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Macquarie Research: Investor Briefing

China Outbound DFI

5 November 2024

Solar Step Change

Agenda

Solar Step Change: Solar has become the dominate source of net new electricity capacity installed globally

China continues to dominate global renewables installs

China is leading a global step change in cleantech manufacturing capacity

Solar + Batteries + EV => accelerating the technology disruption

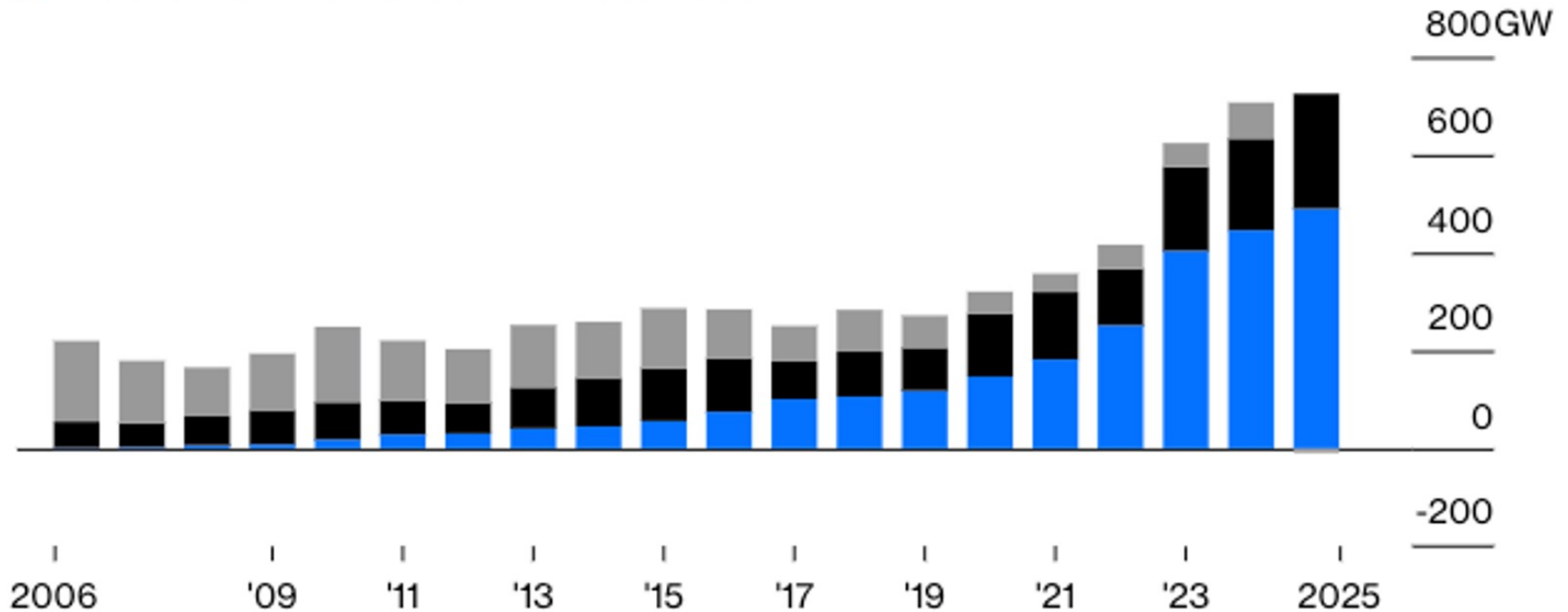
China cleantech is going global: ODFI + exports + offshoring manufacturing

Solar Step Change

Two-Thirds of New Electricity Generating Capacity Is Solar Power

New installations minus retirements

■ Photovoltaic ■ Other clean ■ Fossil fuels

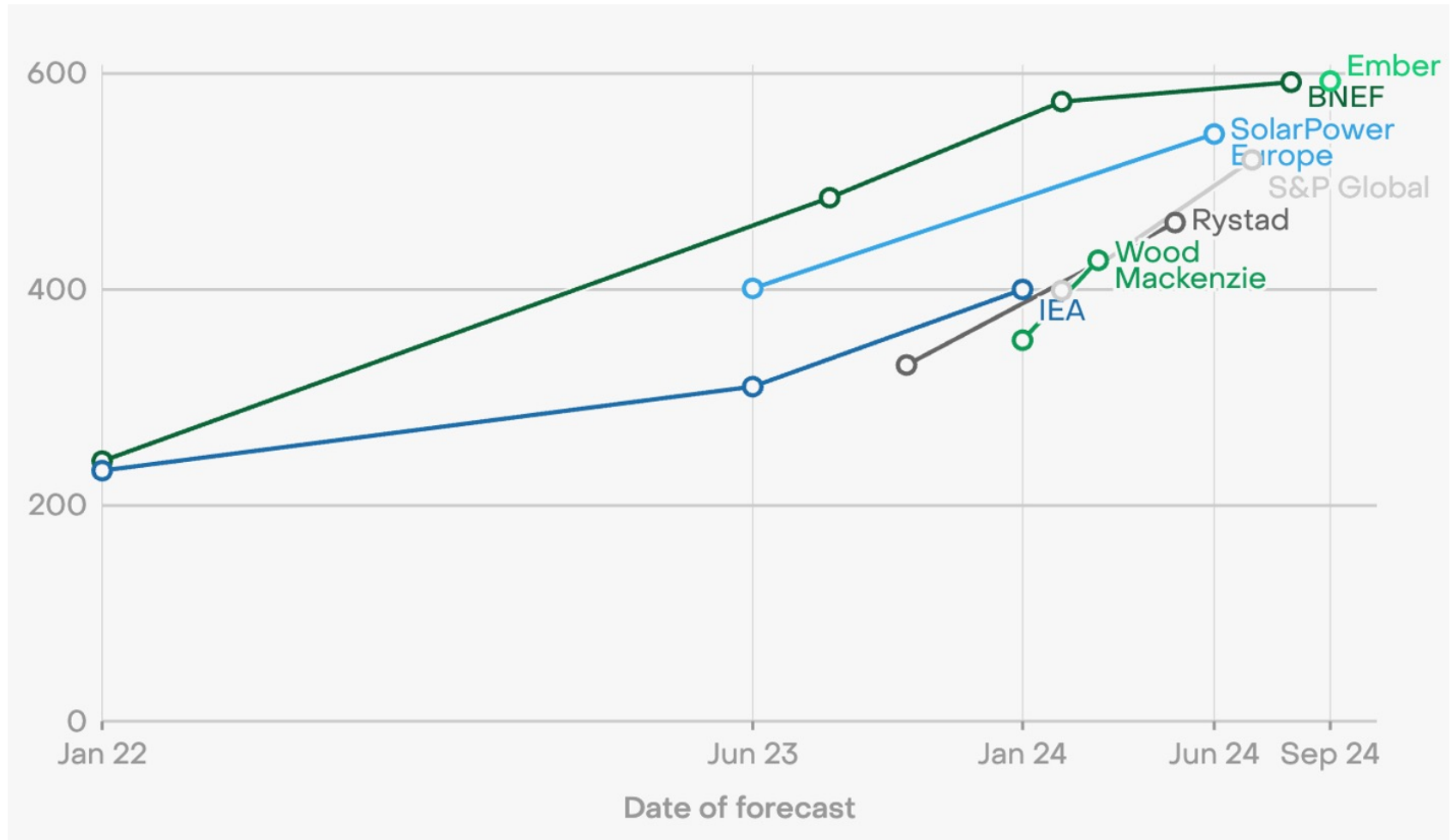


Source: BloombergNEF

Note: Data for 2023 to 2025 are forecasts.

