carbon Border Adjustment Mechanism (CBAM)

- A price on the carbon emitted during the production of carbon intensive goods imported into EU
- Current transitional phase lasts between 2023 and 2025. Final phase from 2026
- Aligned with the phase-out of the allocation of free allowances under the EU Emissions Trading System (ETS)

EU Batteries Regulation

- Importers are required to make declarations on performance classes and maximum limits on the carbon footprint of light transport and rechargeable industrial batteries
- Implemented from 2024 onwards

Likely impact

- Accelerated decarbonisation of EU heavy industry
- Accelerated decarbonisation of industry and supply chains in other countries such as China and India?

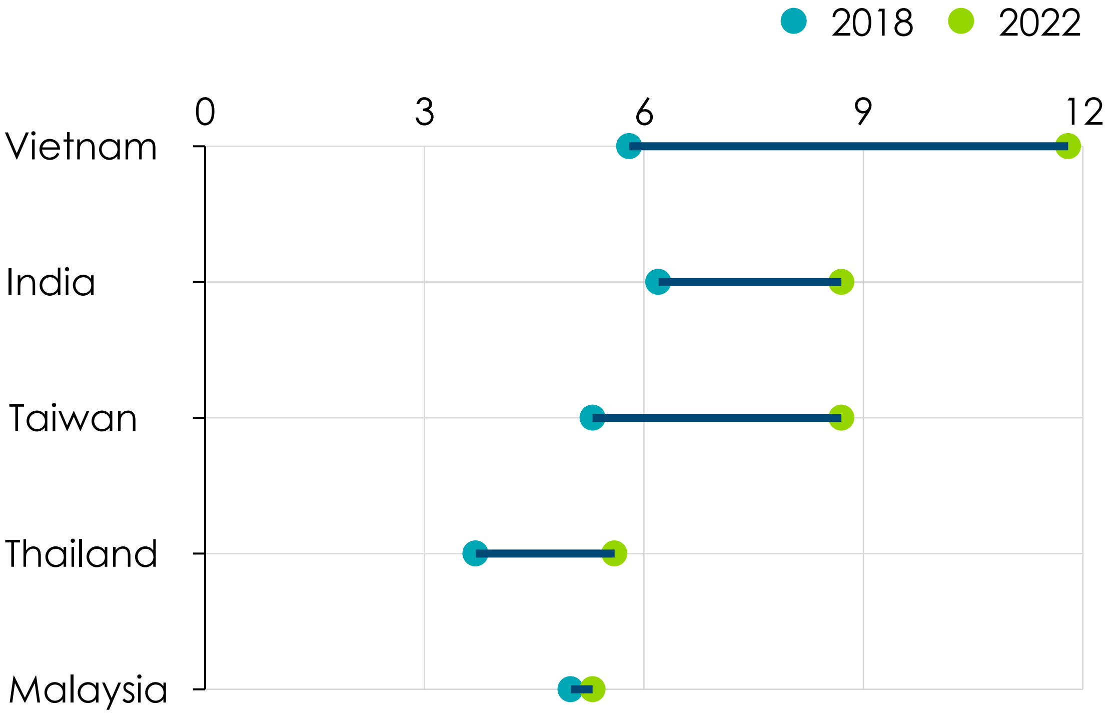
Source: BNEF; Trading Economics (2023) EU Natural Gas; ICE Endex (2023) Dutch TTF Natural Gas Futures (accessed 06/02/24); BNEF (2023), 2H 2023 LCOE Update. European Commission (2024) Carbon Border Adjustment Mechanism, European Commission (2023) Circular economy: New law on more sustainable, circular and safe batteries enters into force

Four potential impacts resulting from tariffs on supply chains and production locations

1. Re-routing of China's supply chains via intermediate countries – which may produce further US policy response
2. Impact on production likely to be smallest where the product is commoditized, and China have a significant cost advantage e.g solar
3. Bigger impact could occur on location of battery / EV production given other advantages of co-location close to customer
4. Chinese overcapacity and low costs will drive low price exports to countries unconcerned by China supply (e.g. solar PV in Africa)

