

CLIMATE ENERGY FINANCE

Tim Buckley, Director

tim@climateenergyfinance.org

Xuyang Dong, CEF China Policy

xuyang@climateenergyfinance.org

www.climateenergyfinance.org

The global energy transformation and China's growing dominance of solar and storage manufacturing, technology and deployments

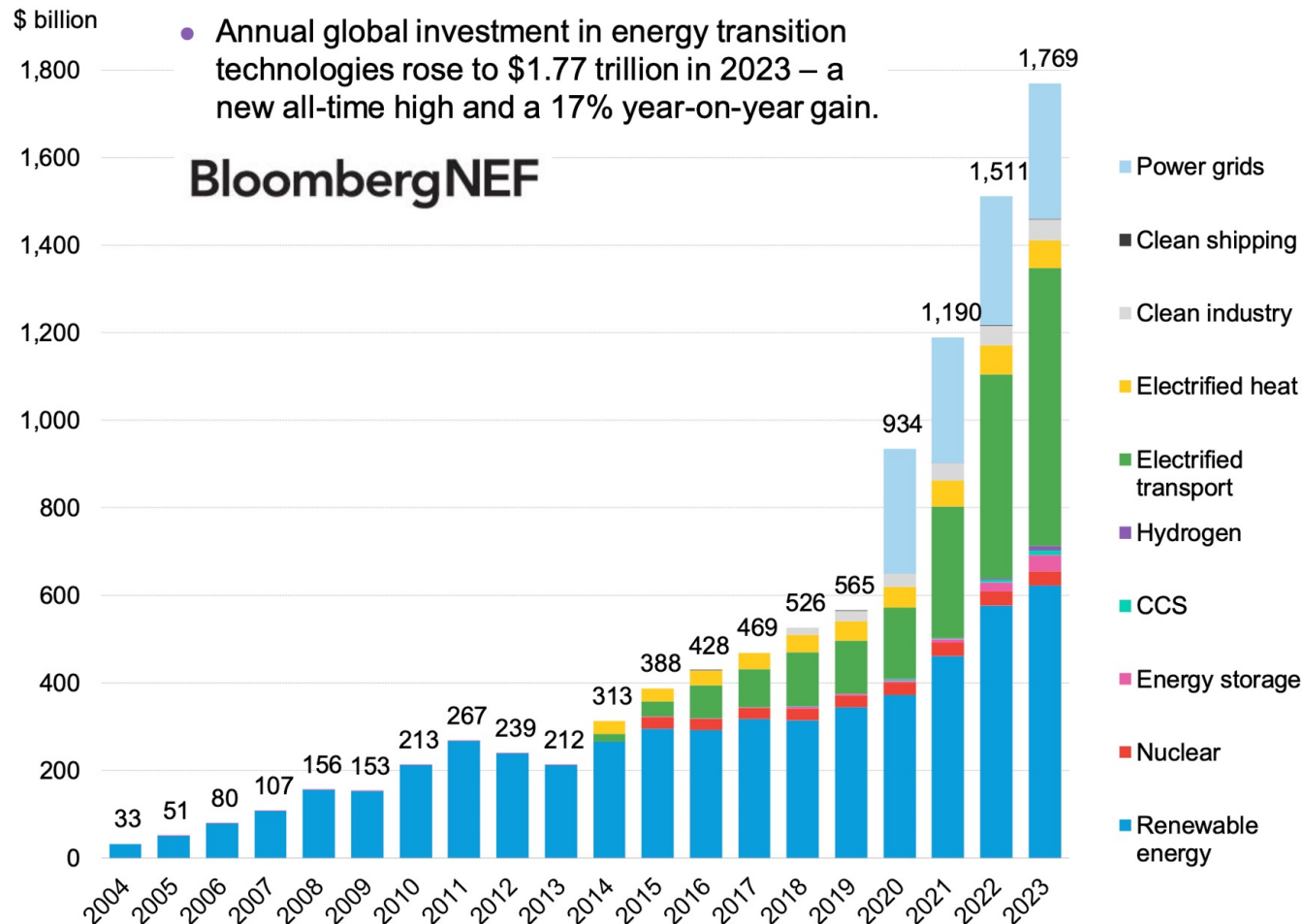
Smart Energy Council

4pm 3 June 2024

1. The Global Energy Transition

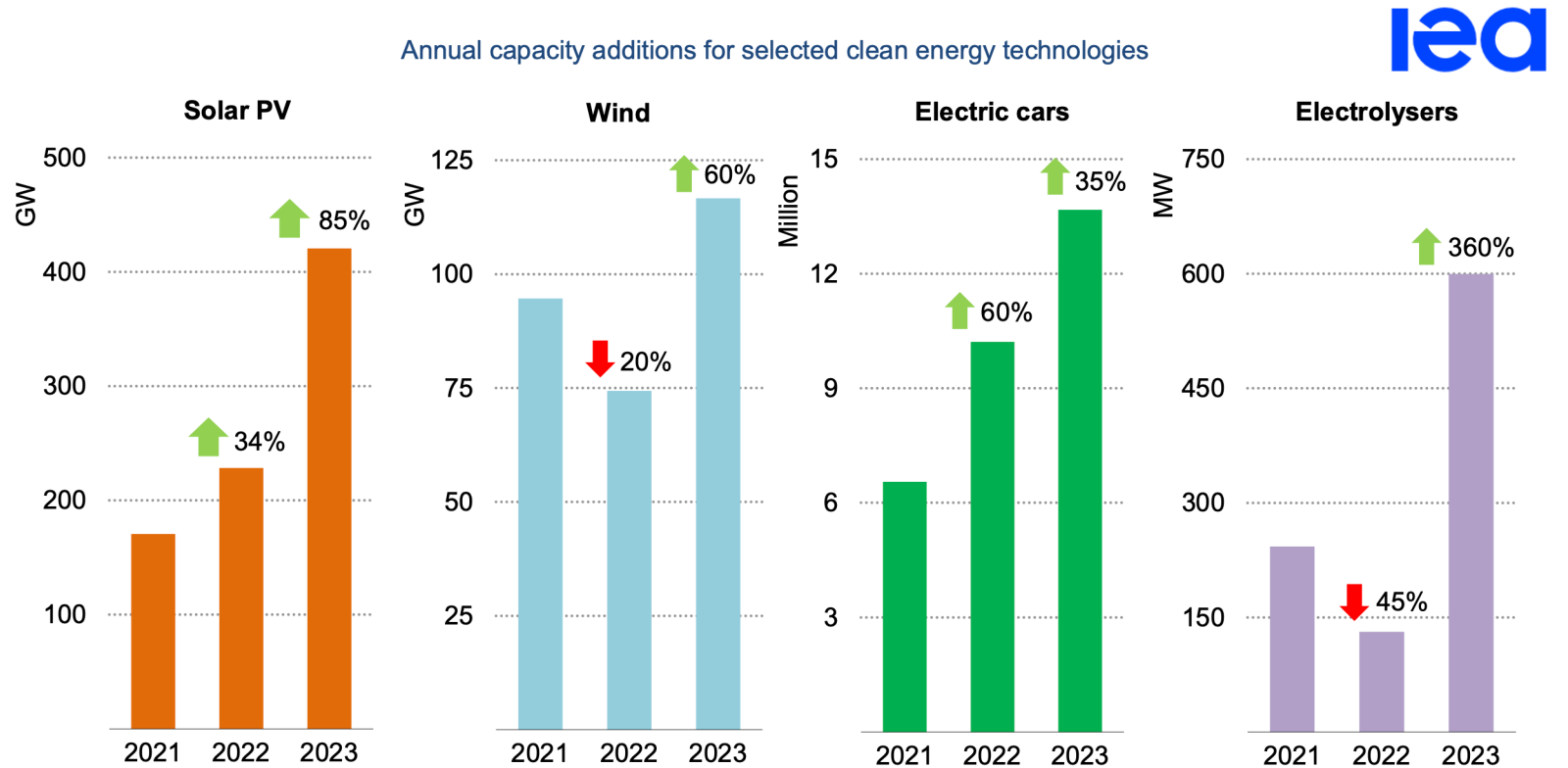
Increases across almost all categories push anticipated spending in 2023 up to a record US\$1.77 trillion, +17% yoy

