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**Uni of NSW
SPREE Seminar
TETB LG07**

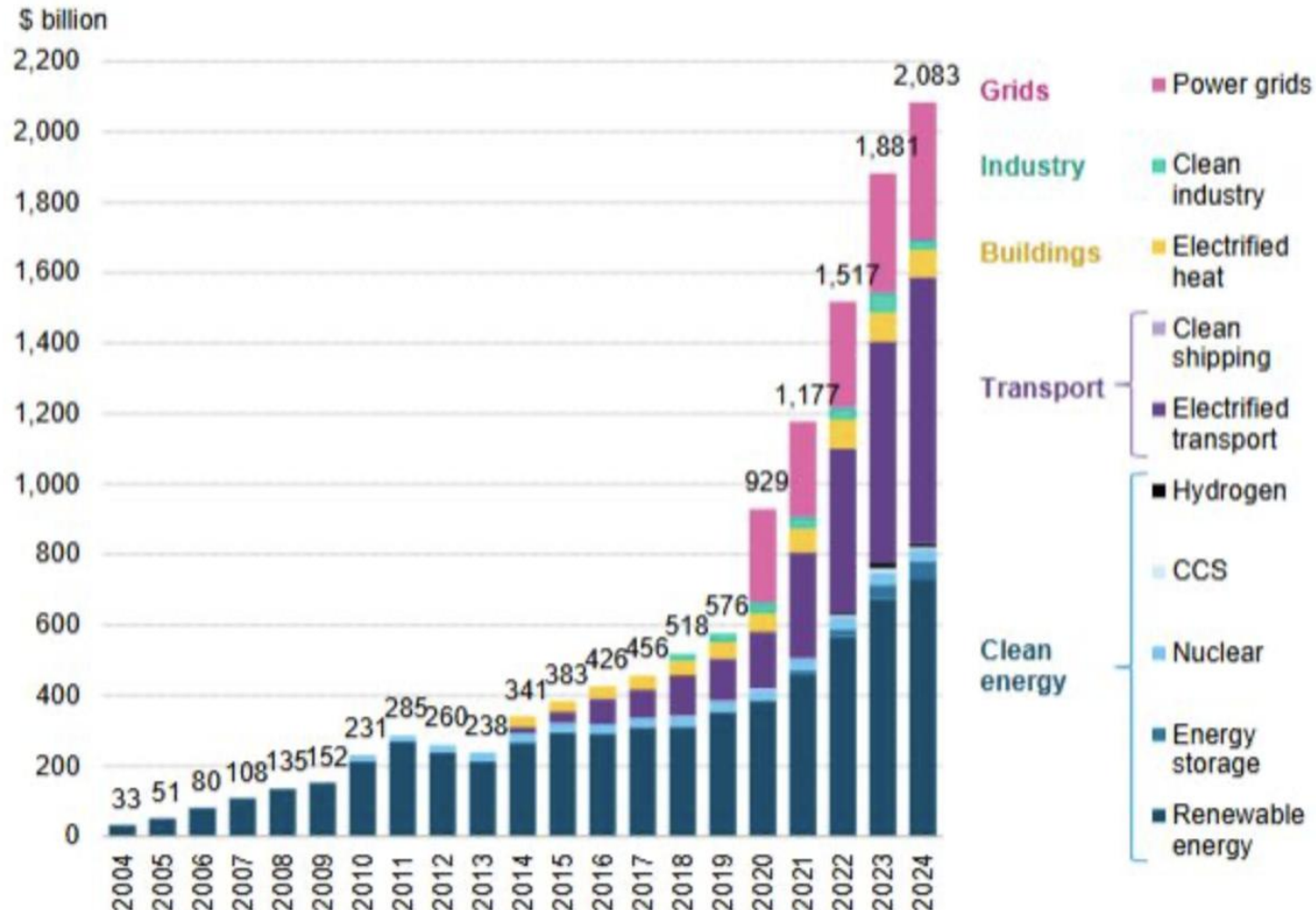
**The China led global
energy system
transformation Leveraging
Solar + BESS**

3 April 2025

China's Cleantech Manufacturing Dominance

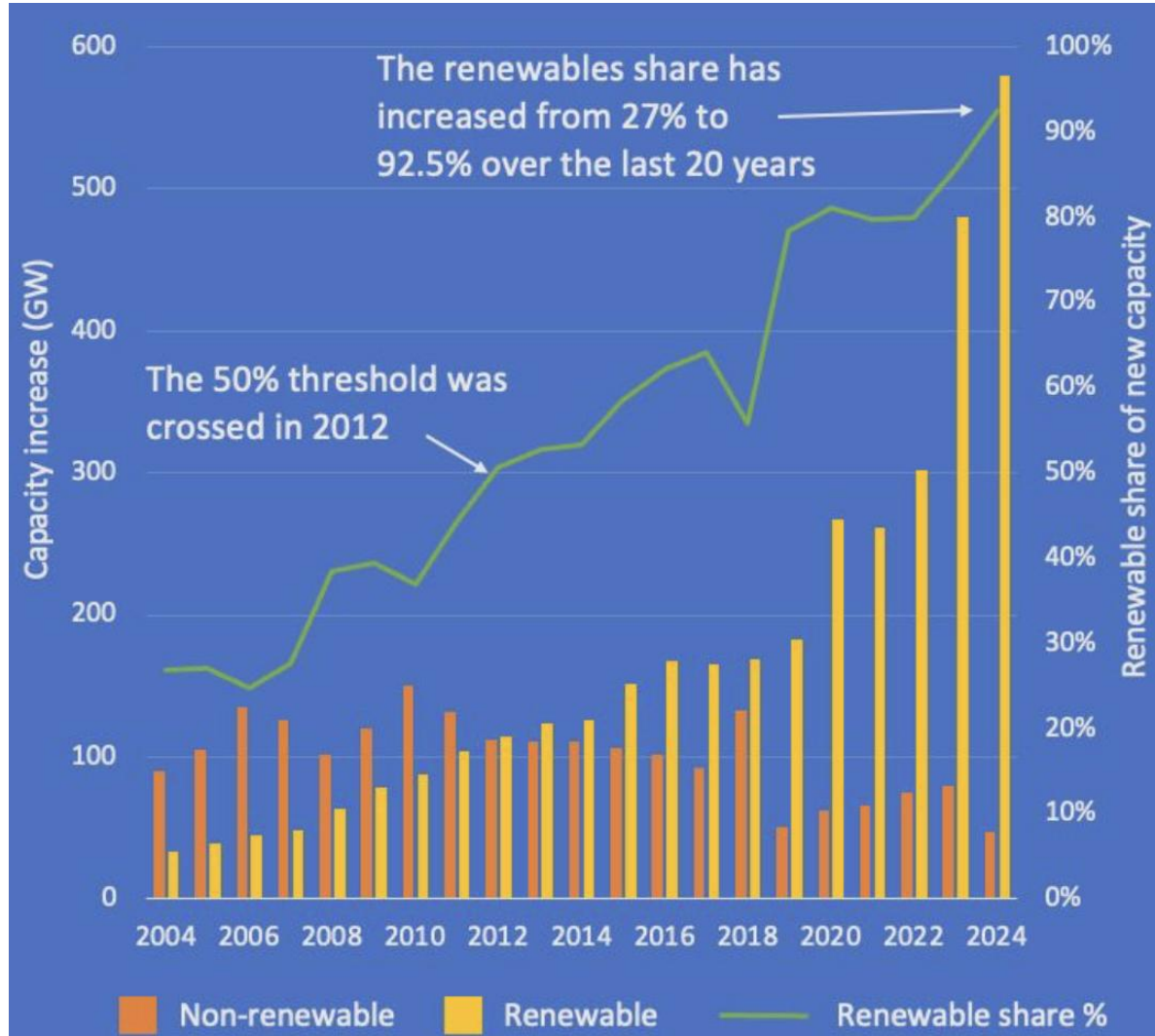
The world invested US\$2.1 trillion in cleantech in 2024, +11% yoy