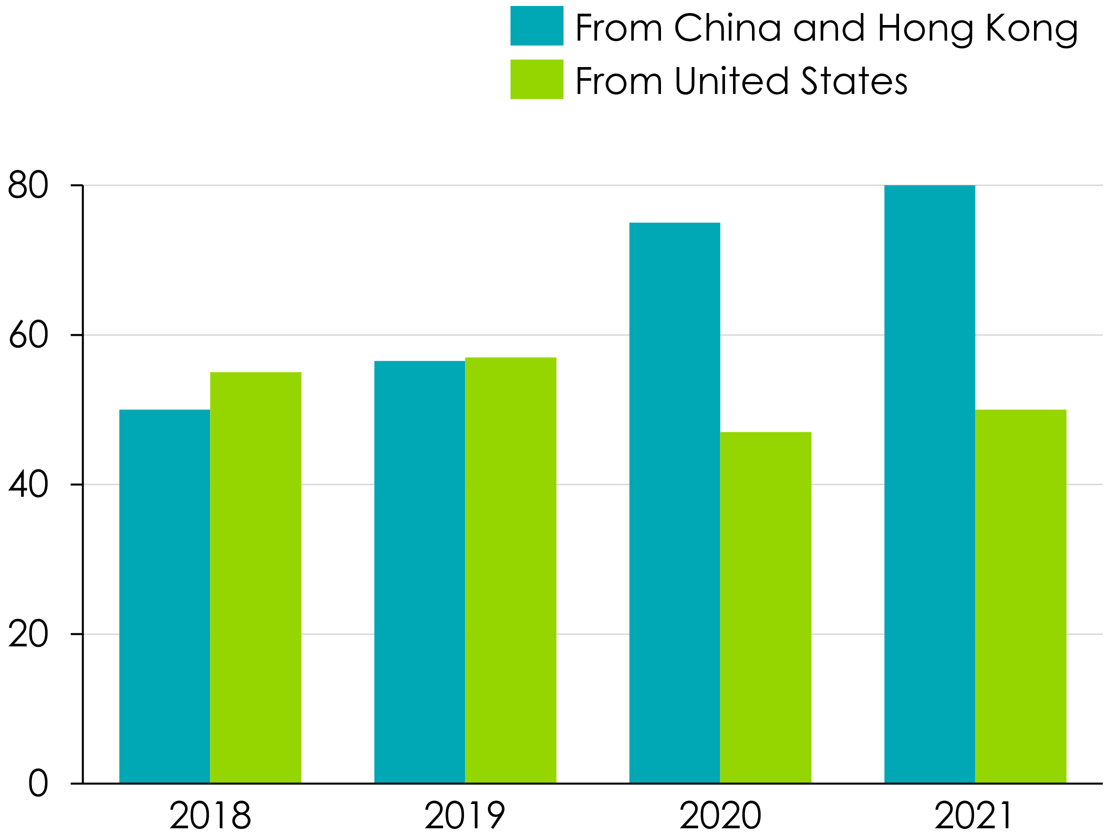
❶ Is China supply rerouting via southeast Asia?

United States manufactured goods
% of total imported from selected countries*



* Bangladesh, Cambodia, China, India, Indonesia, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam
Source ; Kearney