Solar Step Change

Constant upgrades to global solar install forecasts



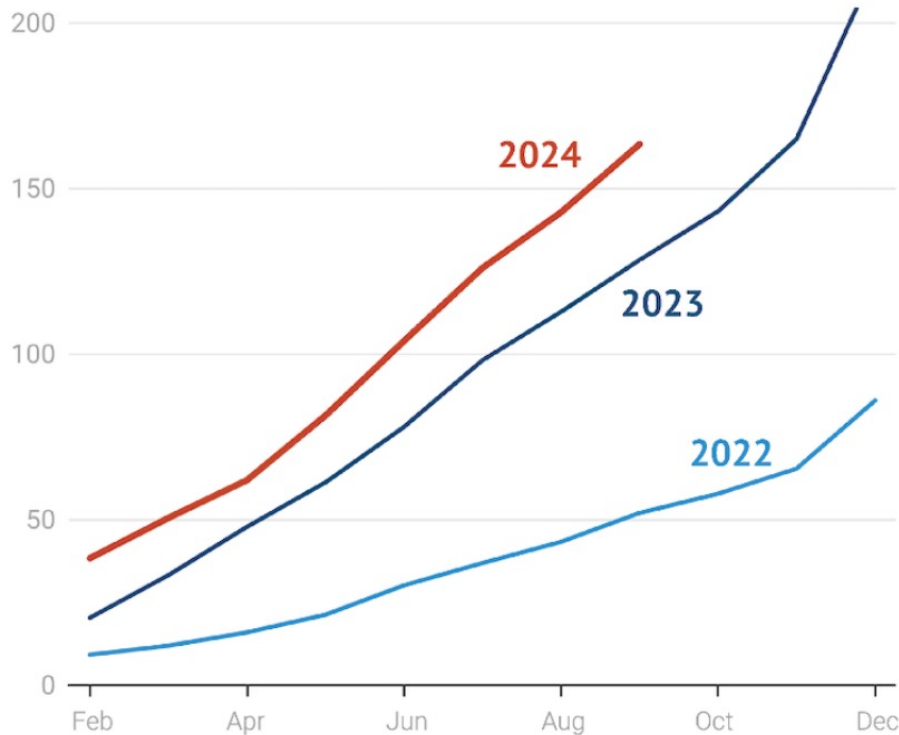
China Renewables Installs

China's Wind and Solar Growth Continues in 2024

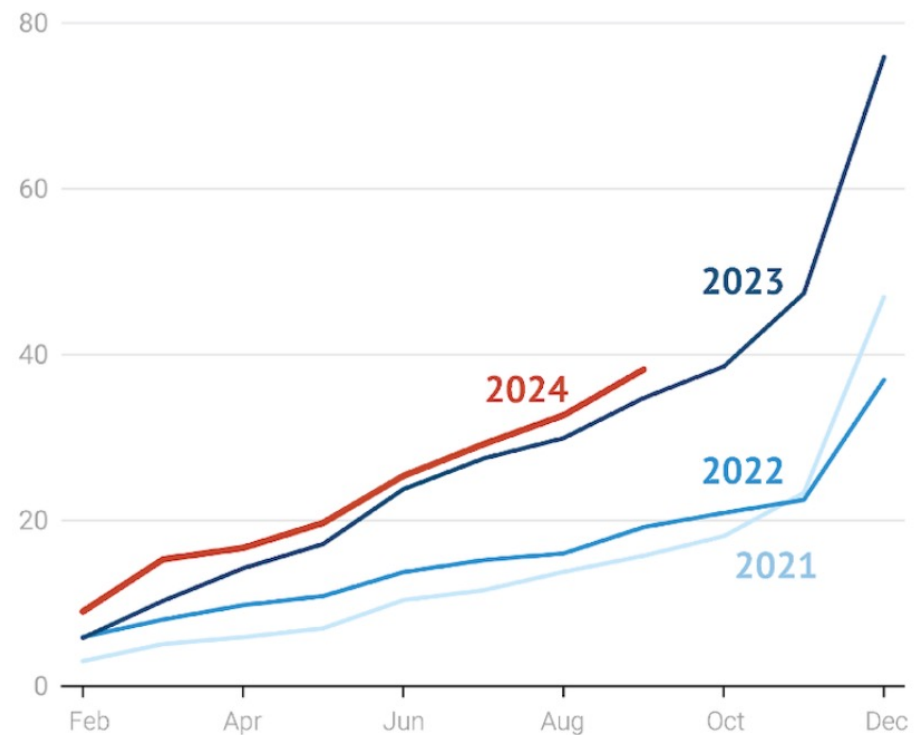
China solar installs: 2021 54GW, 2022 86GW, 2023 217GW, 2024 >240GW

Cumulative new capacity per year, GW

Solar



Wind



China is installing 22GW per month of RE

Zero emissions energy is 36% of total generation in 9MCY2024

China's Electricity Generation Mix in Jan-Sept 2024 (Adjusted for DER)

		9MCY2024	Share of Generation Jan-Sept	Change (y-o-y %)	9MCY2024 Adjusted	Share of Generation Jan-Sept Adjusted	Sep-24	Change (y-o-y %)
Thermal Power	TWh	4,744	67.2%	1.9%	4,744	63.7%	545	8.9%
Hydropower	TWh	1,004	14.2%	16.0%	1,004	13.5%	120	-14.6%
Nuclear Power	TWh	328	4.6%	1.5%	328	4.4%	36	2.8%
Wind Power	TWh	673	9.5%	10.8%	693	9.3%	75	31.6%
Solar Power	TWh	307	4.4%	27.0%	676	9.1%	73	38.0%
Total Power Generation	TWh	7,056	100.0%	5.4%	7,445	100.0%	849	8.7%
Variable Renewable Generation	TWh	981	13.9%	15.4%	1,370	18.2%	148	37.5%
Zero Emissions Power Generation	TWh	2,312	32.8%	13.5%	2,701	36.3%	304	7.4%