Global investment in energy transition, by sector



Renewables in Electricity

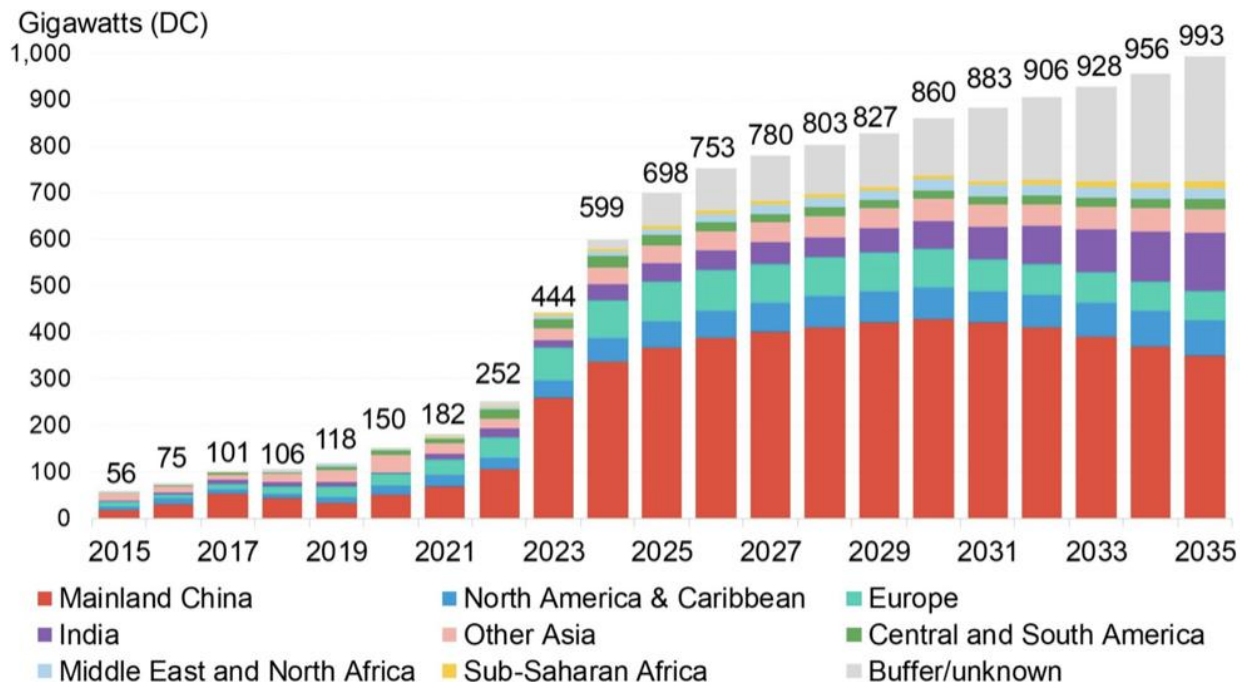
Renewables made up 92.5% of total global capacity added in 2024



Renewables in Electricity

Ongoing deflation & technology improvements in solar + BESS enables the solar boom to continue

PV installations, historical and forecast



Source: BloombergNEF. Note: Full data in BNEF's Capacity tool ([web](#) | [terminal](#)).

