Observations from Singapore China's New-Energy Supply in a Global Transition

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An observation from World Trade Center Singapore (WTC Singapore). This volume examines China's new-energy supply as a global force — how concentrated production reaches markets worldwide across five technology tracks, six regional markets and ten company cases — and what that means for trade, industry chains and capital.

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PREFACE

Message from World Trade Center Singapore

World Trade Center Singapore (WTC Singapore)

China's new-energy supply has moved from exported products to capacity operating inside other markets, and the bottleneck has shifted from factories and price to rules, capital and organization.

The World Trade Centers Association (WTCA) is an international trade-promotion network whose members are World Trade Centers in cities around the world. Its membership network covers nearly 100 countries and regions and more than 300 cities, connects over 750,000 business members, and is often called the "United Nations of business." World Trade Center Singapore is the only authorized member of the WTCA global network in Singapore — an international business and investment platform dedicated to connecting international trade, industrial cooperation, capital and innovation resources.

Singapore is where global capital, technology and industry converge, and ASEAN's green-finance and regional trade-settlement center. From this position, WTC Singapore observes how China's new-energy supply — highly concentrated in production — reaches markets worldwide, and what that means for trade, industry chains and capital. Singapore is where we observe, not where demand is.

When AI computing power is reshaping electricity demand, when carbon tariffs move from policy text to trade law, and when China's new-energy industry shifts from technologically "following" to globally "leading," these three waves are opening the most intense restructuring of the global energy map since the Industrial Revolution. The International Energy Agency estimates total global energy investment in 2025 at about USD 3.3 trillion, of which clean-energy-related investment is about USD 2.2 trillion — twice investment in fossil fuels.

The restructuring raises questions every market participant faces — buyers, host countries, investors and trade-promotion platforms alike: how to secure supply while managing dependency; how to attract capacity while protecting local industry; and how to use networks such as WTCA for market information, counterparty due diligence and dispute prevention.

~100
WTCA member countries & regions

300+
Cities in the WTCA network

750k+
Business members connected

PREFACE

Observations from Singapore

World Trade Center Singapore (WTC Singapore)

China’s new-energy supply has moved from exported products to capacity operating inside other markets. Demand is global; supply is highly concentrated in China; and the rules of trade, investment and standards are being rewritten. Singapore sits at the intersection of these three forces.

From this vantage the report asks three questions, not on behalf of any supplier but as an observer: how far has China’s new-energy supply reached global markets? How are the opportunities and risks of that supply distributed across regions and actors? And what capabilities do demand-side, host-country and buyer actors — not only suppliers — need to build? The analysis that follows is structured around the market five-dimension framework and draws on public data current to August 2026.

> **We observe a global force; we do not speak for it.**
>
> WTC Singapore observation

EXECUTIVE SUMMARY

Ten Core Judgments

The report distills its findings into ten core judgments that form the analytical main line of the chapters that follow.

This report is framed from Singapore — home of World Trade Center Singapore, a hub where global capital, technology and trade networks meet. From this vantage, the globalization of China's new-energy supply reads less as one country's outbound push than as a regional and global value-chain reordering that a neutral observer can help convene and connect.

01 From "optional" to "structural"

Domestic manufacturing overcapacity, intensifying price competition and high trade barriers are shifting China's new-energy supply from product exports toward localized capacity inside other markets. In 2025 China exported 305 GWh of power and energy-storage batteries, up 50.7% YoY — but that was only 17.9% of annual sales. Global demand continues to expand, and the depth of this shift is still early.

02 The "New Three" diverge internally

In 2025 lithium-battery export value rose 24.4% YoY and NEV export volume doubled, while PV product export value fell for a third consecutive year. The divergence points to different market conditions across tracks: PV supply is being pushed toward overseas capacity and higher-value links, while battery and vehicle supply is still expanding through exports. For buyers and host countries the read-across is that no single track behaves alike.

03 Demand grows fastest outside China

Demand is growing fastest beyond China's home market — the Middle East, Southeast Asia, Latin America and Africa. Chinese-made PV module exports to the Middle East rose 99% YoY in 2024 (+115% to Saudi Arabia) and ~75% in 2025, with the UAE nearly doubling; overseas energy-storage orders reached 353 GWh (+94% YoY), and in H1 2026 hit 298 GWh (+83% YoY). In May 2025 Germany replaced the US as China's largest lithium-battery export market, and new European storage installations rose 45% YoY.