Source: NBS, Ember, CEF Estimates

China is installing 22GW per month of RE

RE Momentum in 8MCY2024 has Slowed, it is 'only' +21% yoy

The month of September 2024 was 27GW of RE

New Capacity Installed in China in Jan-Aug 2024

		Jan-Aug 2024	Share of new adds (%)	Change (yoy %)	Aug-24	Share of new adds (%)
Thermal Power	GW	28.6	14%	-17%	4.2	17%
Hydropower	GW	6.6	3%	-9%	0.7	3%
Nuclear Power	GW	1.2	1%	0%	0.0	0%
Wind Power	GW	33.6	16%	16%	3.7	15%
Solar Power	GW	140.0	67%	24%	16.5	66%
Total capacity added	GW	210.0	100%	14%	25.1	100%
Renewable Energy adds	GW	180.2	86%	21%	20.9	83%
Zero Emissions Capacity Adds	GW	181.4	86%	21%	20.9	83%
Investment in Completed Power Grid Project	1 billion yuan	333.0		19%	79.0	

Source: NBS, CEF Estimates

Xi Jinping's Great Economic Rewiring Is Cushioning China's Slowdown

*Advances in EV, solar and semiconductors are helping the nation navigate its
property slump*

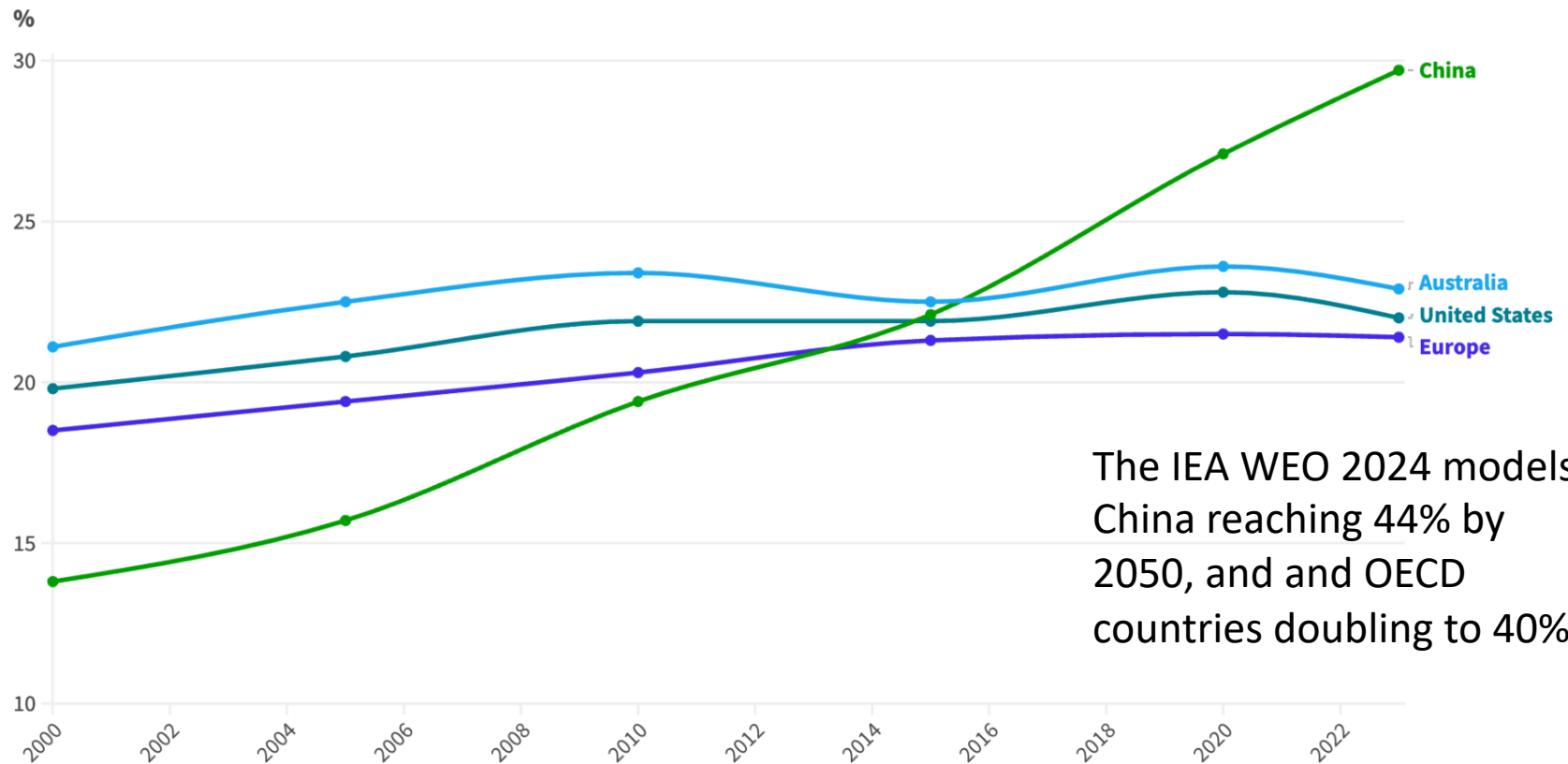
By Bloomberg News 16 July 2024

China's Electrification of Everything

China Leads the world on Progressive Electrification of Everything

Share of final energy from electricity

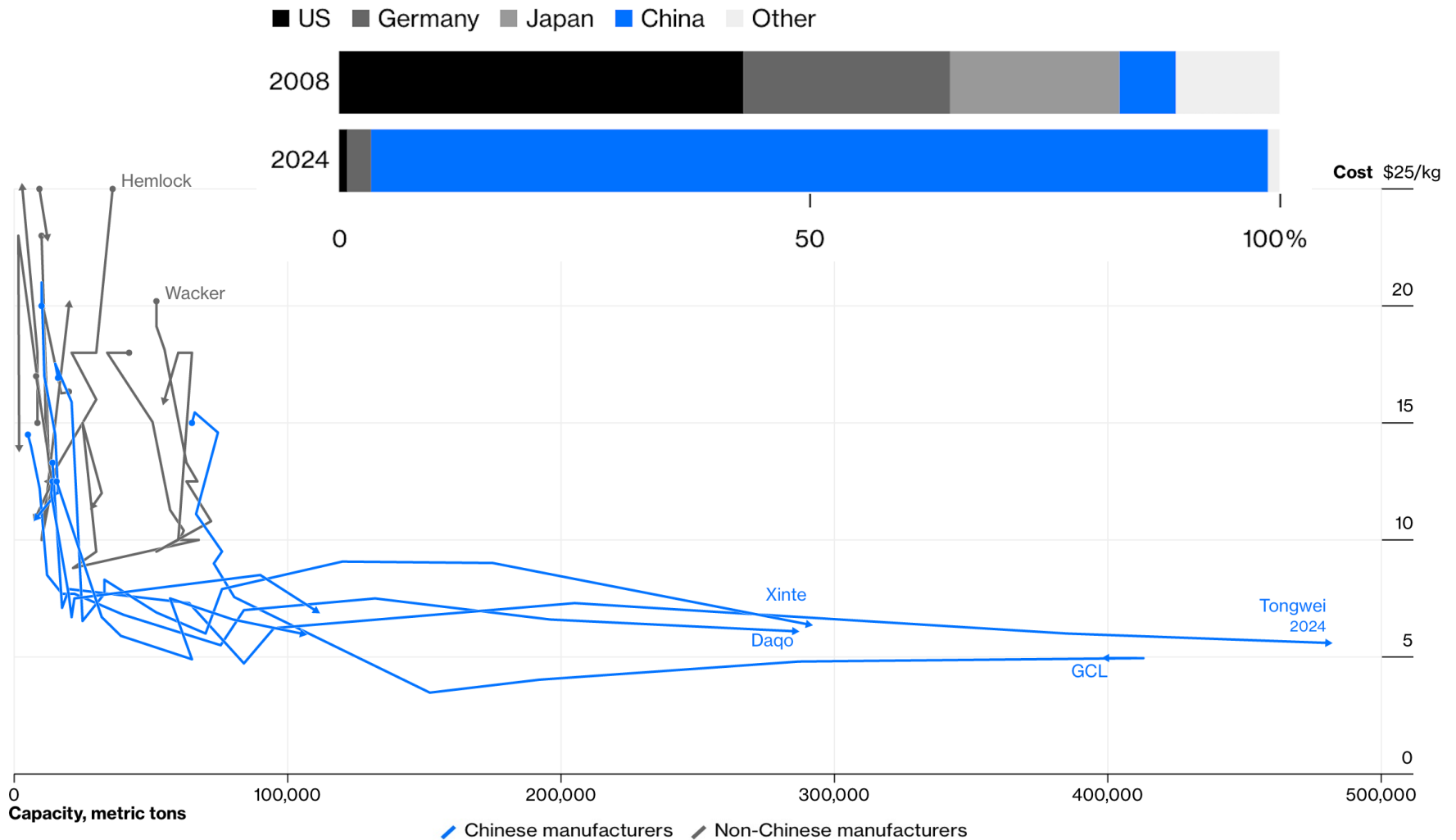
China has leapfrogged United States, Europe and Australia in electrification



The IEA WEO 2024 models China reaching 44% by 2050, and OECD countries doubling to 40%.