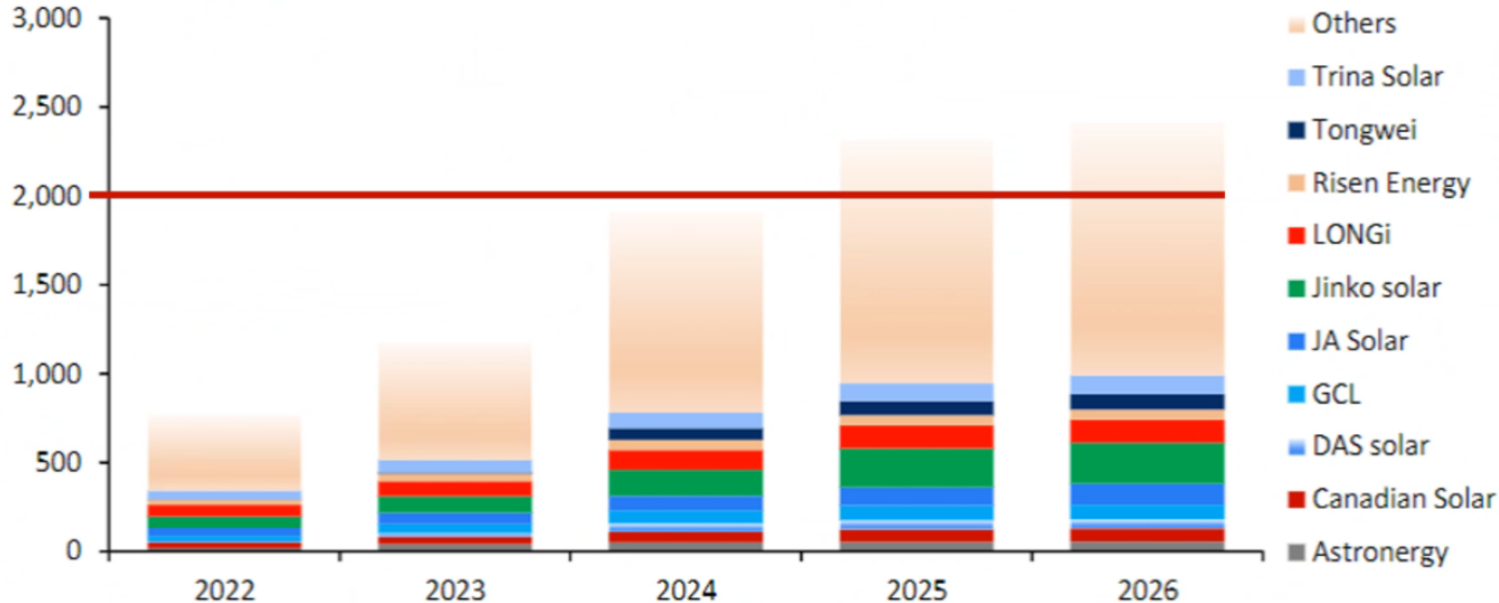
Source: BloombergNEF

Global Solar Module manufacturing capacity

Massive expansion of solar module manufacturing capacity – also outside China

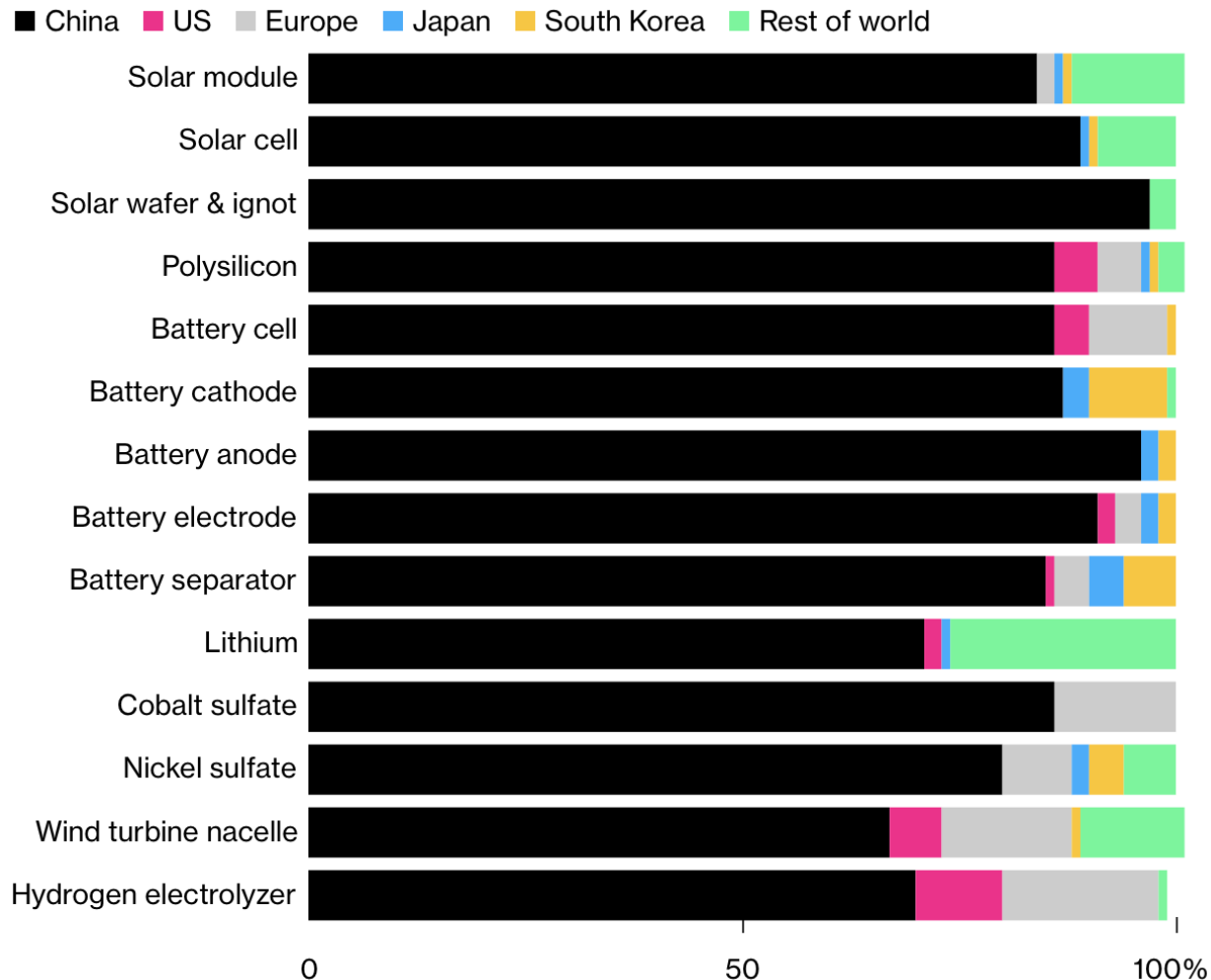
Global module manufacturing capacity, 2022-2026

Gigawatts direct current (GW_{DC})



China's Cleantech Manufacturing Dominance

China now dominates global cleantech manufacturing, RD&D, domestic installs, exports and OFDI



China is Moving in Decarbonisation, Rapidly

China leads the world in firmed renewable energy globally, by far, with a staggering 375GW of zero emissions additions in CY2024.