04 Barriers extend to third-country capacity

Trade measures against China's new-energy supply have extended from direct tariffs on China to AD/CVD actions against four Southeast Asian countries, and to probes of capacity in India, Indonesia and Laos. Many markets now make localization an entry condition, and shallow "move assembly elsewhere" localization is no longer sufficient, as the February 2026 US preliminary CVD determinations on India, Indonesia and Laos show. For suppliers this raises market-access cost; for host countries it changes what local content they can actually require.

05 Competition upgrades to standards & rules

Green rules such as CBAM, the EU Battery Regulation's carbon-footprint declarations and ESG disclosure requirements are rebuilding the entry threshold for global new-energy trade. Carbon-footprint data, ESG ratings and localization track records now enter the tender scorecard alongside price. For buyers this raises the bar for what they can verify in a supplier; for suppliers it shifts competition from cost alone toward compliance — rewarding those already reporting and raising cost for those that are not.

EXECUTIVE SUMMARY

Ten Core Judgments (cont.)

06 Market-entry models mature & diversify

From BYD's eight-country factories and CATL's European cluster, to JinkoSolar's Saudi sovereign-fund JV, Envision's India tech licensing and CEE Hydrogen's Middle East electrolyzer localization, China's new-energy supply has entered global markets through greenfield, JV, licensing and EPC+investment models. The range of models means no single market-entry form fits every market; Chapter 5 sets out the structured comparison.

07 Supply lands as linked ecosystems

Vehicles pull in batteries, power stations pull in storage, and OEMs pull in their suppliers — so China's new-energy supply often lands as linked ecosystems rather than single products. Overseas economic-trade cooperation zones and industrial parks have become the carriers where these ecosystems concentrate. For host countries this bundling is both a chance to absorb a full chain at once and a concentration risk if a single anchor project underperforms.

08 Organization is the binding constraint

For suppliers, the binding constraint is often not the product but cross-cultural management, local compliance, localized supply chains and global brand operation. Where overseas revenue is still a small share, the gap between a firm's commercial reach and its organizational capacity is the part most exposed to failure. Host countries evaluating a project weigh the same capacities — local compliance and supply-chain depth signal whether promised capacity will actually materialize.

09 Trade networks: information, due diligence, dispute prevention

Global networks such as WTCA provide soft infrastructure for market access — specifically market information, counterparty due diligence and dispute prevention — and their value does not fall in an era of barriers. When hard rules turn adversarial, the trust a locally rooted trade network carries becomes more prominent: the market intelligence, partner vetting and dispute buffering such a network offers are not quickly built by any single new entrant.

10 From products to ecosystems inside other markets

Over the next five years the shape of global new-energy trade is shifting from "made in China, sold globally" toward capacity and ecosystems operating inside other markets. China's role is moving from product supplier to exporter of technology, capital, standards and system solutions — a change driven as much by host-country demand and rule-making as by supplier ambition. The questions that matter are posture, pace and capabilities — for suppliers, buyers and host countries alike.

> **Demand is global; supply is highly concentrated in China; the rules are being rewritten.**
>
> WTC Singapore observation

METHODOLOGY

Research Scope, Data Sources & Methodology

Research scope

the globalization of China's new-energy supply covers cross-border activity across five tracks — PV, wind power, energy storage, NEVs (including power batteries) and hydrogen — spanning product exports, outbound direct investment, overseas project contracting and technical-service exports. The time dimension focuses on 2020 to H1 2026, traces history back to 2001, and looks forward to 2030. This report is co-published with Hejun Consulting's Power & Electrical Business Unit. The ten cases in Chapter 7 were selected for entry-model representativeness; inclusion does not imply endorsement. No case company paid for inclusion or reviewed the text.

Data sources

China Customs, CAAM and the China Automotive Power Battery Industry Innovation Alliance; international institutions including IEA, IRENA, GWEC, SNE Research, InfoLink Consulting, BNEF and Wood Mackenzie; listed-company annual reports; and mainstream financial media. Statistical calibers differ across institutions and are noted in the text.