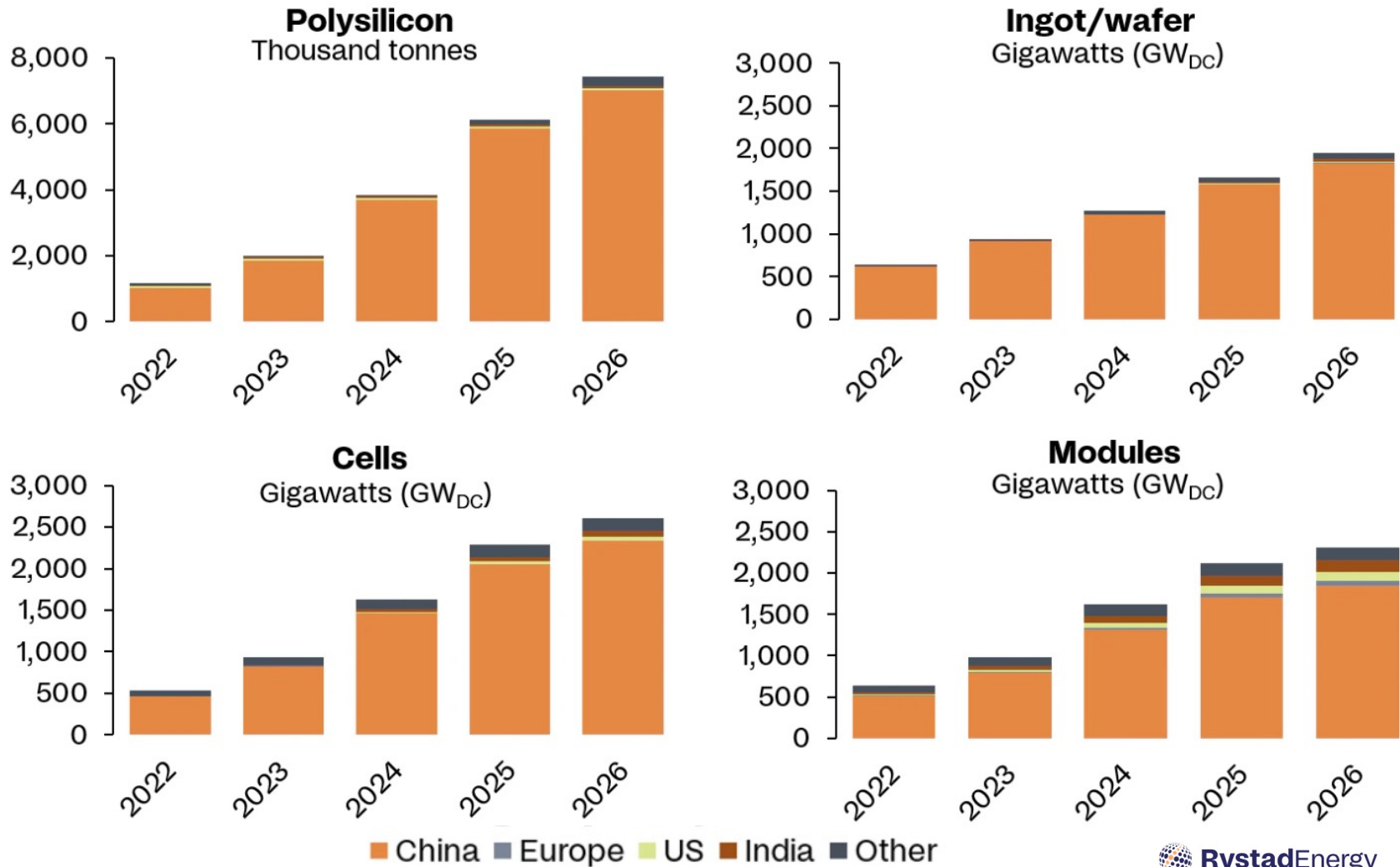
Solar Step Change

How China Came to Control 90% of the Global Solar Market



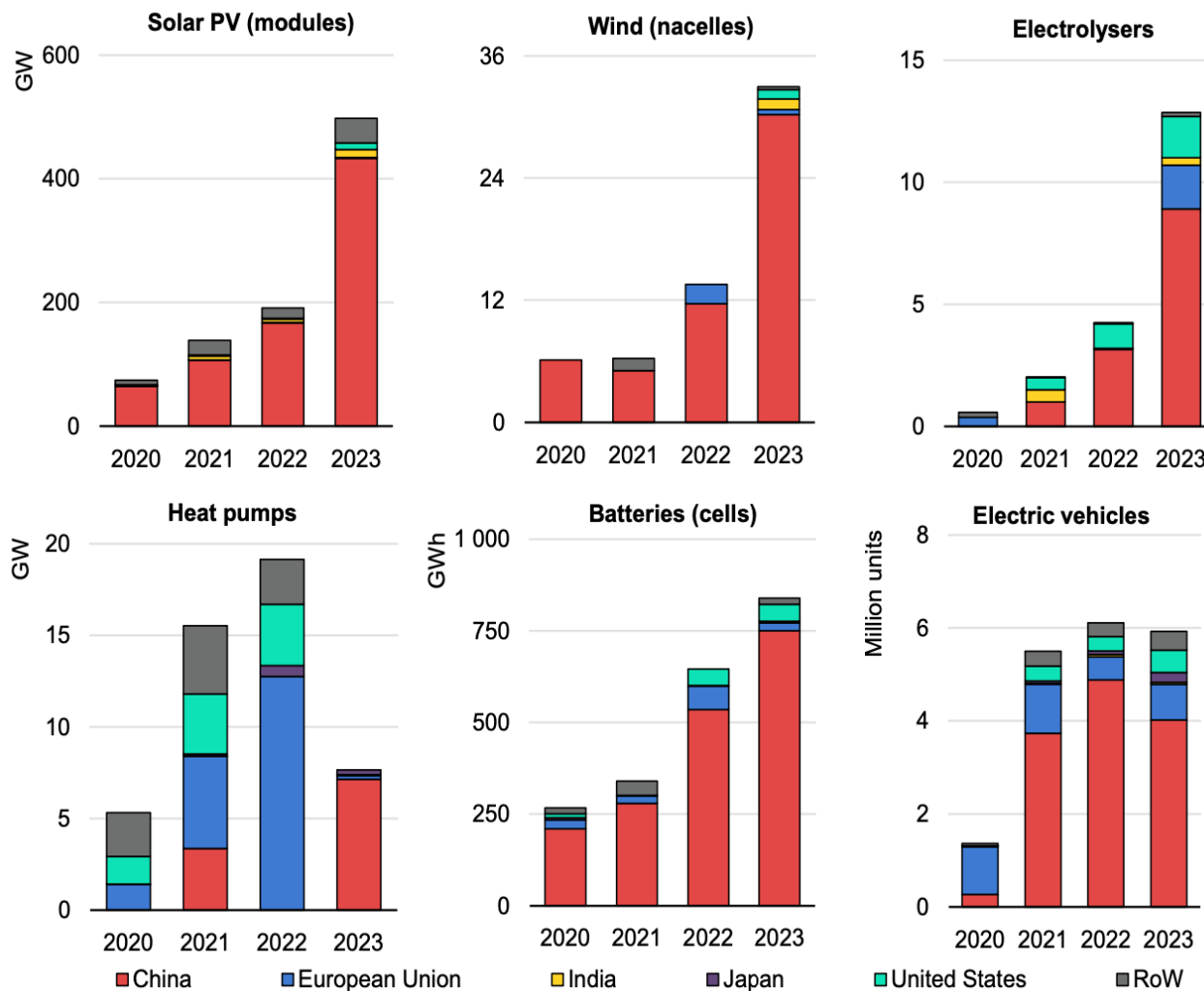
Solar Step Change - Manufacturing

Global Manufacturing Capacity for Solar Components



China – Cleantech Manufacturing

Global Cleantech Net Manufacturing Capacity Expansions by Year by Country, 2020-2023