New Capacity Installed in China in Jan-Dec 2024

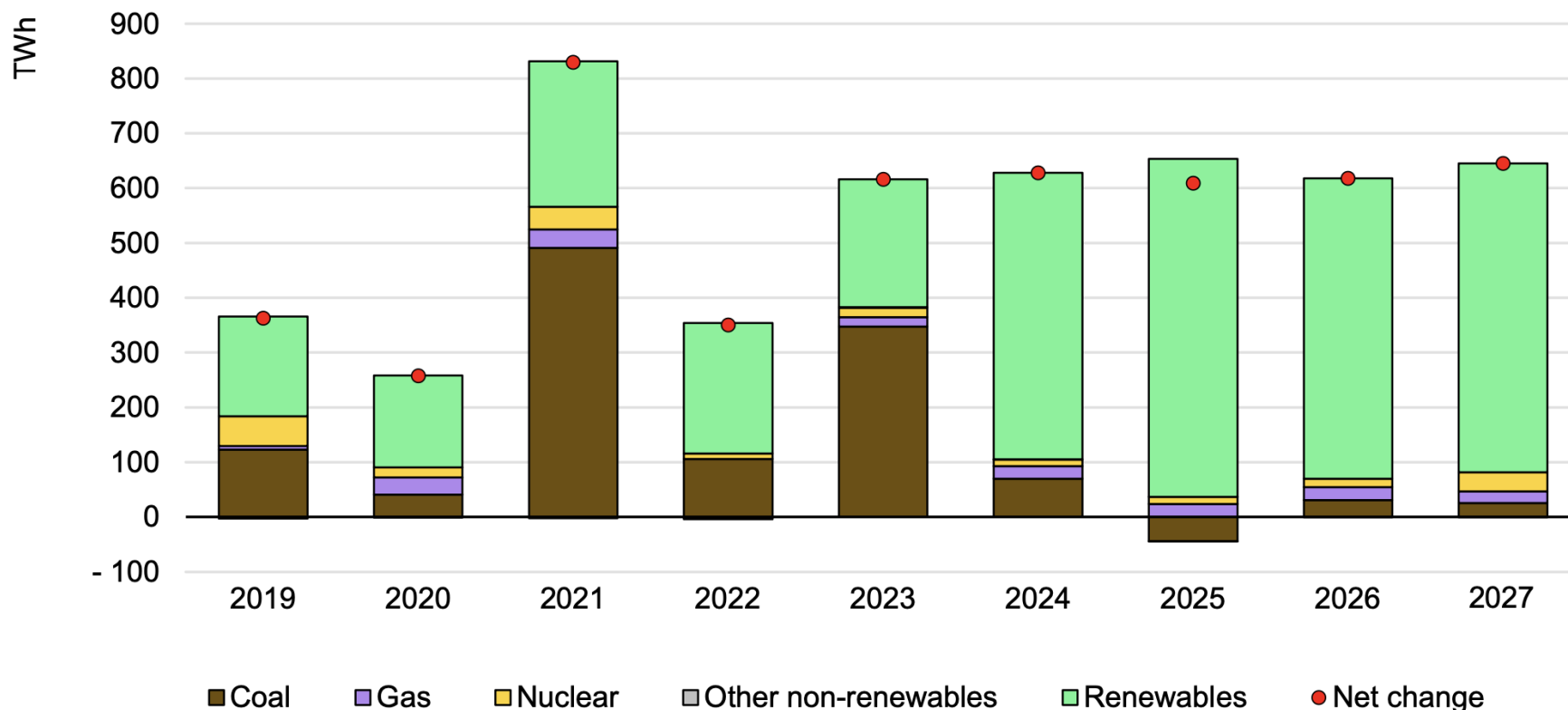
| | | Jan-Dec 2024 | Share of new adds (%) | Change (yoy %) | Dec-24 | Share of new adds (%) |
|--|----------------|-----------------|-----------------------------|-------------------|--------------|-----------------------------|
| Thermal Power | GW | 54.1 | 13% | 4% | 6.7 | 6% |
| Hydropower | GW | 14.4 | 3% | 3% | 4.4 | 4% |
| Nuclear Power | GW | 3.9 | 1% | 7% | 2.7 | 2% |
| Wind Power | GW | 79.3 | 18% | 18% | 27.6 | 25% |
| Solar Power | GW | 277.2 | 65% | 45% | 70.9 | 64% |
| Total capacity added | GW | 429.0 | 100% | 15% | 112.3 | 100% |
| Renewable Energy adds | GW | 370.9 | 86% | 25% | 102.9 | 92% |
| Zero Emissions Capacity Adds | GW | 374.8 | 87% | 25% | 105.6 | 94% |
| Investment in Completed Power Grid Project | 1 billion yuan | 608.3 | | 15% | 79.3 | |

Source: NBS, CEF Estimates

China is Moving in Decarbonisation, Rapidly

The IEA models peak coal in China in 2024, and ~95% of electricity generation growing being zero emissions