Global investment in energy transition, by sector



1. The Global Energy Transition

Global Investment to 2023

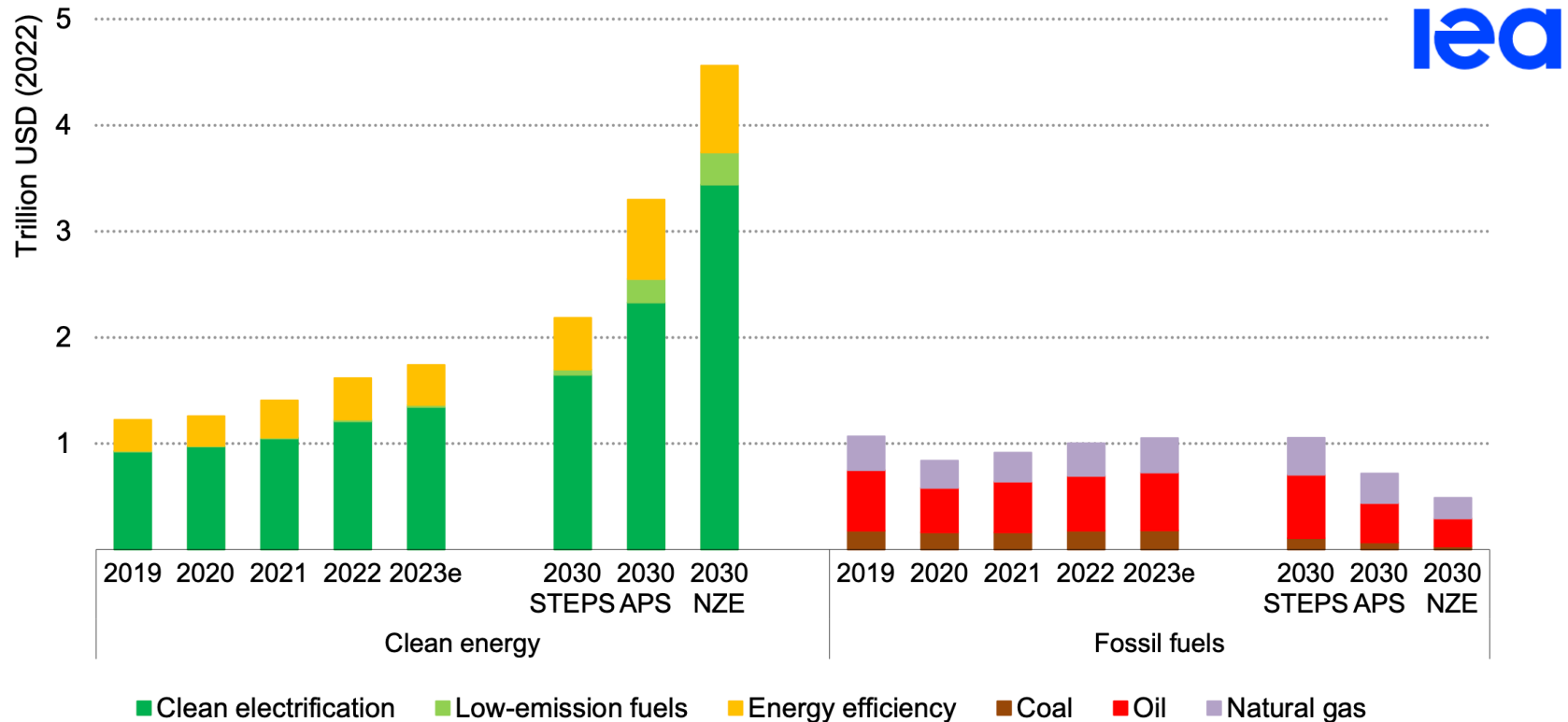


Sources: IEA (2024), [Clean Energy Market Monitor – March 2024](#), and IEA (2024), [Global EV Outlook 2024](#).

IEA. CC BY 4.0.

1. The Global Energy Transition

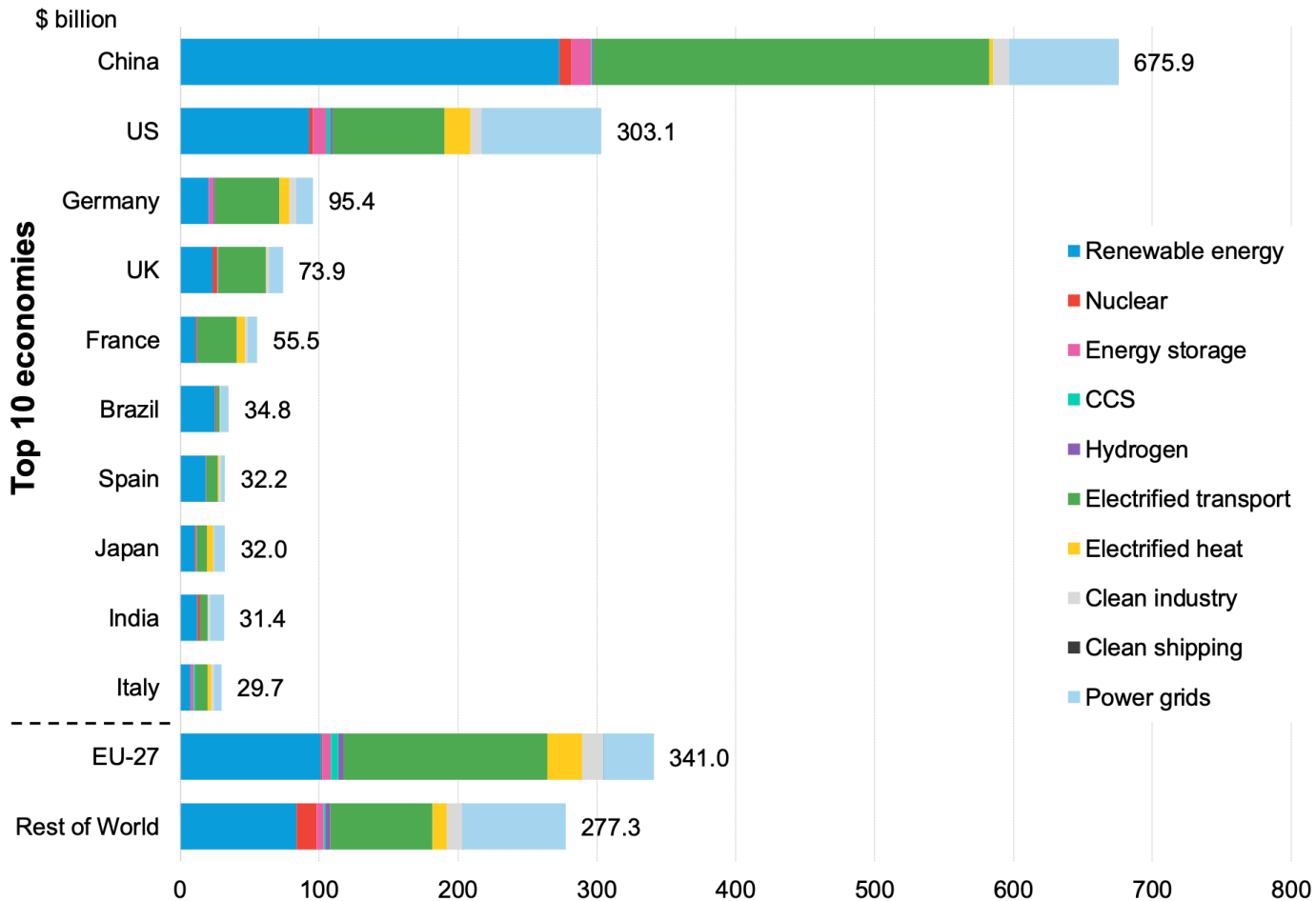
Global Investment Needed by 2030



Notes: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario.