How to use this report

Different readers will find different chapters most relevant: market and buyer analysts on Chapters 2, 5 and 6 (panorama, entry models and risks), with the Chapter 4 market map for calibrating where demand and access conditions align; policymakers and host-country planners on Chapters 1, 4 and 8; investors and researchers on Chapter 3 (tracks) and Chapter 7 (cases). Each chapter is relatively independent and can be read selectively.

Methodology

The report combines literature research, data analysis, case studies and expert interviews, and builds two structured frameworks — a five-dimensional market-assessment framework and a neutral view of market-entry forms — to turn complex phenomena into decision tools. Unless a source is cited, the judgments in this report are WTC Singapore's observations.

ANALYTICAL FRAMEWORKS

One lens for the market

Market assessment (5 dimensions): market size — growth potential — policy environment — access barriers — risk level. This five-dimension lens anchors every market and company judgment in this report; the earlier "firm globalization" lens is replaced here by a neutral view of market-entry forms described in Chapter 5.

5	6	5
market dimensions	priority markets	technology tracks

Forward-looking judgments in this report represent WTC Singapore's observations based on public information and do not constitute investment advice.

CHAPTER 1

The New Pattern of Global Energy Transition and the Global Coordinates of China’s New-Energy Supply

This chapter answers two questions: how much demand space does the global energy transition provide, and where does China’s new-energy supply sit on the global map? The former sets the ceiling; the latter sets the starting point. Read from Singapore — the vantage point of this report — that map resolves into three connected parts: China’s supply, demand in other markets, and global capital.

The transition at a glance

3.3 T
Global energy investment expected in 2025 (USD trillion) — IEA

2.2 T
Of which clean-energy tech & infrastructure — twice fossil fuels (IEA)

450 B
Solar PV alone attracts ~USD billion per year — the top single technology (IEA)

140 +
Countries & regions with carbon-neutrality targets, covering ~90% of GHG emissions

Sources: IEA, World Energy Investment 2025; Paris Agreement NDC tracker. Figures as stated in the source report (Chapter 1).

1.1 Global carbon-neutrality progress and the acceleration of energy transition

The global map of net-zero commitments continues to expand, but the pace of execution is clearly diverging. Since the Paris Agreement in 2015, more than 140 countries and regions have proposed carbon-neutrality targets in different forms, covering nearly 90% of global greenhouse-gas emissions.

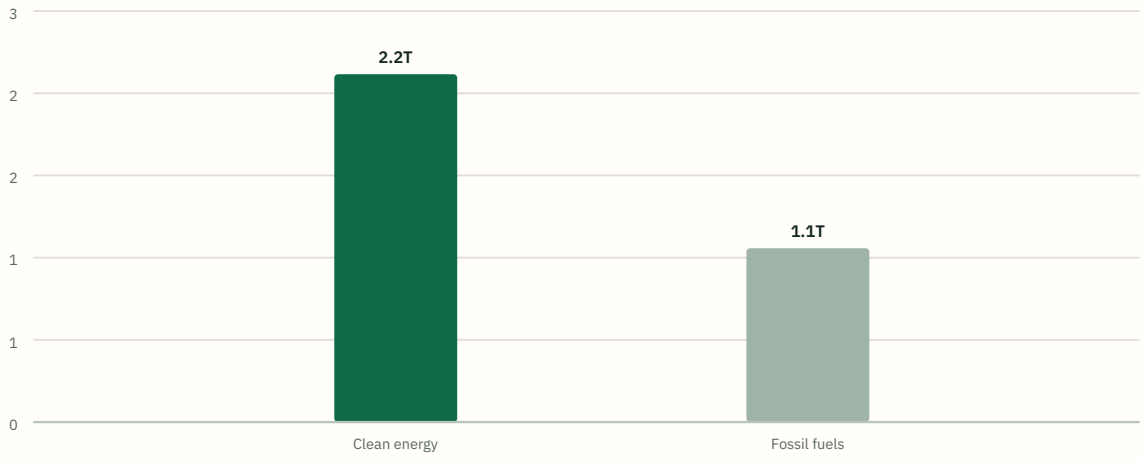
The EU takes the European Green Deal as its master framework and advances it through the “Fit for 55” package and REPowerEU. U.S. climate policy swings with party rotation — since 2025 federal clean-energy policy has clearly swung back, yet state action and market forces continue. China announced its “dual carbon” goals in 2020 and new 2035 NDCs in 2025. Among Middle Eastern oil producers, Saudi Vision 2030 and the UAE Energy Strategy 2050 set ambitious renewable goals.