Year-on-year change in electricity generation in China, 2019-2027



Source: IEA Electricity 2025

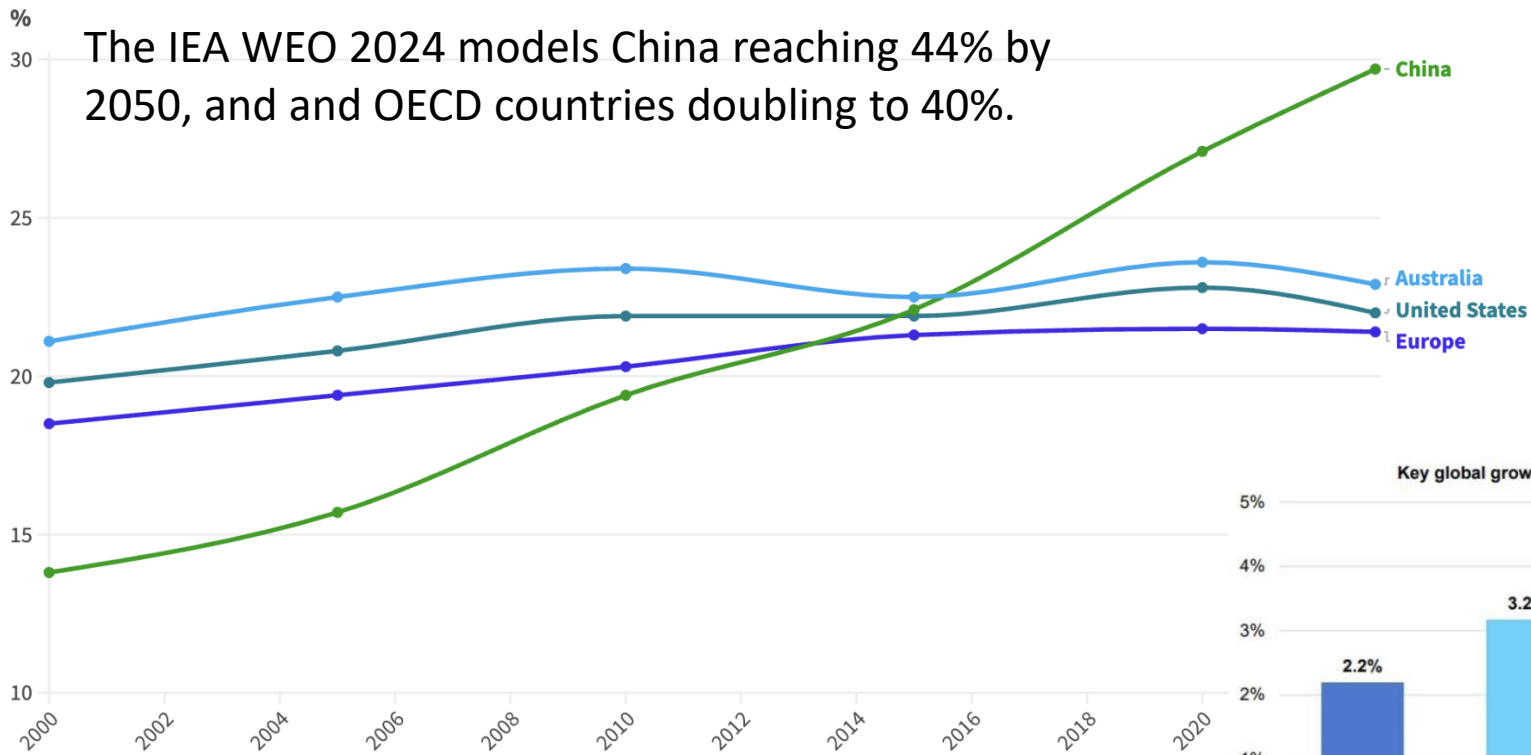
<https://iea.blob.core.windows.net/assets/77522eb7-49c8-4611-851e-59bd5b93454c/Electricity2025.pdf>

China's Electrification of Everything

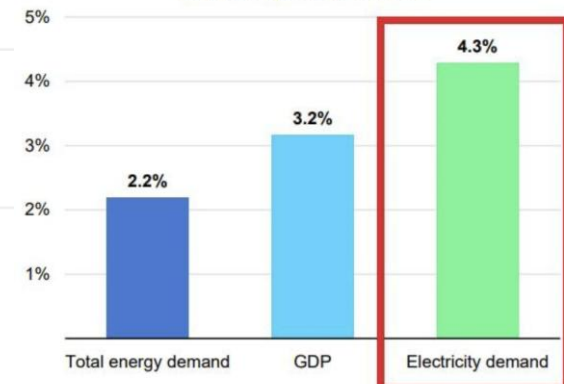
China Leads the world on Progressive Electrification of Everything

Share of final energy from electricity

China has leapfrogged United States, Europe and Australia in electrification



Key global growth rates, 2024



Source: CEF calculations, [Enerdata](#)

China New Energy Vehicles

NEV momentum has accelerated to-date in 2025

Snapshot electric vehicle sales in Jan-Feb 2025 vs Jan-Feb 2024, Year to Date (YTD) %

- Global: 2.4 million, +30%
- China: 1.4 million, +35%
- EU & EFTA & UK: 0.5 million, +20%
- USA & Canada: 0.3 million, +20%
- Rest of World: 0.2 million, +35%

- BYD Global NEV sales in 2MCY2025 were 623,384 vehicles, +92.5% yoy (within this, EV were 250,279 vehicles, +56.2% yoy).
- Tesla's EU sales 45% yoy 2MCY2025 to 25,582 vehicles
- Tesla's China sales in 2MCY2025 were 60,480 -13.6% yoy

Source: RhoMotion, 12 March 2025

<https://rhomotion.com/news/global-ev-sales-up-50-in-february-2025/>

China's US\$150bn Cleantech ODFI since 2023

China's response to the growing US and EU anti-China trade barriers:
>US\$150bn of Outbound Foreign Direct Investment in Cleantech, Globally

China's great green march across the globe

The Middle Kingdom wants to control the global clean-tech sector. Can it save the planet, too?

BY TAN DAWN WEI, DAVID FOGARTY AND WAHYUDI SOERIAATMADJA | PUBLISHED: MAR 22, 2025

THE STRAITS TIMES

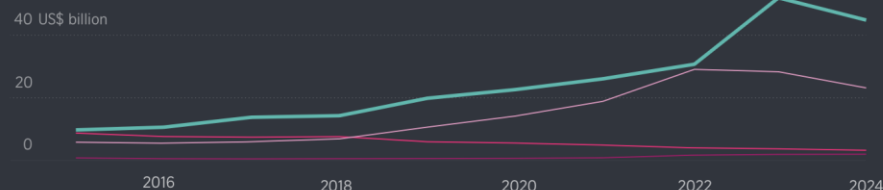
BEIJING/SINGAPORE/JAKARTA – On the outskirts of the Indonesian city of Semarang in Central Java, a new factory is cranking out solar cells and assembling solar panels with the help of robots, while autonomous carts whizz around ferrying parts and components.

The Trina Mas Agra Indonesia solar panel plant, operational since October 2024, is a US\$100 million joint venture between China's Trina Solar, Indonesian conglomerate Sinar Mas and Indonesian state utility PLN.

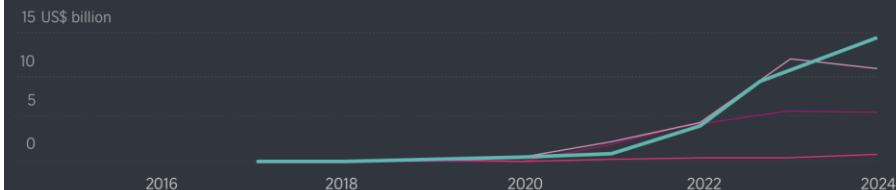
With an annual one gigawatt (GW) total panel capacity that is set to increase to 3GW, the plant is the first and largest integrated solar cell and solar panel manufacturer in Indonesia. It is helping to accelerate a much-needed energy transition in South-east Asia's largest economy, and could in future bring green electricity to Singapore.