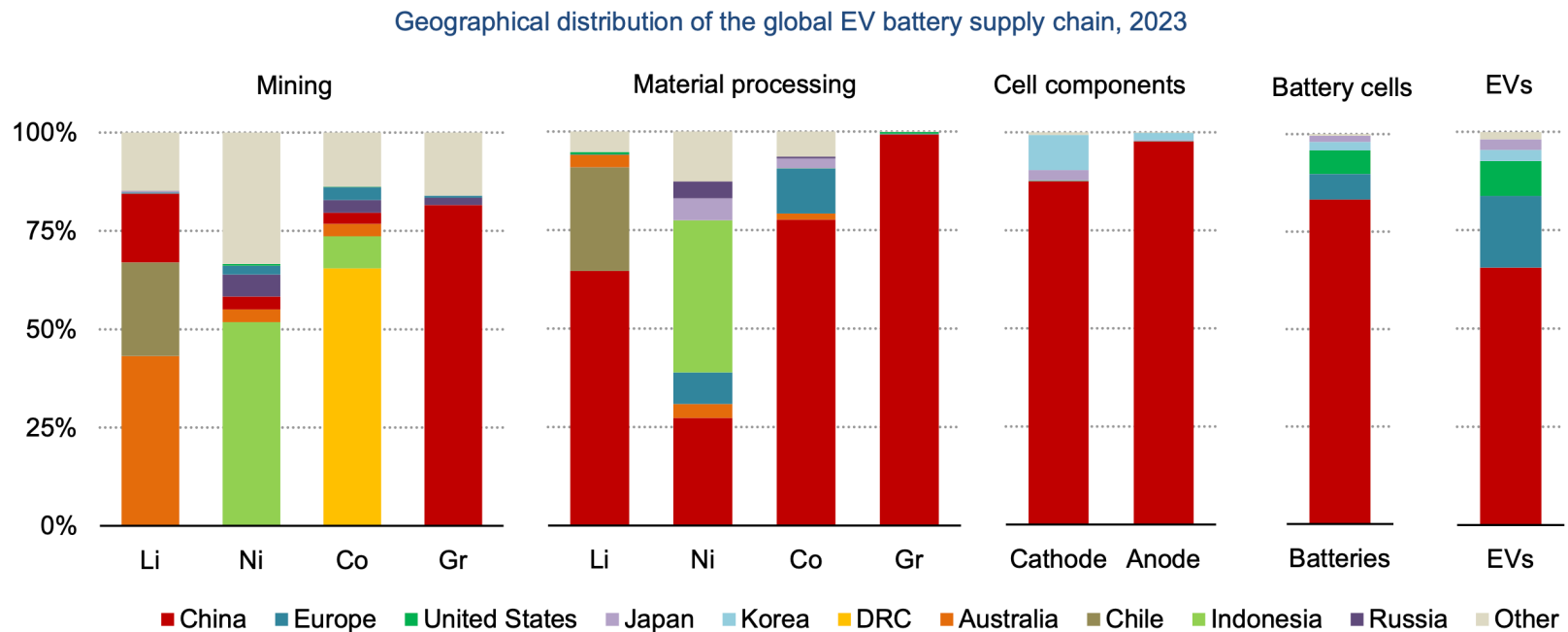
2. China Leads the World in Cleantech Investing

Top 10 economies for 2023 energy transition investment, plus the EU-27 and rest of the world



2. China Dominates Battery Manufacturing

China dominates the entire global battery-EV supply chain

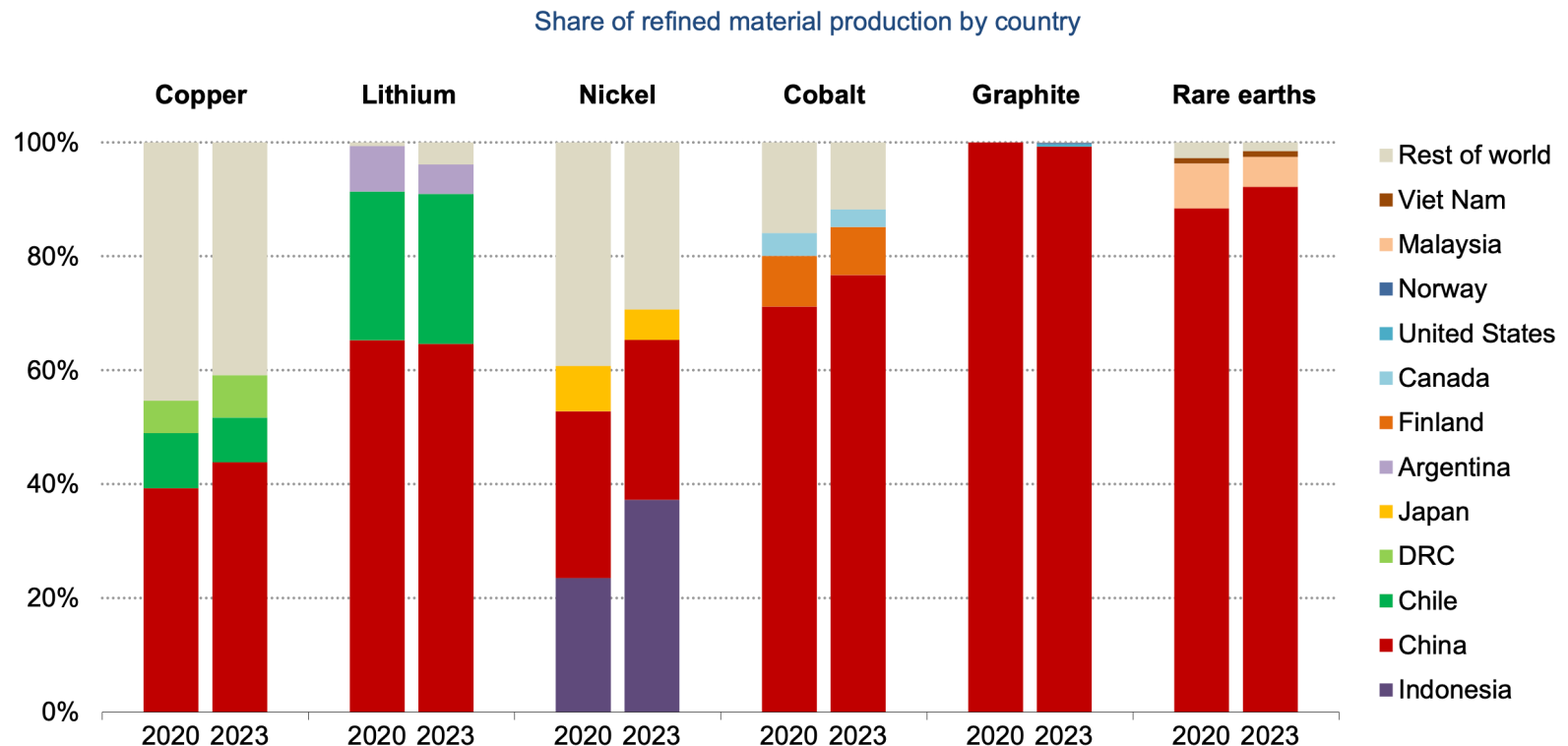


Source: IEA Critical Minerals Outlook Report May 2024

2. China Dominates Battery Manufacturing

China market control has increased further since 2020

The level of geographical concentration for refined products has increased in recent years