Direct investment in Indonesia, Malaysia, Philippines, Thailand and Vietnam
$bn

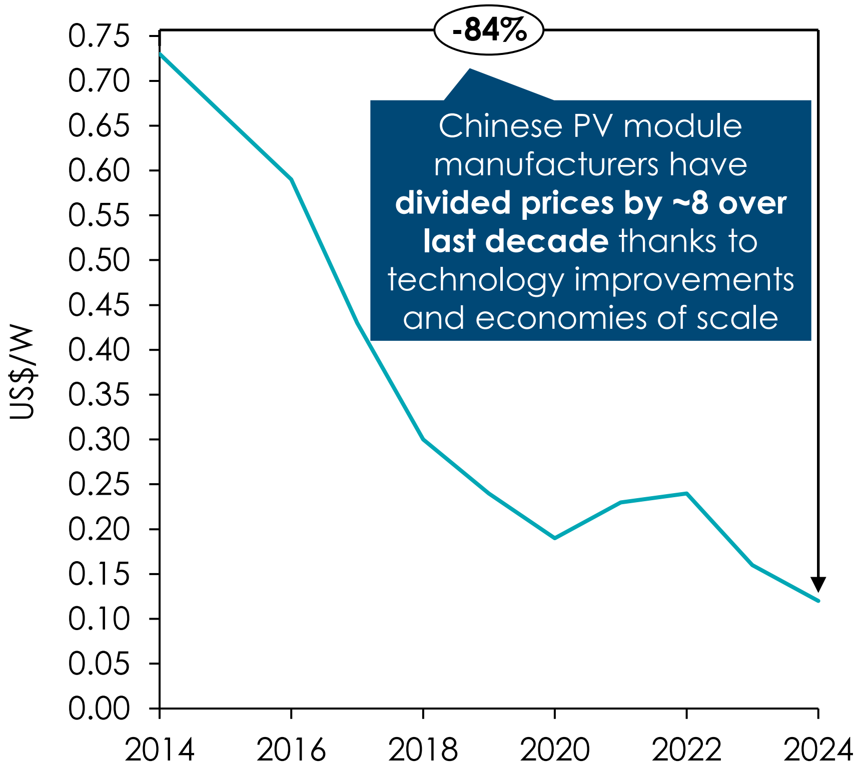


Source ; The Economist , How America is failing to break with China , August 8th , 2023

Import tariffs are unlikely to plug the cost gap with low-cost geographies which have achieved steep cost declines over the last decade