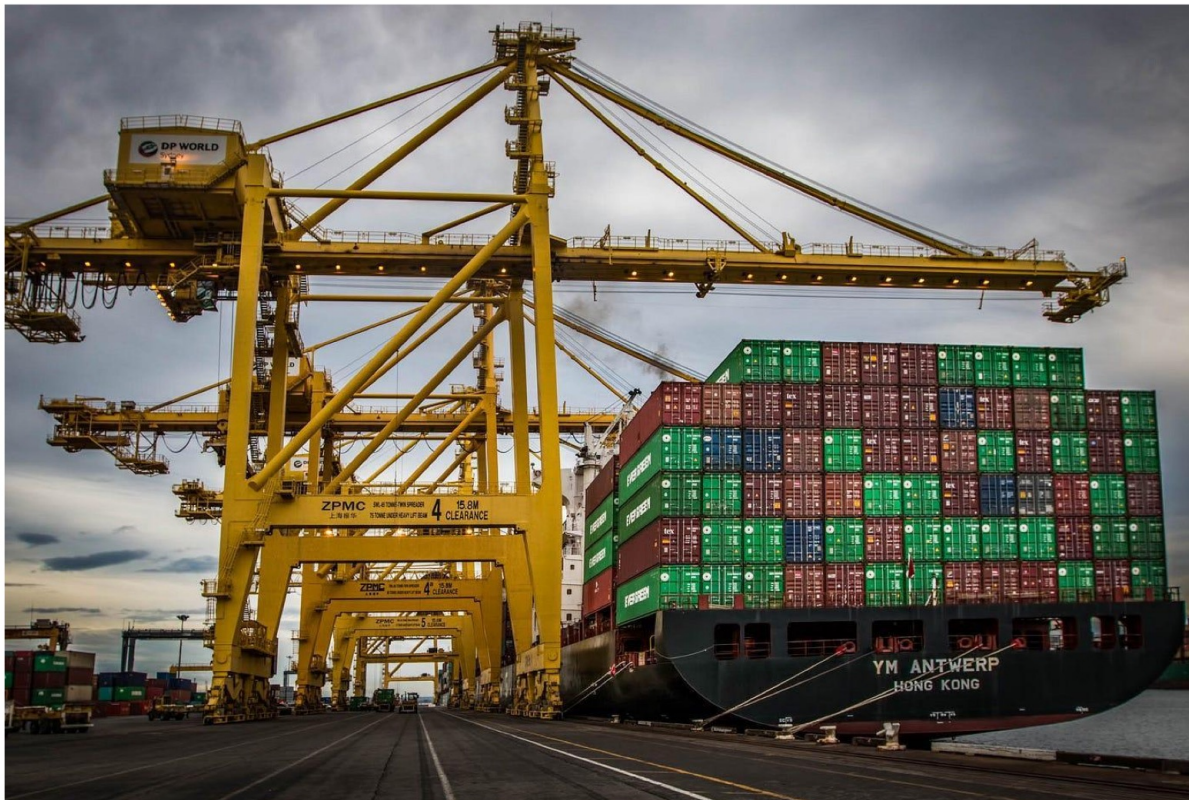
China's >US\$100bn Cleantech ODFI since 2023

Green capital tsunami:

China's >\$100 billion outbound cleantech investment since 2023 turbocharges global energy transition

Unparalleled opportunities for enhanced Australia-China collaboration in zero-emissions trade & investment – with the right policy settings.