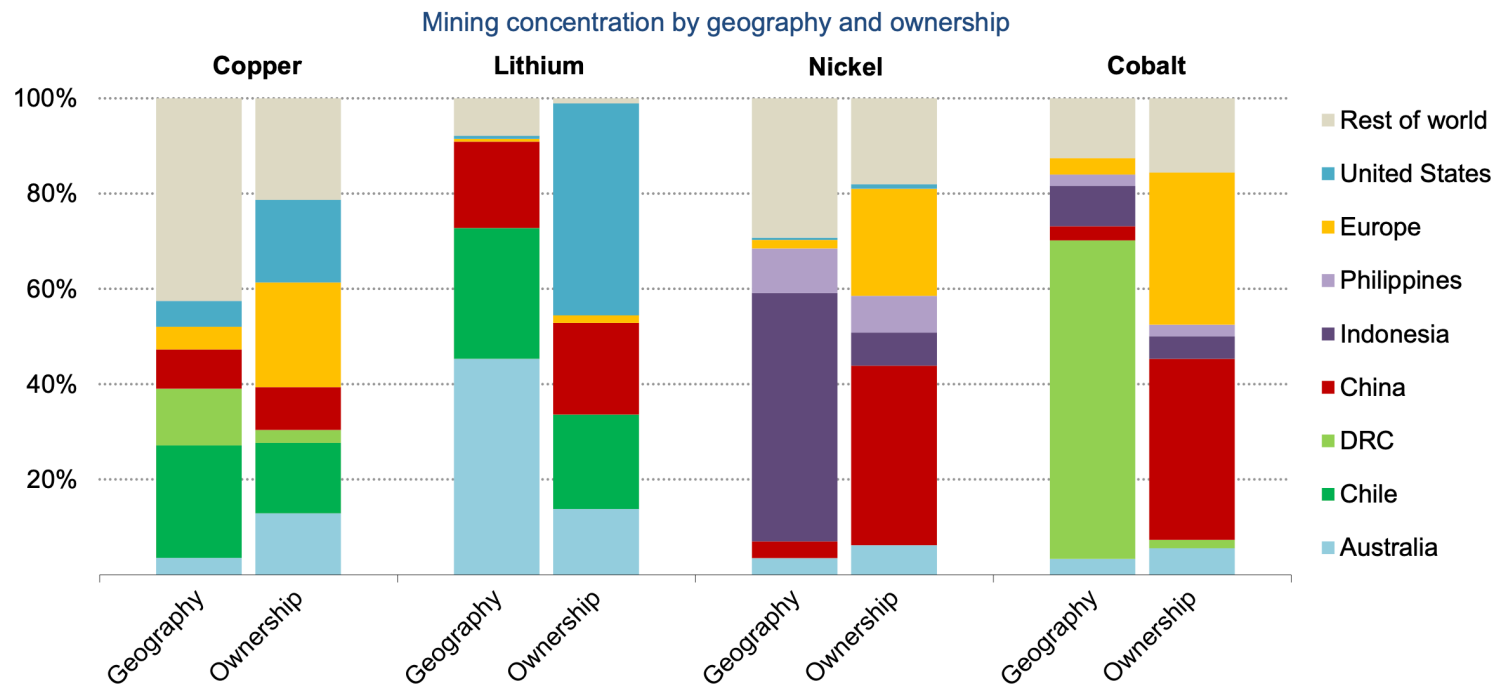


Source: IEA Critical Minerals Outlook Report May 2024

2. China Dominates Battery Manufacturing

China market ownership is much lower than control

Mining concentration looks different if viewed through the lens of asset ownership, with US and European companies playing a greater role

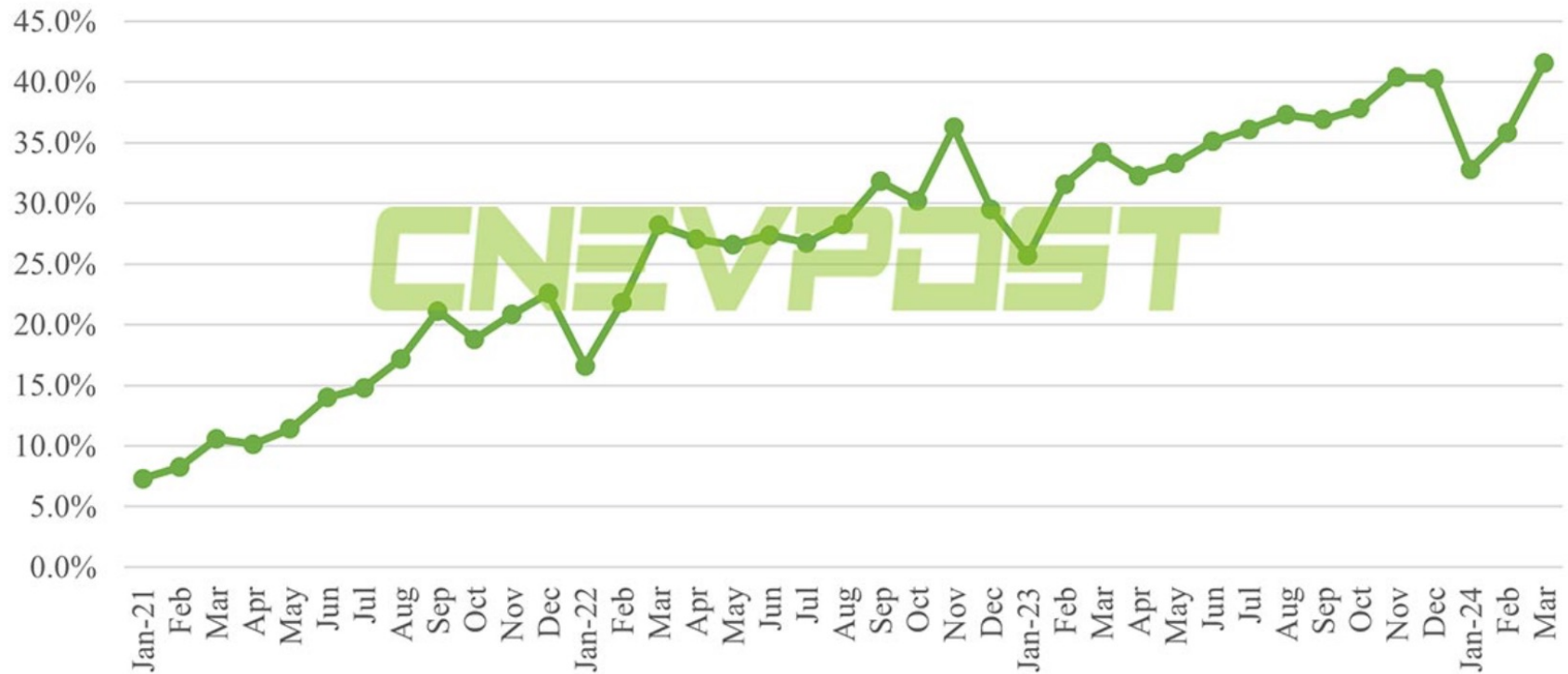


Source: IEA Critical Minerals Outlook Report May 2024

2. China's Rising New Energy Vehicle Penetration

Passenger NEVs in China totalled 709,000 units in March 2024, +29.5% yoy, penetration reaches record 41.6%