Investment is the hardest indicator for observing the transition. According to the IEA’s World Energy Investment report, total global energy investment in 2025 is expected at about USD 3.3 trillion, of which clean-energy technologies and infrastructure reach about USD 2.2 trillion — twice fossil fuels at about USD 1.1 trillion.

Solar PV is the single technology attracting the most investment, at about USD 450 billion per year. Energy security and geopolitical conflict have reshaped transition logic: the 2022 Russia–Ukraine conflict pushed Europe off Russian pipeline gas, while the Red Sea crisis since 2025 re-exposed the geographic concentration risk of fossil supply.

Global energy investment, 2025

Clean energy versus fossil fuels (USD trillion)



IEA, World Energy Investment 2025.

> This “two trillion versus one trillion” pattern means that, even amid political-cycle disturbance, capital’s vote on the energy transition already has an irreversible trend character.

1.1 The policy paths of major economies deserve close inspection

The leading economies are pursuing fundamentally different transition logics — rule-driven, market-driven, target-driven and capital-driven — and each logic redraws the competitive map for China’s new-energy supply.

European Union

EU — RULE-DRIVEN

Targets carbon neutrality by 2050. The Net-Zero Industry Act sets a 40% local clean-tech manufacturing benchmark by 2030; the new Battery Regulation imposes carbon-footprint declarations and battery passports; CBAM enters formal implementation from 2026.

United States

US — MARKET INCENTIVES

The IRA once ignited a local manufacturing boom with ~USD 369 billion in climate investment, but since 2025 the federal EV tax credit ended early and wind/solar subsidy phase-down accelerated. Yet Texas and California markets and data-center-driven electricity demand still support record storage and PV demand.

China

China — TARGET GUIDANCE

After the 2020 “dual carbon” goals, wind and solar beat expectations for years; by end-2024 combined capacity hit ~1.41 billion kW, meeting the 2030 target of 1.2 billion kW six years early. September 2025 NDCs propose wind+solar exceeding six times the 2020 level, striving for 3.6 billion kW by 2035.

Middle East oil producers

Middle East — SOVEREIGN CAPITAL

Saudi Arabia’s Vision 2030 and the UAE Energy Strategy 2050 set ambitious renewable goals. Gigawatt-scale PV tenders by Saudi Arabia and the UAE have repeatedly set global record-low tariffs, turning cheap capital and sunshine into export-competitive clean power.

Emerging markets — the other half of the narrative

Middle Eastern oil producers are using sovereign capital to push energy diversification, and Saudi and UAE gigawatt-scale PV tenders have repeatedly set global record-low tariffs. Southeast Asia, South Asia, Latin America and Africa — with billions of people — are in a rapid ramp-up of electricity consumption; their thirst for “cheap, clean and quickly deployable” energy forms the common background of Global South markets.

16.91 GW
Pakistan’s module imports from China in 2024, +127% YoY — low prices activate PPP markets

57
Countries achieved new wind grid connections in 2025 — diffusion beyond mature markets (GWEC)

700 M+
People worldwide still lack electricity — the emerging-market demand base

> Whoever can provide high cost-performance system solutions will win the incremental market of the next decade — the shared background color of the Global South.

1.2 Panorama of global new-energy market demand

Electricity demand has entered a new growth cycle, driven by three forces: electrification of transport, industry and buildings; the explosive power demand of AI data centers (IEA: more than doubling by 2030 vs 2024); and industrialization plus electrification access across emerging markets, where over 700 million people still lack electricity.

Renewables' share of new power capacity

Share of annual global new power installations



IRENA.