Foreword by the Chair of the Australia China Business Council



Source: CEF Report: **Green capital tsunami**

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

China's >US\$100bn Cleantech ODFI since 2023

China's response to the growing US and EU anti-China trade barriers

Investment					Date of		Expected	
US\$m	Technology	Company	Investment Partner	Location	news	Product	start of production	Confirmed / FID
8,100	Battery	CATL	n.a.	Debrecen, Hungary	May'2024	Battery Mfg, 100GWh	2025	Yes
5,600	NEV	Human Horizons	Ministry of Investment	Saudi Arabia	Jun'2023	NEV Mfg - MoU	n.a.	No
4,200	Hydro	Power China	n.a.	Tanzania	Feb'2024	Hydro-electricity - 2,115MW	2024	Yes
3,300	Grid T&D	China State Grid	n.a.	Brazil	Apr'2024	2*1,500km grid transmission lines	n.a.	Yes
2,600	Solar Farms	CEEC	ACWA & Aramco	Saudi Arabia	Feb'2024	2,600MW of solar farm	2024	Yes
2,450	Wind Farm & BESS	Goldwind	Omni Energy	NSW, Australia	Aug'2024	1.4GW wind, 200MW-2hr BESS	2028	No
2,360	Battery	Gotion	n.a.	Michigan, US	Aug'2024	Battery Mfg	n.a.	No
2,200	Battery	CALB	n.a.	Portugal	Jan'2024	Battery Mfg, 15GWh	2026	No
2,100	Solar Mfg	TCL Zhonghuan	RELC & Vision	Saudi Arabia	Jul'2024	20GW solar wafers pa	n.a.	No
2,000	Wind Farms	CEEC	ACWA Power	Uzbekistan	Aug'2024	to construct a 1GW wind farm	2026	Yes
2,000	Solar Farms	CGN	n.a.	Laos	Aug'2024	2,000MW of solar across 3 farms	2026	Yes
2,000	Hydro	CEEC	China Energy	Pakistan	Aug'2024	Hydro-electricity - 884MW	2025	Yes
2,000	BESS	Sungrow	Algihaz	Saudi Arabia	Jul'2024	BESS - 7,800MWh	2025	No
1,575	Battery	EVE Energy	n.a.	Coventry, UK	Mar'2024	Battery Mfg	n.a.	No
1,550	Battery Materials	Huayou Cobalt	n.a.	Acs, Hungary	Jul'2024	Cathodes, 100,000tpa	2026	Yes
1,500	Solar Farms	Jinko Solar	EDF & TAQA	Dhafrah UAE	Aug'2024	1,500MW solar farm	2024	Yes
1,500	Grid T&D	Southern Power Grid	Chilean partners	Chile	Apr'2024	1,342km grid transmission line	n.a.	No
1,500	Battery Materials	Shanghai Putailai	n.a.	Sundsvall, Sweden	May'2023	Graphite anodes, 100,000tpa	n.a.	No
1,500	BESS	BYD	Grenergy	Atacama, Chile	Sept'2024	BESS - 3,000MWh	2025	Yes
1,450	Battery	Envision AESC	n.a.	Kentucky, US	Sep'2023	Battery Mfg, 30GWh	2024	Yes
1,450	Battery	Envision AESC	n.a.	Douai, France	Nov'2023	Battery Mfg, 9GWh	n.a.	Yes
1,400	Battery	EVE Energy	n.a.	Debrecen, Hungary	Nov'2023	Battery Mfg, 28GWh	2025	Yes
1,400	Battery Materials	CATL	YLB Mining	Bolivia	Jan'2024	Lithium hydroxide, 50,000tpa	n.a.	Yes
1,350	Battery Materials	Shanghai Shanshan	n.a.	Finland	Oct'2023	Graphite anodes, 100,000tpa	n.a.	No
1,332	NEV	Geely's Volvo	n.a.	Košice, Slovakia	Jul'2022	NEV Mfg - 250,000 units pa	2026	No

Source: CEF Report: [Green capital tsunami](#)

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

China's >US\$100bn Cleantech ODFI since 2023

Eastern European Battery and NEV Investments from China since 2023

Company	Investment Partner	Location	Investment (€m)	Date announced	Product	Expected start of production	Jobs
BYD	n.a.	Szeged, Hungary	n.a.	Dec'2023	NEV	n.a.	n.a.
BYD	n.a.	Turkey	900	Jul'2024	NEV	n.a.	n.a.
CATL	n.a.	Debrecen, Hungary	7,600	Aug'2022	Batteries, 100GWh	2025	9,000
EVE Energy	n.a.	Debrecen, Hungary	1,300	May'2023	Batteries	2025	1,000
Gotion	InoBat	Surany, Slovakia	1,000	Nov'2023	Batteries, 20GWh	2027	1,500
Huayou Cobalt	n.a.	Acs, Hungary	1,400	Jun'2023	Cathodes, 100,000tpa	2026	900
Sanhua Automotive	n.a.	Tychy, Poland	43	Dec'2023	NEV components	2025	350
Sunwoda	n.a.	Nyiregyhaza, Hungary	275	Jul'2023	Batteries	2026	1,000
Ganfeng Lithium	Yigit Aku	Turkey	450	Aug'2024	Batteries, 5GWh	2026	n.a.
Farasis Energy	Togg	Turkey	n.a.	Apr'2023	Batteries, 8GWh	2023	n.a.
Geely / Volvo	n.a.	Košice, Slovakia	1,200	Jul'2022	NEV	2026	n.a.
Leapmotor	Stellantis	Tychy, Poland	1,500	Oct'2023	NEV	2024	n.a.

Source: Climate Energy Finance calculations

Source: CEF Report: [Green capital tsunami](#)