China passenger NEV penetration at retail



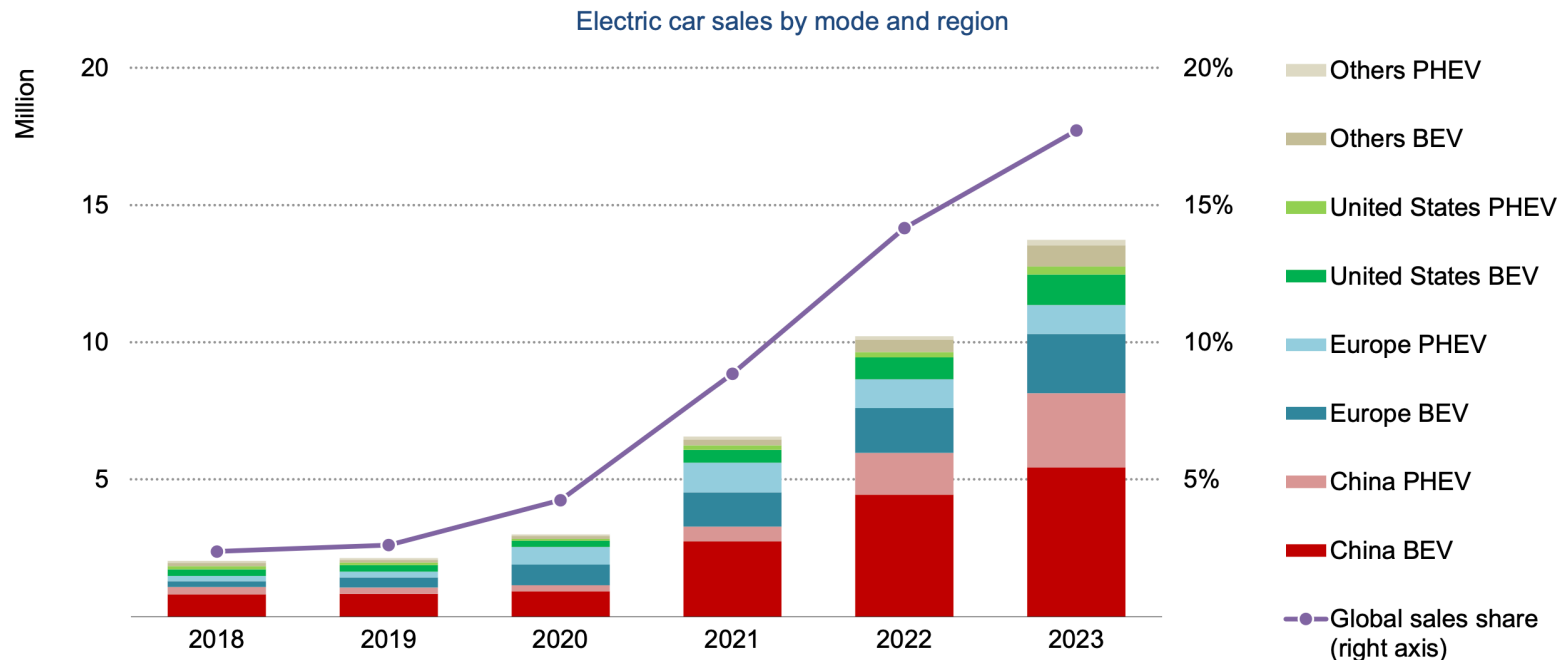
Source: CPCA

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China Leads the World in EVs

Passenger NEVs in China totalled 709,000 units in March 2024, +29.5% yoy, penetration reaches record 41.6%

The growth story continued in 2023 for EVs



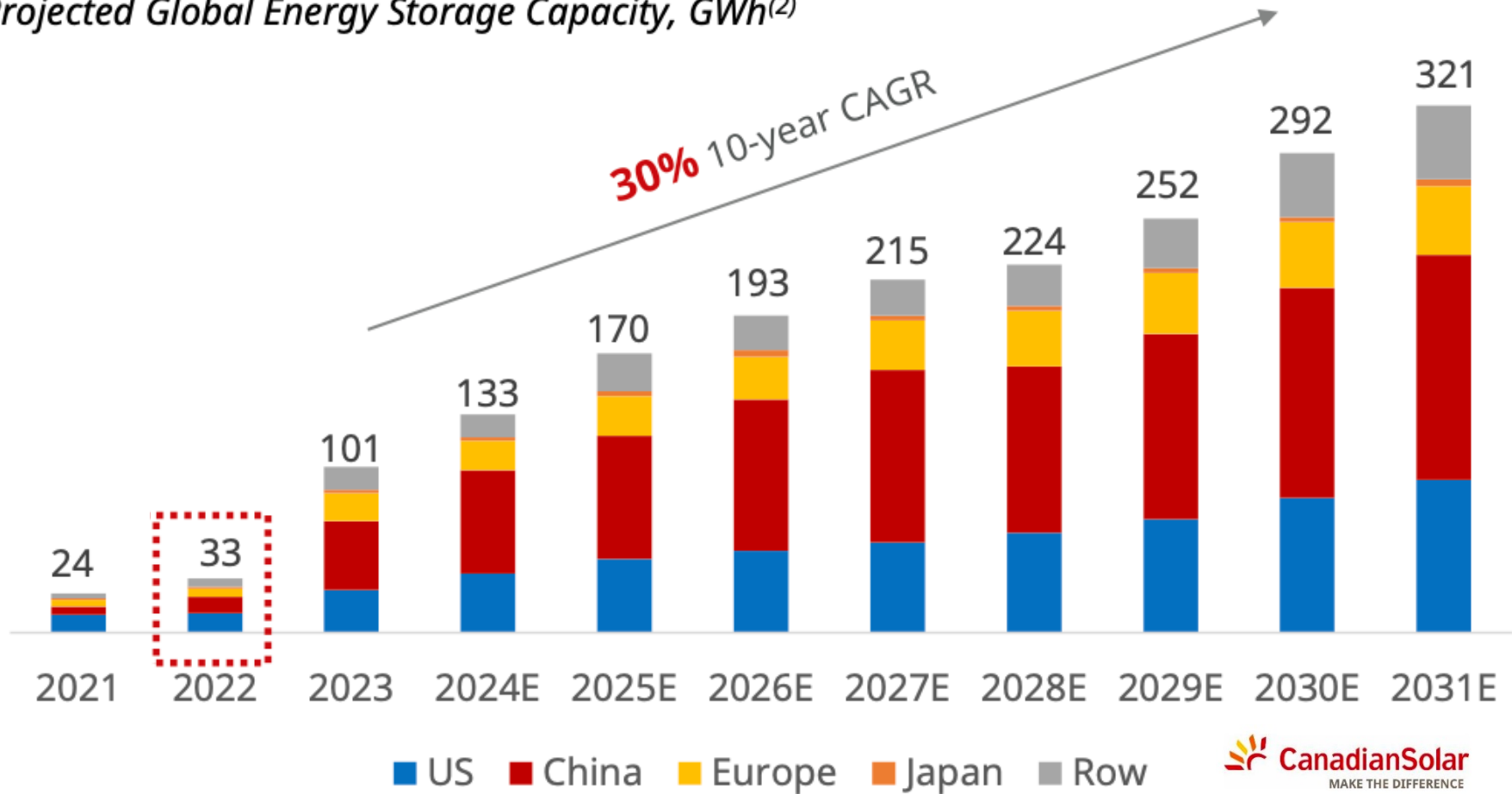
IEA. CC BY 4.0.

Note: BEV = Battery electric vehicle; PHEV = Plug-in hybrid electric vehicle.

Source: IEA (2024), [Global EV Outlook 2024](#).