The **Global South** has emerged as a major destination for Chinese clean-tech exports, vying with the **EU**, **US** and **UK**.

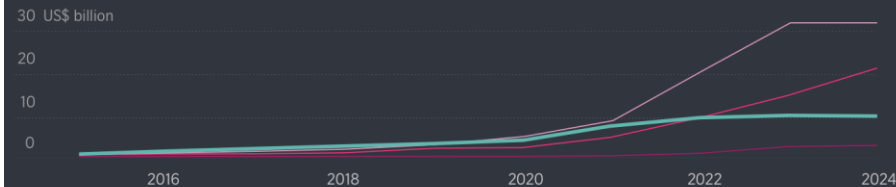
Solar



Electric vehicles



Batteries



Source: CEF Report: **China Outbound FDI, Oct'2024**

https://climateenergyfinance.org/wp-content/uploads/2024/10/final_-CEF-Report-China-Outbound-FDI-2-October-2024-2.pdf

The Straits Times 22 March 2025: <https://www.straitstimes.com/multimedia/graphics/2025/03/china-great-green-march-globe/index.html?shell>

The World is Responding to China's Challenge

The European Commission announced another €100bn for clean industrial investments

Europe's clean industrial future

27 February 2025

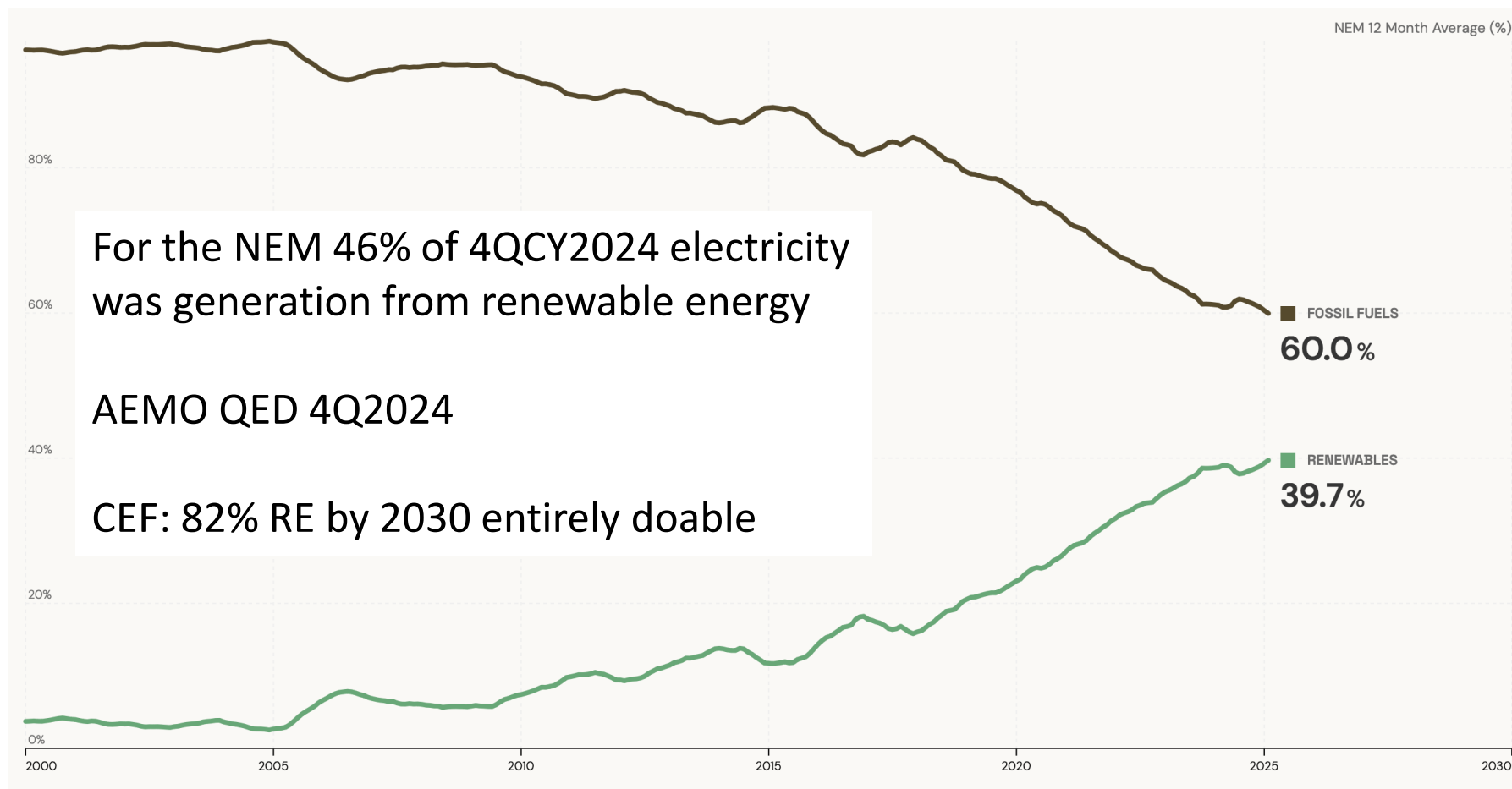
Yesterday, one of the year's most awaited legislative pronouncements was unveiled, as European Commission President Ursula von der Leyen [presented the EU Clean Industrial Deal](#) — a roadmap to strengthen Europe's industrial competitiveness & accelerate decarbonisation.

Bringing together energy-intensive industries & clean-tech innovation, the **Clean Industrial Deal** sets the course for a climate-neutral and resilient European economy. Landing as a response to geopolitical tensions, economic slowdowns, and increasing global competition, the deal has been labelled a big win for clean-tech manufacturers and industrial decarbonisation aiming to ensure that Europe's industries remain at the forefront of the green transition. Key initiatives are:

- €100+ billion mobilised for clean industrial investments, including a new Industrial Decarbonisation Bank.
- Made in Europe” incentives to ensure EU procurement prioritises sustainable, locally produced clean tech.
- Support for energy-intensive sectors (steel, cement, chemicals) to cut emissions while maintaining competitiveness.
- An [Affordable Energy Action Plan](#) to lower energy bills for industries, businesses and households and speed up the roll-out of clean energy and accelerate electrification and interconnectivity, making the link between security of supply and competitiveness abundantly clear.
- Looser state aid rules to help industries transition to low-carbon production and green manufacturing.
- New Circular Economy & Raw Materials Plan in 2026 to reduce waste and secure key industrial materials.
- Skills & workforce development to create new green jobs in industrial regions.
- Carbon Border Tax (CBAM) adjustments to protect EU industries from carbon-intensive imports.