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

China's >US\$100bn Cleantech ODFI since 2023

Major DFI Announcements from China into Australian Cleantech since 2023

Technology	Company	Investment Partner	Location	Investment (A\$m, Est.)	Date of news	Product	Expected commence ment	Confirmed / FID
Wind Farm & BESS	Goldwind	Omni Energy	NSW, Australia	2,450	Aug'2024	1.4GW wind, 200MW-2hr BESS	2028	No
BESS	Trinsolar	n.a.	Kemerton, WA	1,000	Sept'2024	660MW/2,640MWh BESS	n.a.	No
Wind Farm	Shenhua Clean Energy	Hydro Tasmania (25%)	Mortlake, VIC	1,000	Feb'2023	Proposed 400MW Mt Fyan windfarm	n.a.	No
Solar Farm	BJEI	Lightsource bp	various	813	Dec'2023	Acquisition of 5 solar farms	operating	Yes
BESS	Trinsolar	n.a.	Kiewa Valley, Victoria	600	May'2024	500MW/1,000MWh BESS	n.a.	No
Solar	Pacific Blue (SPIC)	n.a.	Townsville, Qld	500	n.a.	500MW solar farm, in stages	2026	Yes
BESS	Valent Energy	GAW Capital & BW ESS	Mornington Pen., VIC	300		240MW/480MWh Mornington BESS	2025	Yes
BESS	Trinsolar	n.a.	Augusta, SA	300	n.a.	270MW/540MWh BESS	n.a.	No
Solar Farm	BJEI	n.a.	Mudgee, NSW	280	n.a.	280MW Wollar Solar Farm	2024	Yes
Wind Farm	Shenhua Clean Energy	Hydro Tasmania (25%)	Tasmania	280	Feb'2024	Proposed 140MW wind repowering	n.a.	No
Solar Farm	Trinsolar	n.a.	Jindera, NSW	250	Sep'2024	200MW Wollar Solar Farm	n.a.	No
Wind Farm	BJEI	Goldwind	Victoria	197	2023	Acquired a 26% equity stake	operating	Yes
BESS	CEEC	ZEN Energy	Adelaide, SA	138	May'2024	EPC for a 138MW/330MWh BESS	2026	Yes
BESS	Pacific Blue (SPIC)	n.a.	Clements Gap, SA	100	Sep'2024	60MW/130MWh BESS	2026	No
BESS	China Light & Power	n.a.	Hallett, SA	100	Sep'2024	Won CIS Tender underwrite	n.a.	No
BESS	e-Storage	FRV Australia	Victoria	100	Aug'2024	EPC for a 100MW/200MWh BESS	2026	Yes
Energy Retailer	BJEI	TPC Consolidated	n.a.	100	Apr'2024	Acquisition of CovaU	operating	Yes
Solar Manufacturing	Trinsolar	SunDrive	NSW	100	Oct'2024	Proposed equity investment	2024	No
Solar Farm & BESS	Shanghai Electric	APA Group	Port Headland, WA	80	Sept'2024	EPC for 45MW solar + 35MW BESS	2024	Yes
BESS	Shenhua Clean Energy	Hydro Tasmania (25%)	Tasmania	50	Jan'2024	40MW/80MWh Derby BESS	2025	No

Source: CEF Report: [Green capital tsunami](#)

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Solar Step Change

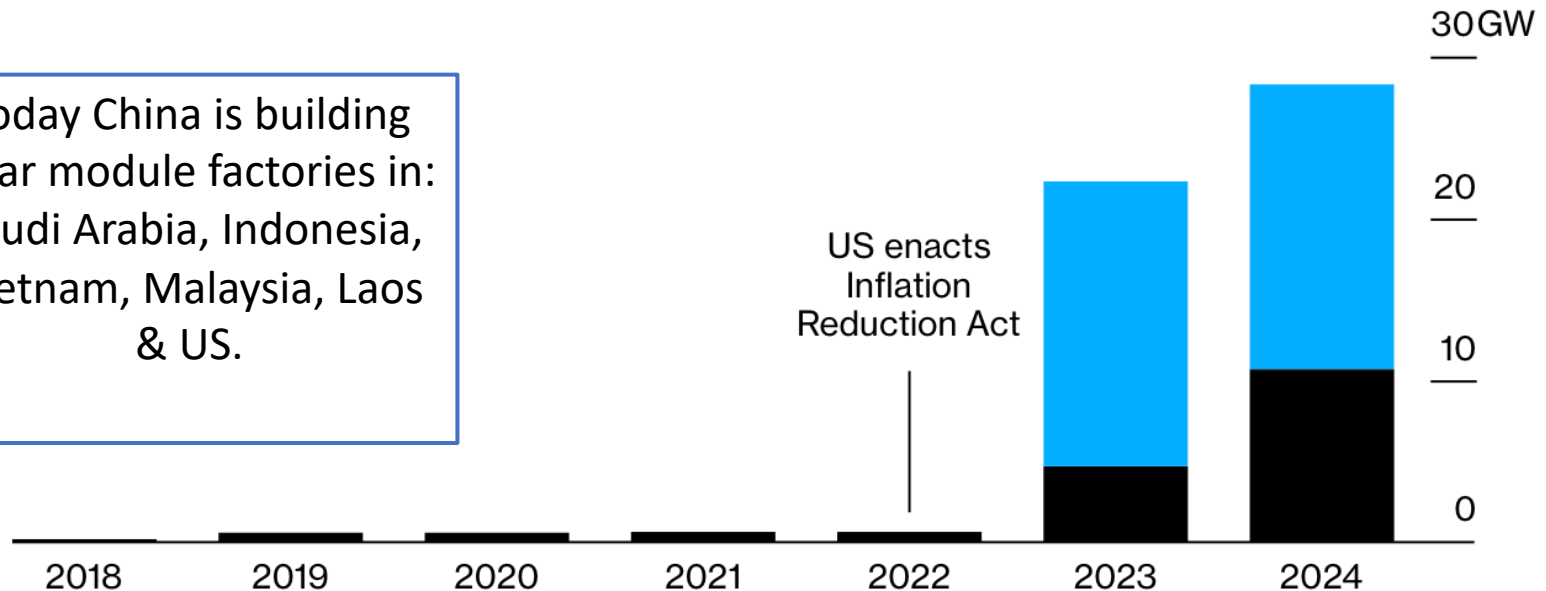
How China Came to Control 90% of the Global Solar Market

Chinese Solar Manufacturers Have Big American Ambitions

Production capacity of China-backed solar panel factories in the US

■ Operating ■ Announced

Today China is building solar module factories in: Saudi Arabia, Indonesia, Vietnam, Malaysia, Laos & US.



Source: BloombergNEF

Note: Data as of Aug. 2024

Source: Bloomberg, <https://www.bloomberg.com/news/features/2024-10-29/ira-investment-created-us-jobs-and-tax-breaks-for-chinese-solar-firms>

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

BESS + Solar => Disruption!

Sungrow secures 7.8 GWh battery storage deal with Saudi Arabia's Alghihaz Holding

China's Sungrow has signed three landmark energy storage contracts with Saudi Arabia's Alghihaz Holding, amounting to the world's largest grid-side storage order. Each project will have a capacity of 2.6 GWh, totaling 7.8 GWh.



By Vincent Shaw | Jul 16, 2024



3 Chinese clean-energy firms to set up solar, wind manufacturing in Saudi Arabia

- Jinko Solar, TCL Zhonghuan and Envision Energy will set up joint ventures with Saudi Arabia's Public Investment Fund and a private firm

[Yujie Xue](#) | 17th July 2024 | SCMP

Three major Chinese clean-energy manufacturers will build production plants in Saudi Arabia to expand their global footprints amid US and European trade barriers and fierce competition at home.

[Saudi Arabia's](#) Public Investment Fund (PIF) announced on Tuesday that it will form joint ventures in the [Middle Eastern](#) country with Jinko Solar and TCL Zhonghuan, two of the world's largest producers of [solar modules and solar silicon wafers](#), as well as [wind turbine](#) maker Envision Energy.

BESS + Solar => Disruption!

2GW of Solar + 11GWh of BESS in Chile

CATL to supply Grenergy 1.25GWh BESS for ‘world’s largest energy storage project’ in Chile

By [Jonathan Tourino](#) October 30, 2024 Energy Storage News



CATL supply will cover phase four of the Oasis de Atacama project in Chile which is expected to be operational by 2026. Image: Grenergy

Spanish independent power producer (IPP) **Grenergy** has secured a 1.25GWh energy storage supply agreement with **CATL** for its Oasis de Atacama project in Chile.