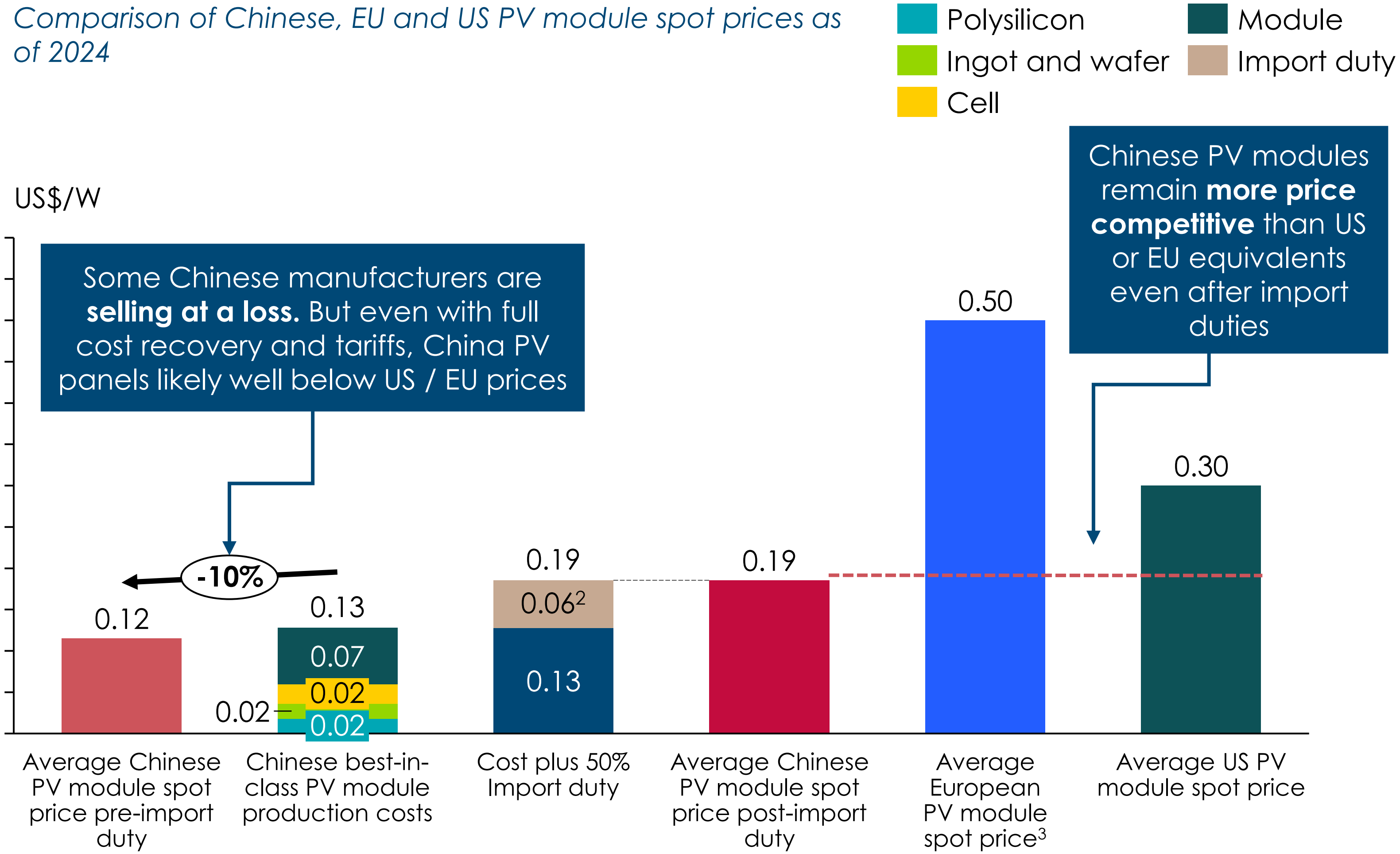
Example: consistent cost reductions have made Chinese PV modules more price competitive than EU or US equivalents even after import duties

Annual average spot price of monocrystalline silicon modules (c-Si) from China[1]



Chinese PV module manufacturers have **divided prices by ~8 over last decade** thanks to technology improvements and economies of scale

Comparison of Chinese, EU and US PV module spot prices as of 2024



Some Chinese manufacturers are **selling at a loss.** But even with full cost recovery and tariffs, China PV panels likely well below US / EU prices

Chinese PV modules remain **more price competitive** than US or EU equivalents even after import duties

Note: [1] Due to lack of China-specific data, BNEF lowest quote spot price data is used as proxy for Chinese manufacturers spot price, reflecting the fact that Chinese manufactures have consistently achieved lowest prices. [2] Assuming an import duty of 40% (highest import duty observed to date in solar industry). [3] Due to limited number of EU- and US-based manufacturers, prices of specific manufacturers are used as proxy for EU and US average PV module prices (First Solar for the US, Meyer Burger for the EU).