Australia's Electricity System Decarbonisation

Electrification & Decarbonisation – National Electricity Market (NEM) CY2024 @ 39.3% renewables; 1QCY2025 @ 44.0%

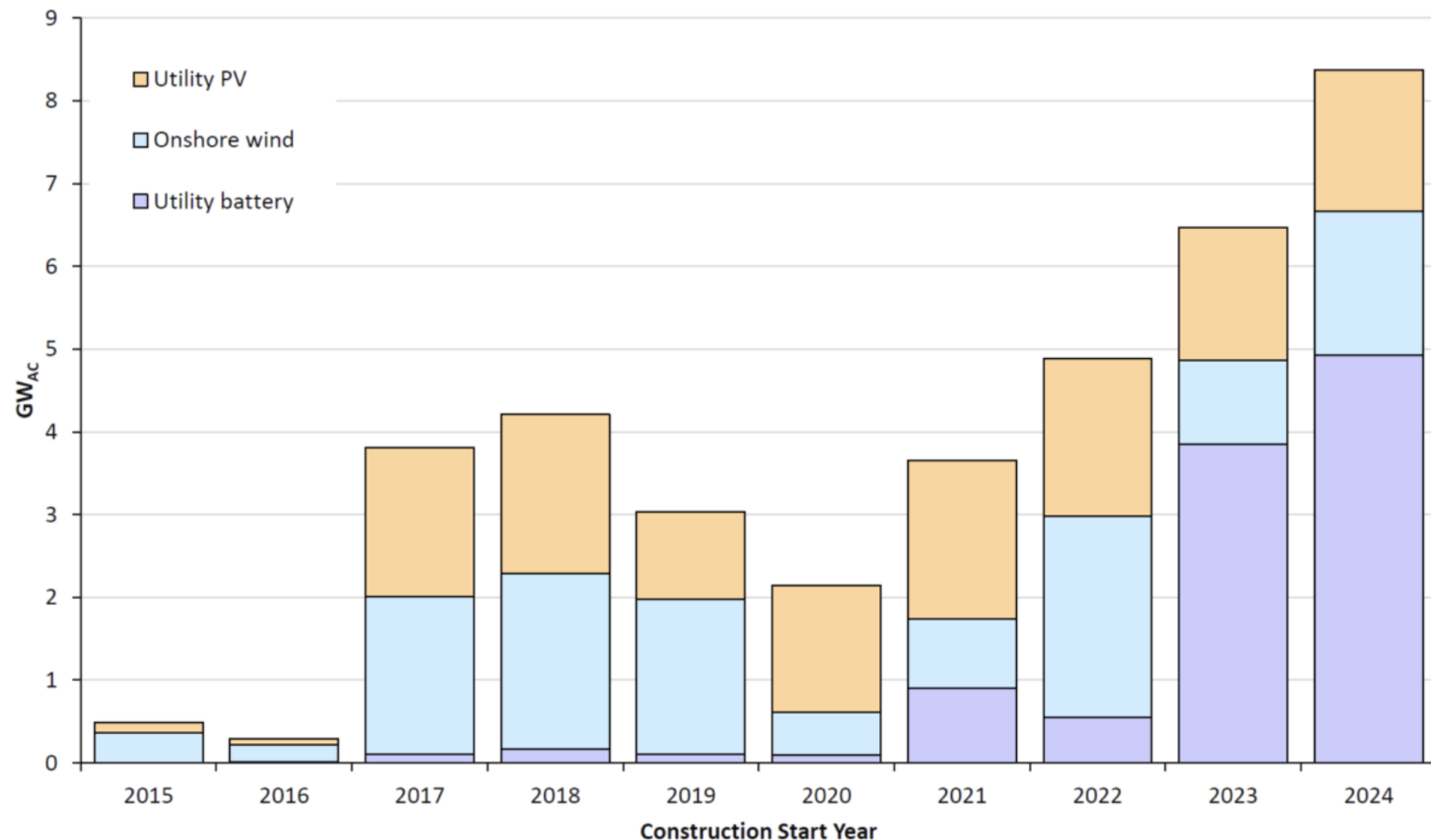


Source: Open Electricity, <https://openelectricity.org.au>

AEMO QED 4QCY2024 <https://aemo.com.au/energy-systems/major-publications/quarterly-energy-dynamics-qed>

Australia's Electricity System Decarbonisation

7GW pa of new generation capacity (including DER) is too little



The Lightsource bp announcement takes Australia's capacity starting construction from utility solar, wind and batteries to over 8 GW.

Image: Rystad Energy

Australia is Responding to China's Challenge

Strategic public capital is a key facilitator, in the absence of a CO₂ price signal

FMIA, CIS, RTN, NRF, Future Fund, CEFC, ARENA, EFA, NAIF

Capacity Investment Scheme

The Capacity Investment Scheme (CIS) is an Australian Government revenue underwriting scheme to accelerate investment in:

- 23 GW of renewable capacity representing \$52 billion in investment
- 9 GW of clean dispatchable capacity representing \$15 billion in investment.

South Australia

Australian
Associated Press

20 Feb 2025

Troubled Whyalla steelworks gets \$2.4bn government bailout as hunt for new owner begins

“Crucial support:” Federal Labor launches \$2bn green aluminium production credit scheme

\$19bn

Rewiring the Nation Fund

 **RENEW ECONOMY** Andrew Brown Jan 20, 2025

The \$19 billion Rewiring the Nation (RTN) Fund is a significant expansion of CEFC investment capacity, with a particular focus on facilitating the timely delivery of grid and transmission projects, using CEFC capital to accelerate the benefits of grid transformation to consumers, including helping to lower consumer energy costs.