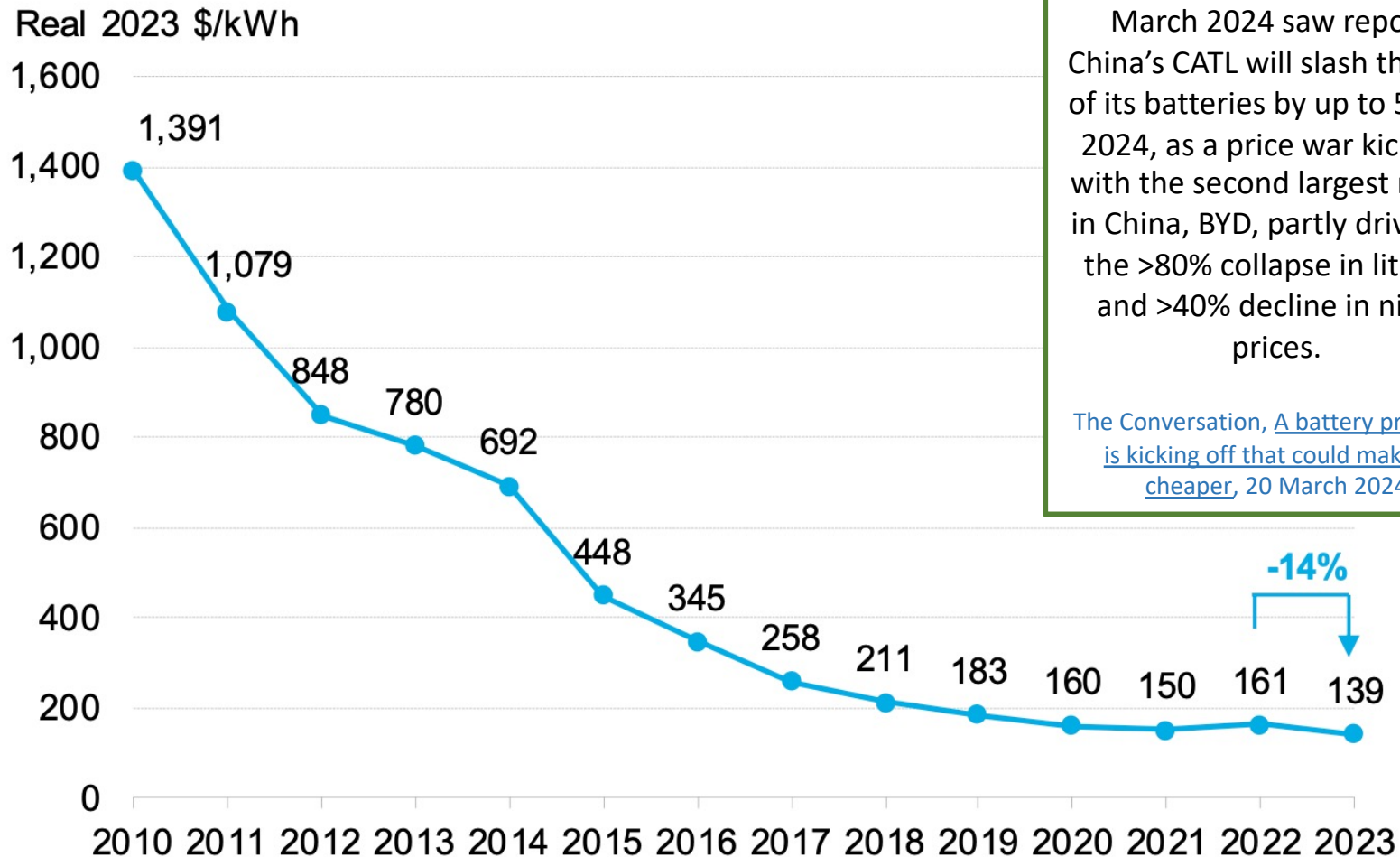
3. Global BESS installations are set to boom

Projected Global Energy Storage Capacity, GWh⁽²⁾



3. BESS Deflation

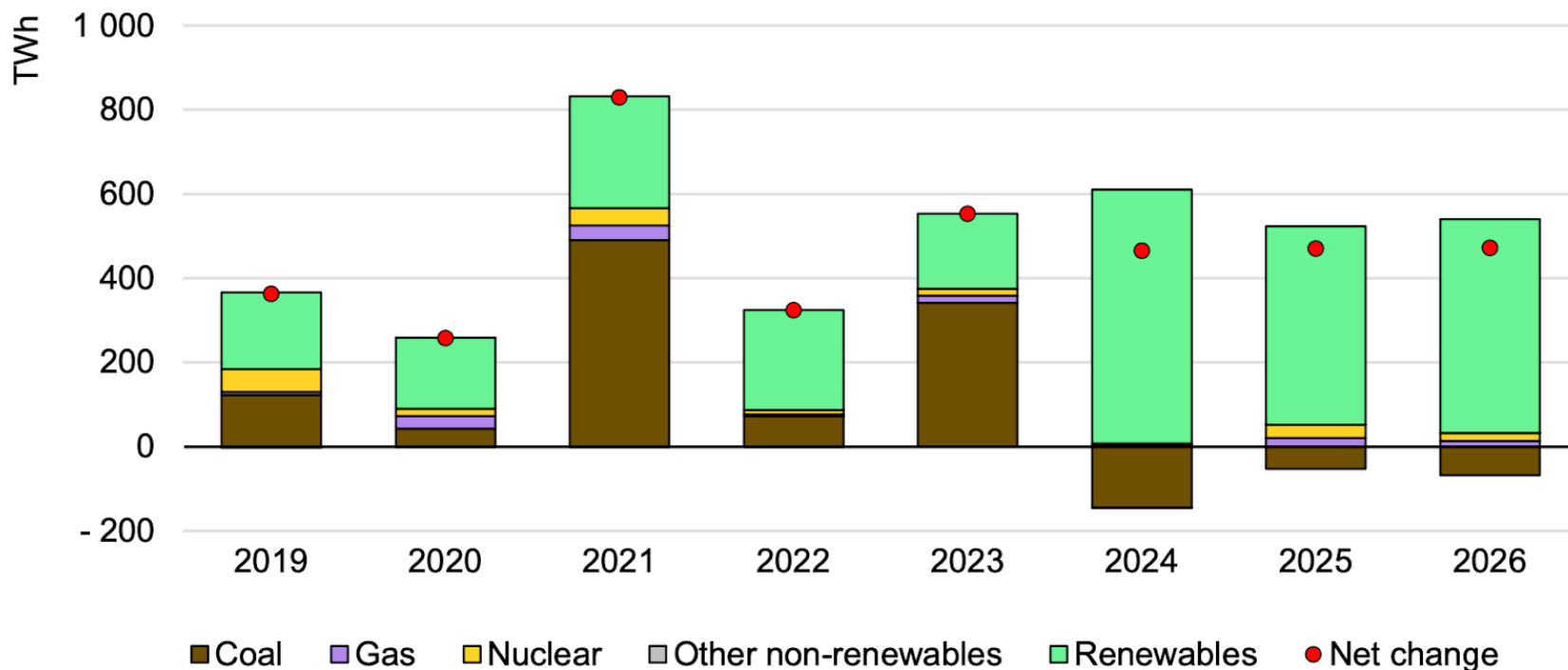
Volume-weighted average lithium-ion battery pack price



Source: BloombergNEF. Note: Historical figures have been adjusted to real 2023 dollars.

4. China's Electricity Generation Mix

Year on year change, TWh, 2019-2026

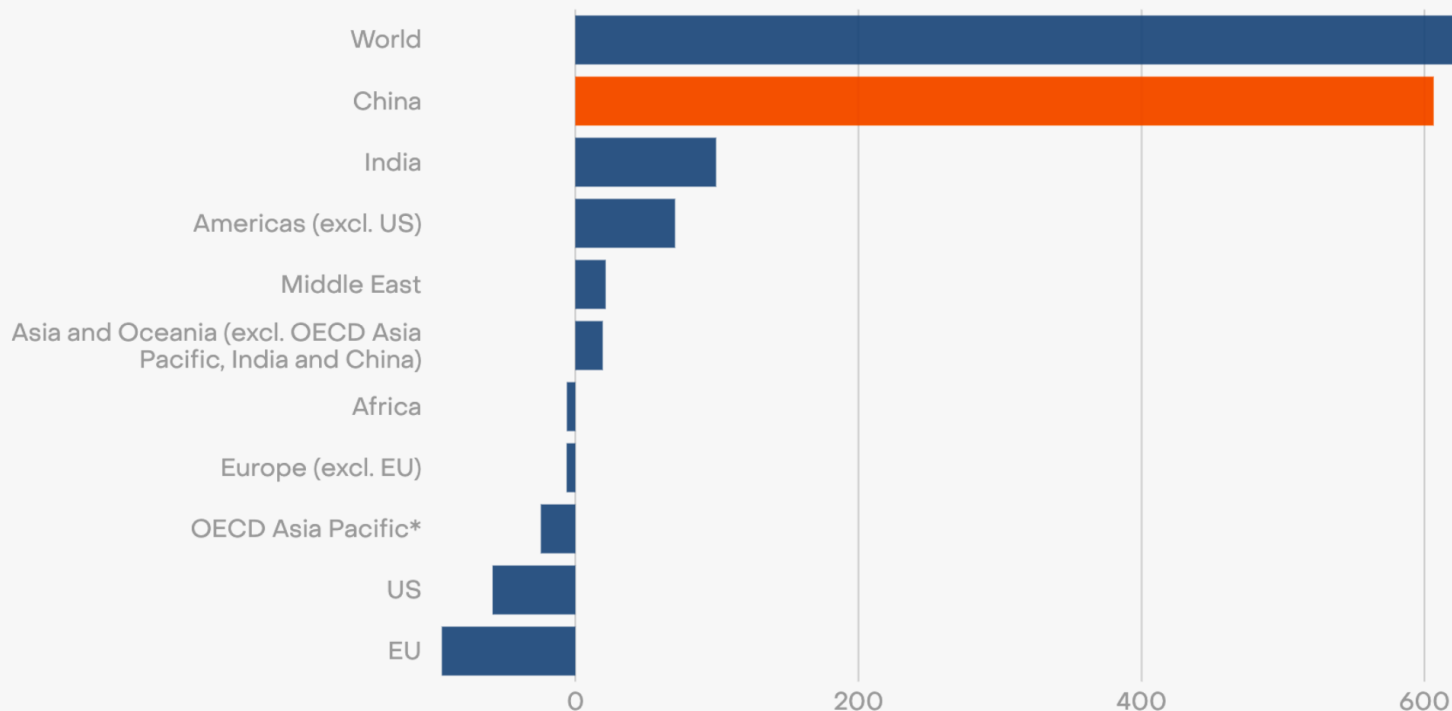


4. China Drives Global Electricity Markets

Year on year change, TWh, 2023

China was the main driver of global electricity demand growth, while the EU and US saw sharp falls