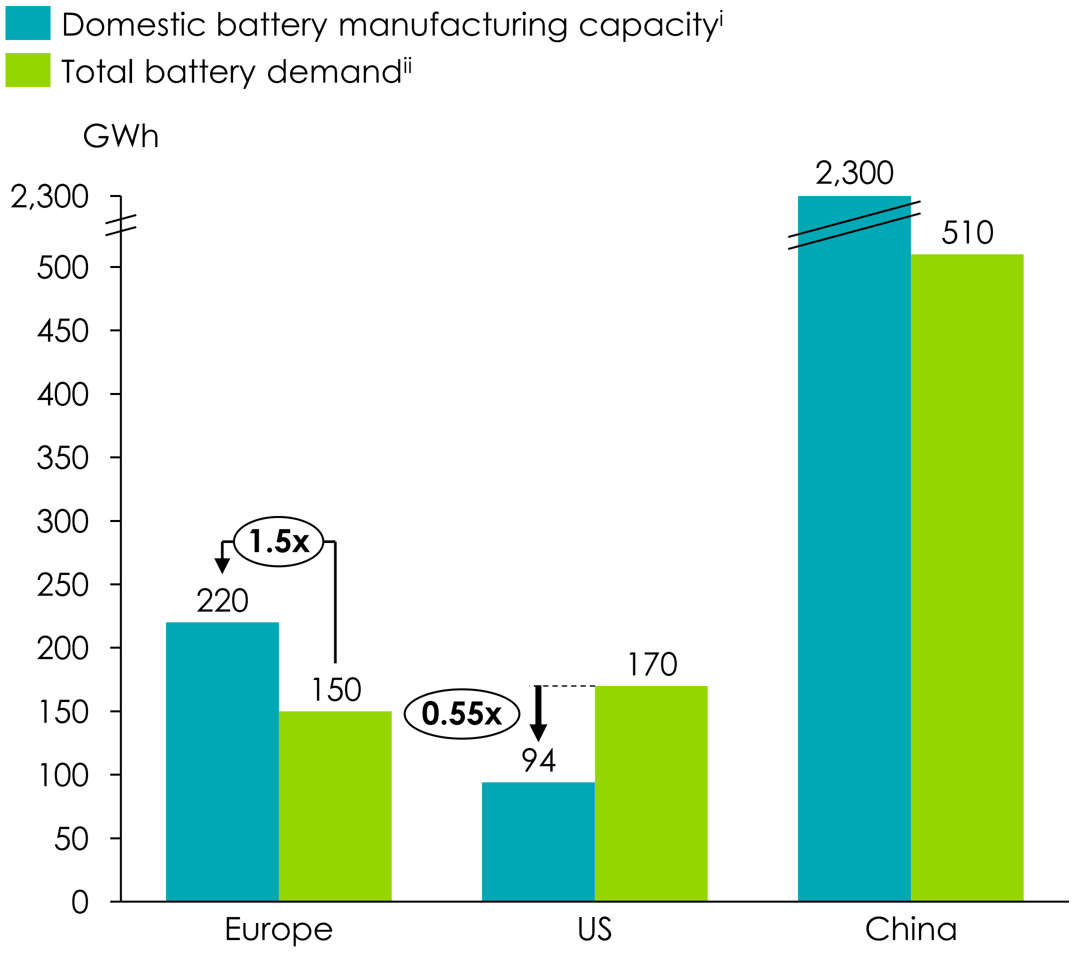
Source: BNEF (2024), *Online Data Explorer: Solar – Spot Price Index*; BNEF (2024), Solar Supply Chain Index, March 2024: Pitched Battle; First Solar (2023) *Annual Report*; BNEF (2024), *EU's Solar Onshoring Goal Hit by Possible German Closure*; InfoLink (2024), *Spot Price*.

3

In contrast, the greater market fragmentation visible today in EV batteries is expected to remain prevalent over the coming years