The capacity will be for the **Oasis de Atacama solar-plus-storage project in Chile**, which is the ‘world’s largest energy storage’ project with a total 11GWh of battery capacity and 2GW of solar PV.

Solar Step Change

Pakistan is set to install 10-15GW of Solar in 2024

Opinion

David Fickling,
Columnist

An Electricity Protection Racket Makes Pakistan Opt Out

Clean power can provide the solution if the government would only accept it.

22 August 2024 A recent study by BloombergNEF analyst Jenny Chase illustrates the extraordinary scale of this off-the-books boom. Last year, \$1.45 billion in solar panels were exported from China to Pakistan. That's enough to buy about 6 gigawatts of modules, sufficient to provide about 7% of Pakistan's electricity. Roughly the same amount was imported in the first six months of this year alone. With the drop in cell prices over the past year, that now represents something closer to 13 GW.



Separate evidence from machine-learning processing of satellite imagery suggests huge amounts of panels are going undetected. The area of arrays visible from space is equivalent to a minimum of between 1.4 GW and 2.8 GW, BloombergNEF found. Much appears to be built on the rooftops of factories, for industries to consume themselves. Chase estimates that a total 12.7 GW was installed by the end of last year and a further 10 GW to 15 GW will be added in 2024, making Pakistan the world's sixth-largest solar market.

China's >US\$100bn Cleantech ODFI since 2023

New Chinese transactions in October 2024

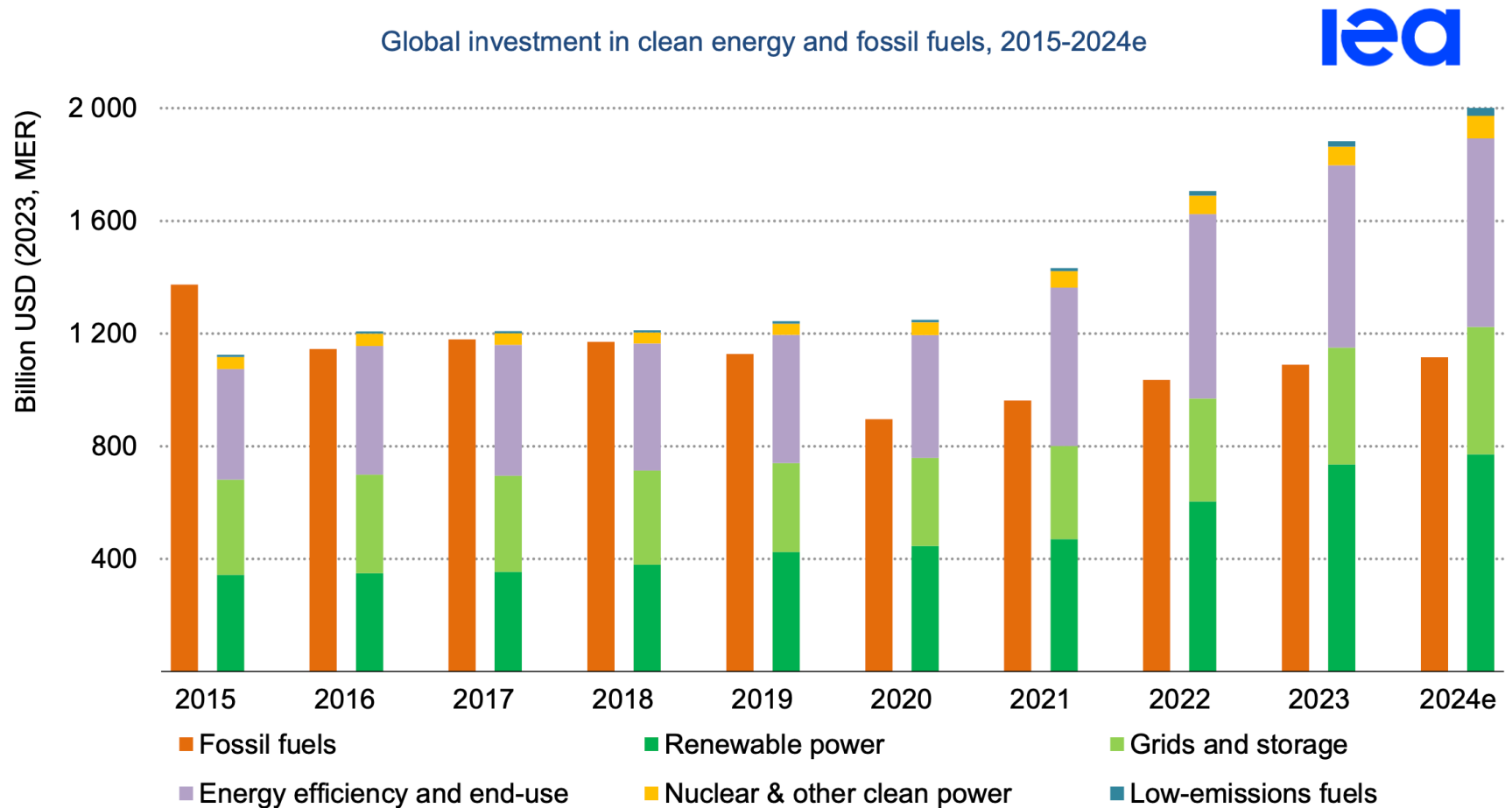
- China's **CATL** & **BYD** are supplying BESS to **Greenergy Renovables'** 11GWh BESS + 2GW solar Oasis de Atacama solar-plus-storage project in Chile 🇨🇳 🇨🇱
CATL & State-owned **Indonesia Battery Corporation** signed an MoU to build a new US\$1.5bn 15GWh capacity battery cell plant in Karawang, West Java 🇨🇳 🇮🇩
- China's **HiTHIUM** Energy Storage joined Saudi firm **MANAT** on a 5GWh production facility in Saudi Arabia. 🇨🇳 🇸🇦
- **Illuminate USA's** new Ohio solar module factory was commissioned, a JV by **Invenergy** (51%) & **LONGi Solar** (49%), one of ~30GW of module manufacturing capacity being built in the US by Chinese solar leaders. 🇨🇳 🇺🇸
- **SANY Group** wins sales agreements for >1.6GW of Indian wind turbines 🇨🇳 🇮🇩
- **Goldwind** commissioned its first overseas turbine manufacturing plant in Brazil to enhance its South American presence 🇨🇳 🇧🇷
- **Geely's Volvo** takes over **NOVO Energy's** 50GWh battery cell factory in Sweden from Northvolt. 🇨🇳 🇸🇪
- **Trinasolar** and **SunDrive** announce an Australian manufacturing JV 🇨🇳 🇦🇺

Source: CEF Report: **Green capital tsunami**

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

The Global Energy Transition

The world now invests almost twice as much in clean energy as it does in fossil fuels...



Source: IEA World Energy Investments 2024