Rio Tinto says aluminium could run on renewables and batteries

\$200 million investment in critical minerals to build Australia's future

FINANCIAL REVIEW

Feb 6, 2025

15 January 2025

The Hon Ed Husic MP

Minister for Industry and Science

The Albanese Government's National Reconstruction Fund Corporation (NRFC) will invest \$200 million in Arafura Rare Earths to help build Australia's Future.

Australia's Electricity System Decarbonisation

Massive deflation, manufacturing capacity expansion and technology development: Solar + BESS => Accelerated Energy System Disruption



CLIMATE ENERGY FINANCE

International Solar PV and BESS Manufacturing Trends

Solar PV's disruption is happening at a speed beyond imagination, turbocharged by BESS firming

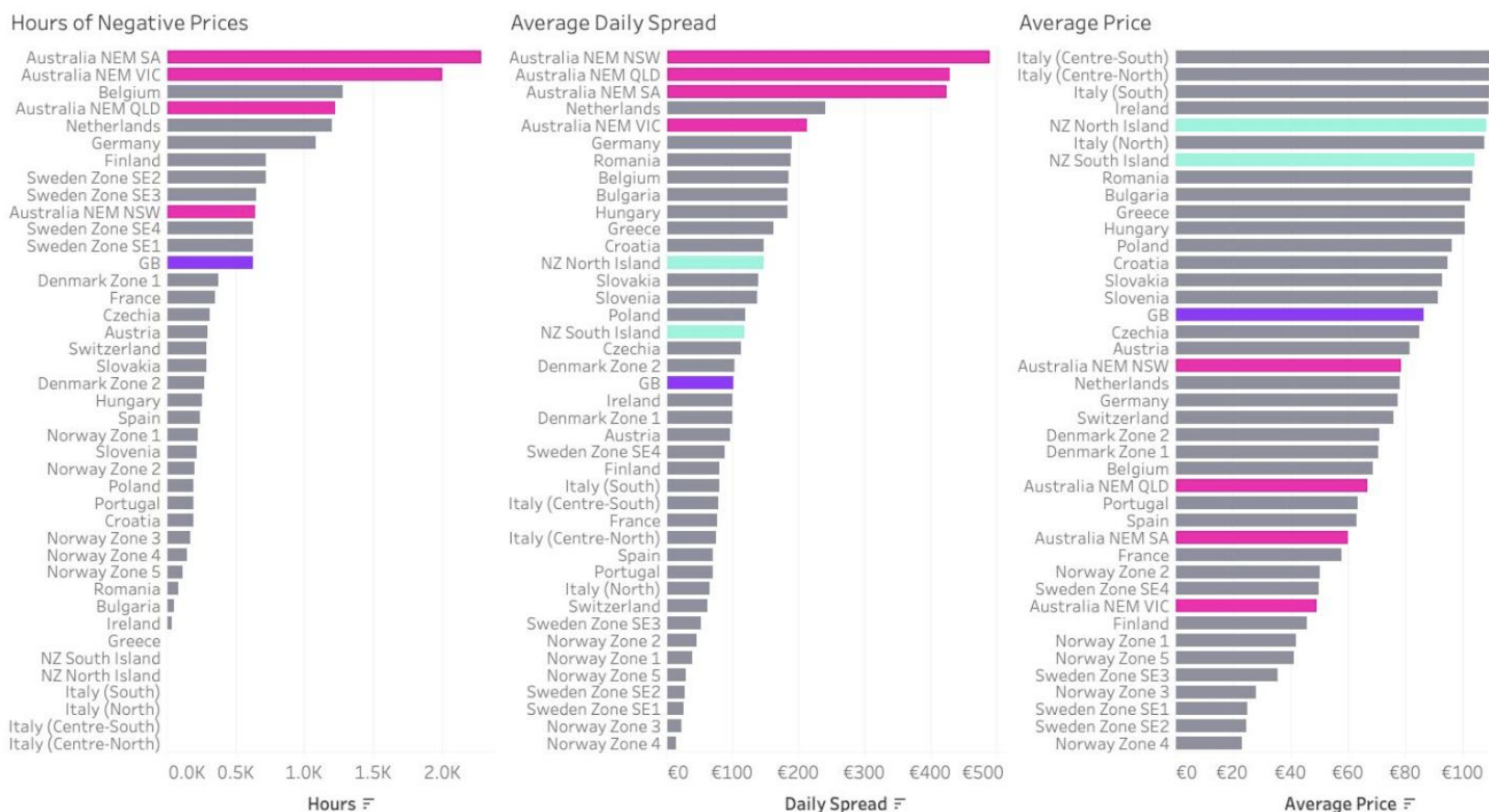


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Australia's Electricity System Decarbonisation

Negative electricity prices enable a lot more batteries, in turn enables a lot more VRE

2024 Wholesale Energy Market Metrics



GB and European data based on day-ahead hourly markets

Electricity System Decarbonisation

Massive deflation, manufacturing capacity expansion and technology development: Solar + BESS => Accelerated Energy System Disruption

China's Huadian announces winners in 6 GWh BESS tender with average bid at \$65/kWh

The procurement exercise has attracted 67 battery energy storage companies but only six have emerged as winners. The average bid stood at CNY 0.473/Wh (\$65/kWh).



By Marija Maisch | Mar 24, 2025

Grid Storage at US\$66/kWh: The World Just Changed

What China's new BESS prices mean for oil, cars, hydrogen — and your grid

Michael Barnard The Future is Electric 31 March 2025

The **Power Construction Corporation of China** drew 76 bidders for its tender of 16 GWh of LFP BESS. Bids averaged US\$66.3/kWh, with 60 bids under \$68.4/kWh. The tender, covering supply, system design, installation guidance, 20-year maintenance, and safety features, targets systems to be built in 2025–2026.

That's an astounding price, as earlier this year even I, as a battery optimist, was astounded by **CATL**'s announcement that it would be shipping LFP cells at \$56/kWh. I did a cost workup of the implications for [buffering batteries for truck stop megawatt scale charging](#) in May, and found that at that price point, the economics of big batteries to enable near term charging without being delayed by big grid upgrades made fiscal sense. I was always a little uneasy about that analysis as I knew it wasn't a full BESS with cells, container, HVAC, thermal runaway protection, sensors, & a battery energy management system, but it was directional.

Source: Michael Barnard, 31 March 2025

<https://medium.com/the-future-is-electric/grid-storage-at-66-kwh-the-world-just-changed-c2f39f42f09f>