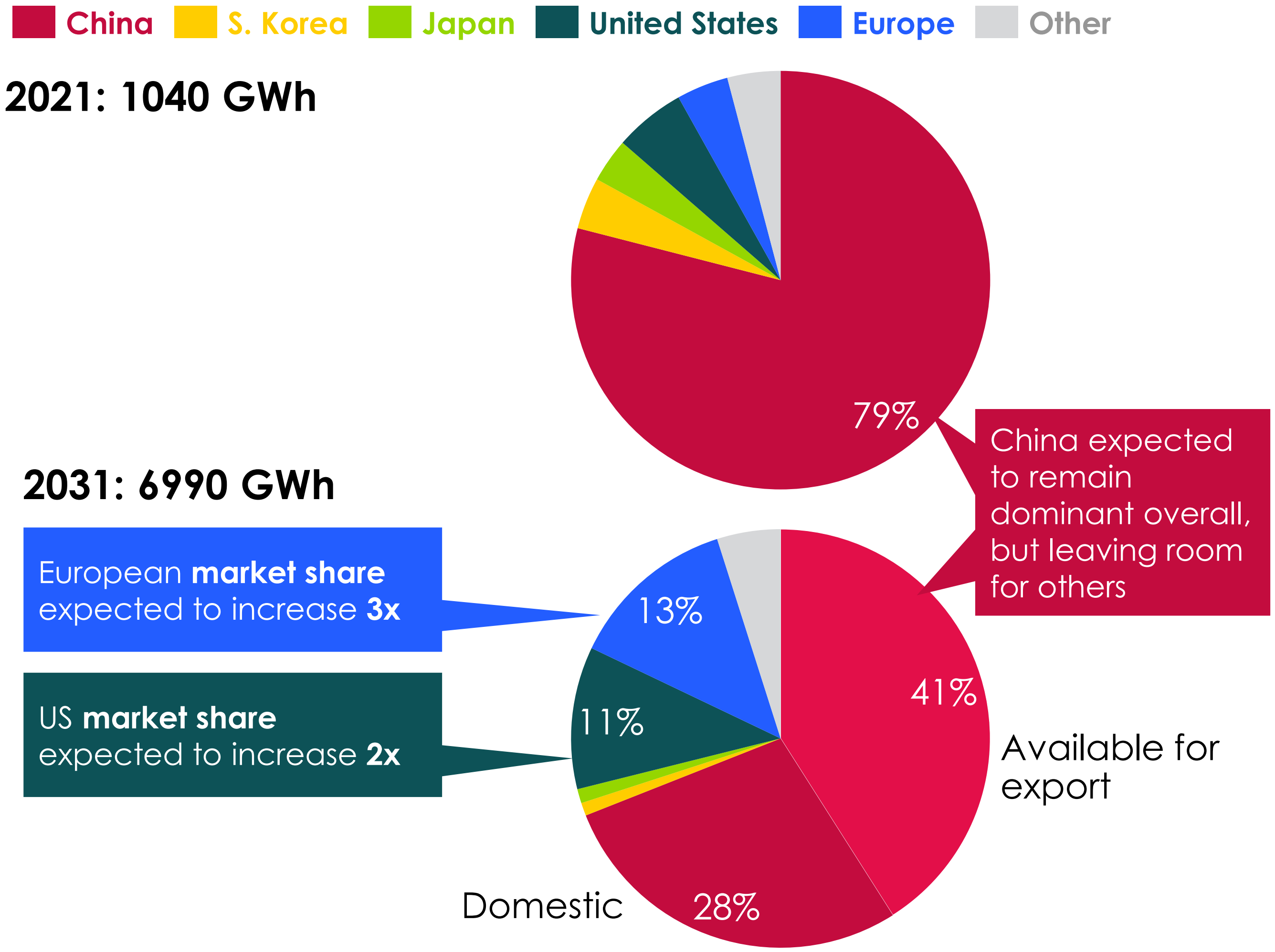
Today, Europe and US are already well placed to meet domestic demand with local production

2023 values



Moving forward, China is expected to remain dominant overall, but Europe and US will gain market share