Change in electricity demand in 2023 (TWh)



Source: Annual electricity data, Ember
*South Korea, Japan, Australia and New Zealand

EMBER

Source: Ember 2024 <https://ember-climate.org/insights/research/global-electricity-review-2024/>

4. China is installed 24GW per month of RE

CY2023 Capacity Installs was a Global Gamechanger, +99% yoy

New Capacity Installed in China in Jan-Dec 2023

		Jan-Dec 2023	Share of new adds (%)	Change (yoy %)	Dec-23	Share of new adds (%)
Thermal Power	GW	57.9	16%	30%	11.5	12%
Hydropower	GW	8.0	2%	-66%	0.2	0%
Nuclear Power	GW	1.4	0%	-77%	0.2	0%
Wind Power	GW	75.9	21%	102%	28.5	31%
Solar Power	GW	216.9	60%	148%	51.9	56%
Total capacity added	GW	360.1	100%	78%	92.2	100%
Variable Renewable adds	GW	292.8	81%	99%	80.4	87%
Zero Emissions Capacity Adds	GW	302.2	84%	92%	80.7	88%

Source: NBS, CEF Estimates

4. China is installing 20GW per month of RE

Momentum in CY2024 Has Slowed, but still Positive, +21% yoy

New Capacity Installed in China in Jan-April 2024

		Jan-April 2024	Share of new adds (%)	Change (yoy %)	Apr-23	Share of new adds (%)
Thermal Power	GW	9.2	10%	-28%	2.8	14%
Hydropower	GW	2.7	3%	-24%	0.9	5%
Nuclear Power	GW	-	0%	-100%	0.0	0%
Wind Power	GW	16.8	19%	19%	1.3	7%
Solar Power	GW	60.1	68%	24%	14.4	74%
Total capacity added	GW	88.8	100%	11%	19.4	100%
Renewable Energy adds	GW	79.7	90%	21%	16.6	86%
Zero Emissions Capacity Adds	GW	79.7	90%	18%	16.6	86%

Source: NBS, CEF Estimates

4. China is installing 20GW per month of RE

Generation is very different to capacity

China's Electricity Generation Mix in Jan-Apr 2024

		Jan-Apr 2024	Share of Generation	Change (y-o-y %)	Apr-24	Change (y-o-y %)
Hydropower	TWh	294	10%	8.4%	84	22.1%
Thermal Power	TWh	2,062	70%	5.9%	458	1.9%
Nuclear Power	TWh	141	5%	1.9%	37	6.0%
Wind Power	TWh	325	11%	11.7%	81	-2.6%
Solar Power	TWh	111	4%	31.7%	31	36.0%
Total Power Generation	TWh	2,933	100%	7.4%	690	4.8%
Variable Renewable Generation	TWh	437	15%	16.2%	112	5.8%
Zero Emissions Power Generation	TWh	871	30%	11.0%	607	11.1%

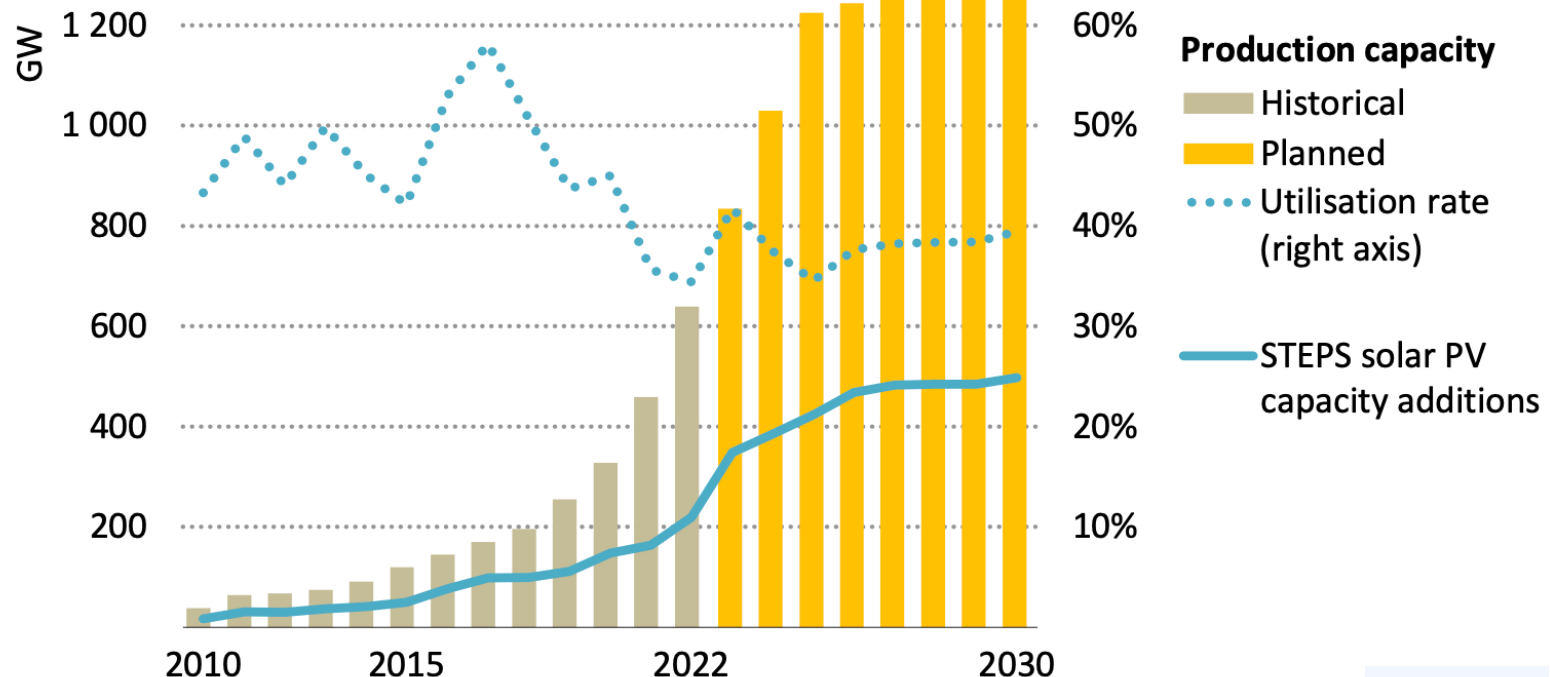
Source: NBS, CEF Estimates

China's reported generation excludes distributed solar & wind (<30MW); capacity includes this

5. China Dominates Solar

Solar Growth is Accelerating, Globally. BNEF forecasts 392GW in 2023, +56% yoy, and module prices of US\$0.145c/w by end 2023.