Country market share of battery production, %



China expected to remain dominant overall, but leaving room for others

European **market share** expected to increase **3x**

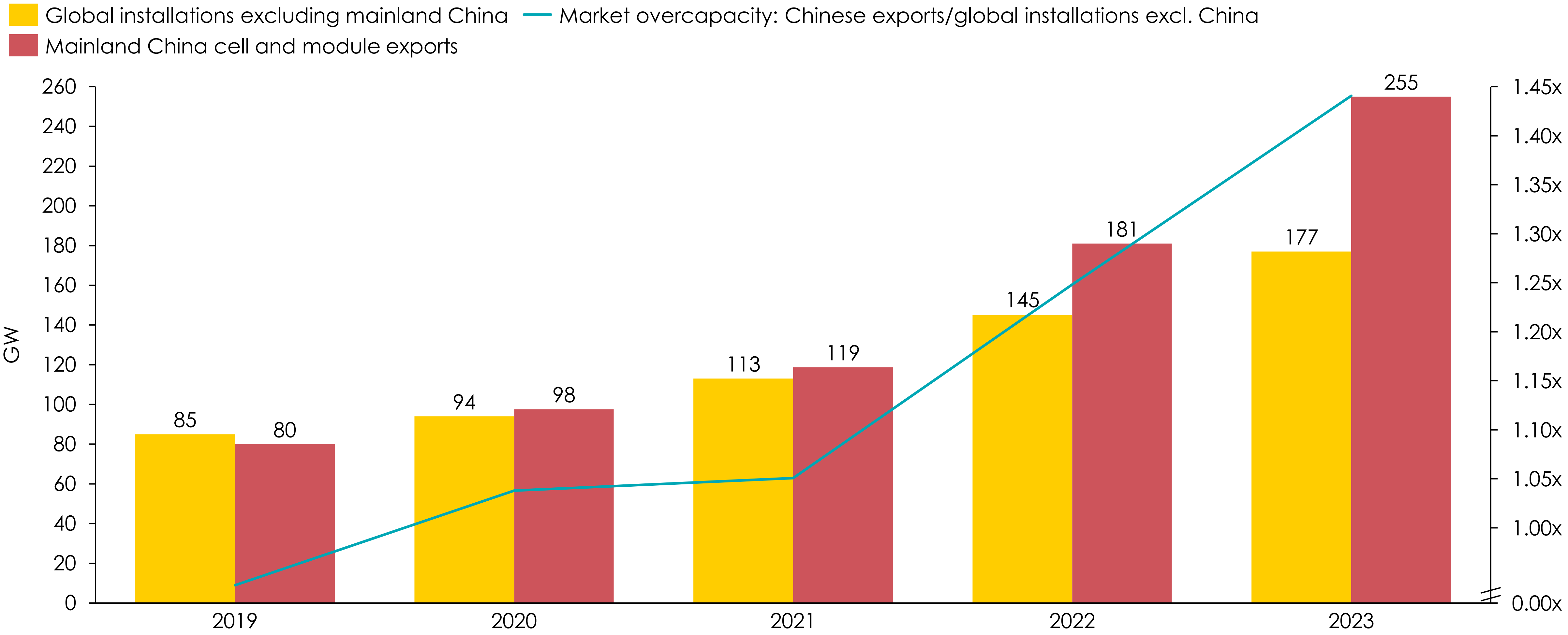
US **market share** expected to increase **2x**

Note: [i] Encompasses capacity of all fully commissioned battery manufacturing plants in designated location. [ii] Encompasses battery demand for passenger vehicles, commercial vehicles, two- and three-wheelers, buses and stationary storage.

Source: BNEF (2023), *Online Data Explorer: Electric Vehicles*; IEA (2022), *Global supply chains of EV batteries*; Benchmark Mineral Intelligence (Aug 2022), *Lithium-ion battery gigafactory assessment*.

Additionally, market overcapacity leaves little to no room for new entrants, with China's export capacity vastly exceeding global demand

Comparison of global solar installations and Chinese cell and module exports,
GW

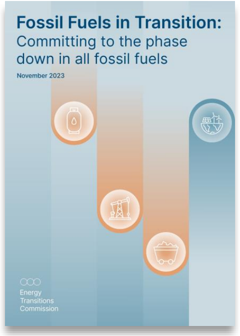


Source: BNEF (2024), *1Q 2024 Global PV Market Outlook*

Q & A

Remaining ETC Webinars for the end of 2024 (UK Time)

07 November 2024	13.00-14.30	**ETC Webinar - Fossil Fuels in Transition: Committing to the phase-down of all fossil fuels**



Fossil Fuels in Transition:
Committing to the phase
down in all fossil fuels
November 2023

Energy
Transitions
Commission

Backup