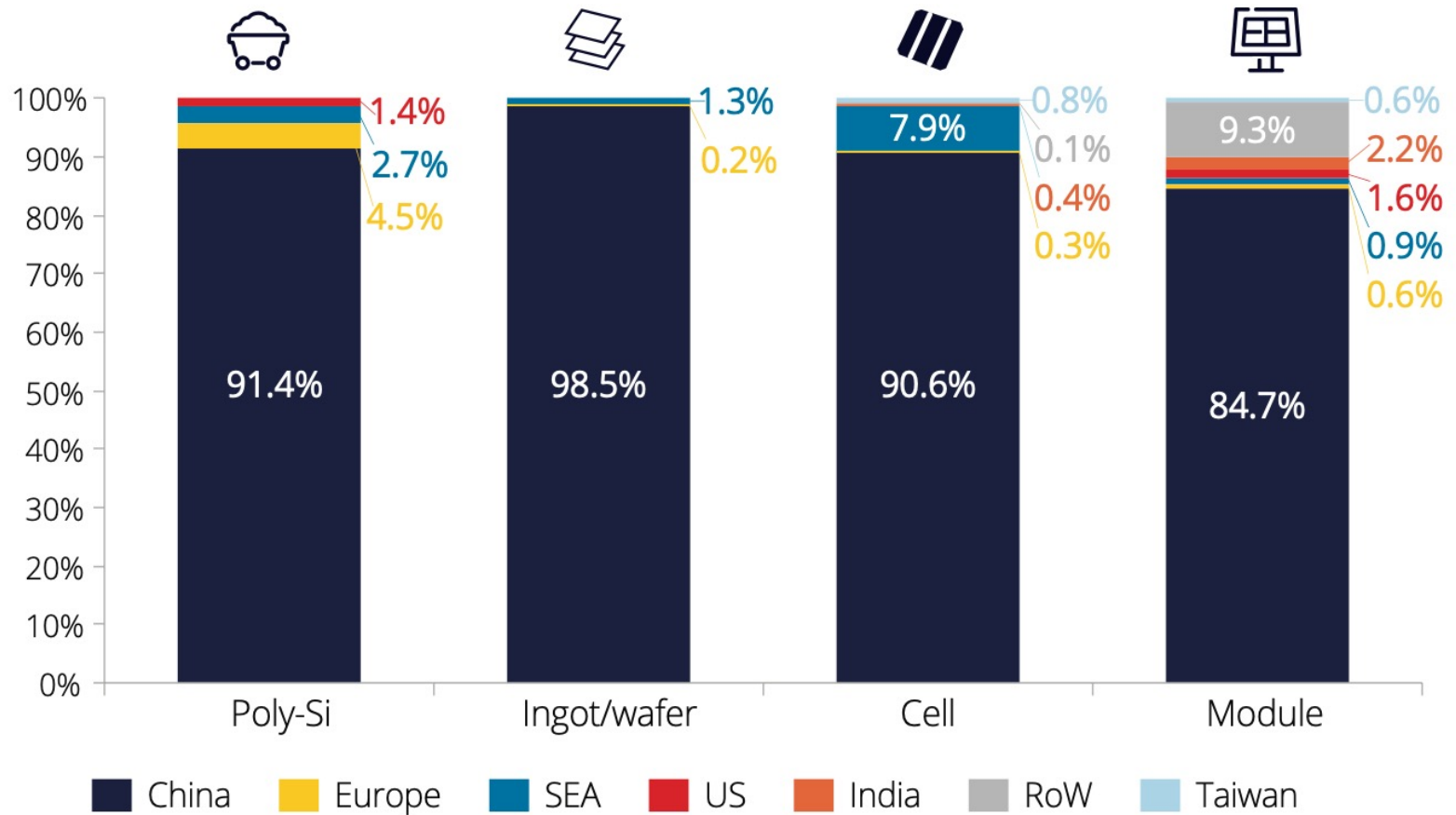
Figure 1.10 ▶ Global solar module manufacturing and solar PV capacity additions in the STEPS, 2010-2030



Planned expansion of solar manufacturing outpaces solar PV capacity additions to 2030; its low utilisation rate presents a huge opportunity to accelerate clean energy transitions

5. China's Solar Manufacturing Dominance

Market share in 2023 global PV manufacturing production⁴



5. Australia's Silicon 2 Solar Roadmap

Projected annual solar PV demand in Australia¹

Collaboration with China is key for Australia

June 2023 installed capacity:
(residential and utility)

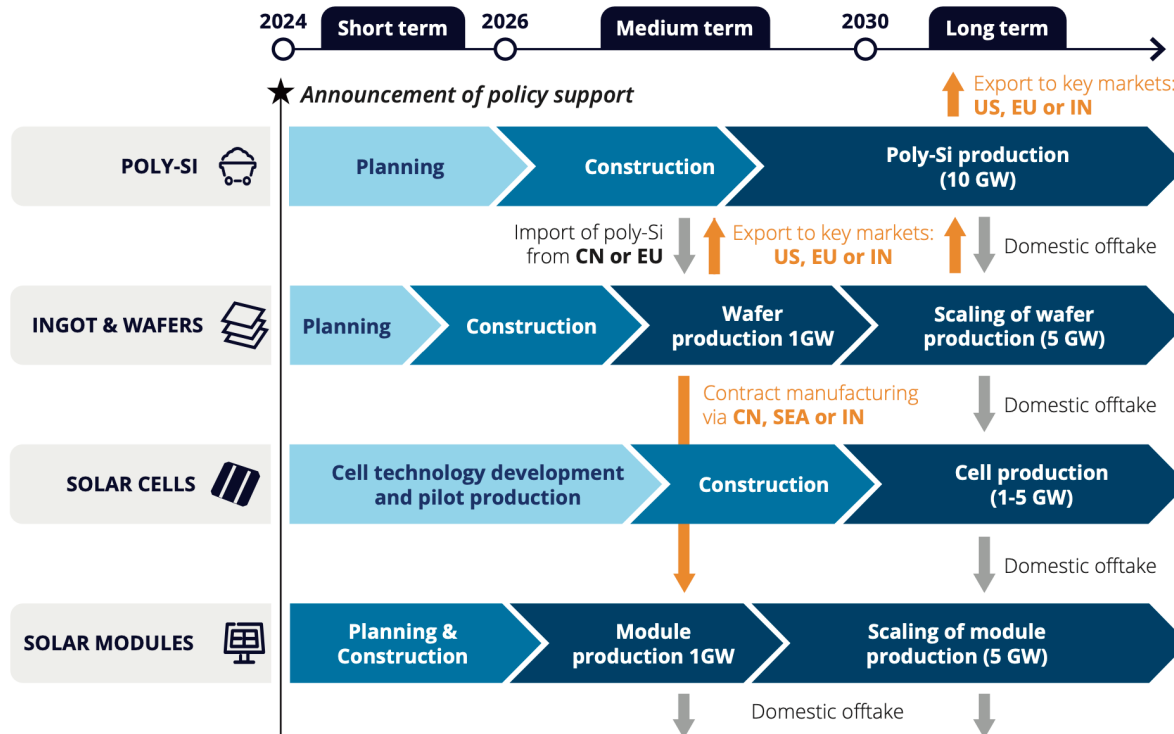
32 GW

AEMO ISP baseline forecasts:
(Range: Step Change – Hydrogen Superpower)

5 – 15 GW
per annum

Alternative ambitious forecasts:
(Range: ARENA Ultra low-cost solar whitepaper – Net Zero Australia)

37 – 70 GW
per annum



Priority considerations

At the poly-Si step, Australia can be part of a globally diversified supply chain exporting particularly to the rapidly growing US and EU markets. Australia would export energy-intensive value-added products and have direct control over poly-Si for the needs of the domestic solar market.

Ingot & wafer manufacturing addresses the most concentrated step in the solar value chain. Australian wafers can be exported to the US, EU and other regions. Contract manufacturing overseas could enable domestically produced wafers to be used in local solar systems in the medium term.

Rapid development of **cell technology** and large capacity scale up present a challenge to setting up viable cell production domestically. Australia's strong track record in cell research could lead to cutting-edge production, however, R&D, prototyping and pilot lines require additional time.

Module production represents a "low-hanging fruit" option due to the relatively small upfront investment and government support needed. However, building globally competitive module production is challenging and Australian modules would be for the domestic market only.