510 GW
Solar PV added in 2025 (~3/4 of renewables); cumulative 2.4 TW — IRENA

164.6 GW
Global wind additions 2025, +40% YoY; cumulative 1,299 GW (China ~73%) — GWEC

550 GWh
Global energy-storage battery shipments 2025, +79% YoY — SNE Research

21.47 M
Global NEV sales 2025, +21.5% YoY; ~1 in 4 new cars electric — SNE / IEA

PV is the absolute main force of installation growth: 2025 renewable additions reached 692 GW (+15.5% YoY, 85.6% of all new power), of which solar was ~510 GW; cumulative solar hit 2.4 TW, and it took only two years to break the 2 TW mark — the industry has entered the "TW era." Over fifteen years global PV levelized cost fell more than 80%.

Wind is diffusing from mature markets to the globe: GWEC puts 2025 new installs at 164.6 GW (+40% YoY), 57 countries connected, with onshore additions in Africa and the Middle East up ~50% and ~32% respectively. Storage shipments reached ~550 GWh (+79%) and NEV sales ~21.47 million units — the demand curves differ in shape, but the direction is consistently upward.

Sources: IRENA Renewable Capacity Statistics 2026; GWEC Global Wind Report 2026; SNE Research; IEA Global EV Outlook.

> New fossil-fuel capacity is no longer economical in most markets worldwide — the cumulative inertia of transition investment, not any single political cycle, is what matters.

1.3 The global coordinates of China's new-energy supply

China holds a dominant position in the global new-energy manufacturing map: every link of the PV chain (polysilicon, wafers, cells, modules) exceeds 80% global capacity; in power batteries, Chinese-made products took six of the global top ten by installations in 2025 with combined share above 70.4%; in wind, Chinese-made turbines took the top six of global new hoisting in 2025, with Goldwind first at 29.3 GW. Such concentration is what makes Chinese-made supply attractive on cost and delivery — and what makes buyers and host countries watch for single-point dependency and widening review scope, from components to software and remote operations.

Twenty years ago the PV industry had "both ends outside" — equipment, materials and markets all imported or exported. Today suppliers based in China lead cell-technology iteration (TOPCon, HJT, BC, perovskite), export the LFP battery route in reverse, and keep setting wind-turbine records. The globalization of China's new-energy supply has moved through three stages.

2001–2019

Product exports

Exports of PV modules, turbines and batteries; trade-oriented and asset-light.

2020–2024

Overseas capacity

Trade barriers push production plants into SE Asia, Europe and the U.S.; localized production forms.

2025–

Ecosystems in other markets

Localized supply chains, local R&D, and export of brands and standards — moving from supplying products to anchoring local ecosystems.

CHINA'S 2035 NDC TARGET

Wind & solar capacity to exceed 3.6 billion kW

Announced September 2025, China's new NDC proposes that by 2035 combined wind and solar installed capacity reach more than six times the 2020 level, striving for 3.6 billion kW — the most certain demand anchor for the global new-energy market.

3.6B kW
Wind + solar target by 2035

6×
Versus 2020 installed level

1.41B kW
Wind + solar at end-2024 (2030 goal met 6 yrs early)

> The real challenge is not “whether there is demand,” but “where the demand is and under what rules it is released.”

CHAPTER 2

Panorama of China’s New-Energy Supply Reaching Global Markets: History, Structure and Entry Forms

Using data as the main line, this chapter outlines how China’s new-energy supply has reached global markets — the road traveled, today’s scale and structure, and the forces that move it.

Headline figures, 2025

USD 184.9B
“New Three” exports USD 184.9B (RMB 1.28T), +28% YoY

2.615M
NEV exports (+103.7% YoY)

249.8GW
PV module exports (+5.7%)

EUR 7B+
CATL Hungary plant investment

2.1 middot; REVIEW OF THE JOURNEY (2001–2026)

Four stages of reaching global markets

Stage 1 · 2001–2012

PV exports begin & the first "double-anti" test

First-generation firms such as Suntech and Yingli rose on cost advantages; by 2011 Chinese modules held over half the global market. The 2011–2012 US and EU anti-dumping and countervailing probes brought the first crisis — and two lasting lessons: single-market dependence is fatal, and market share won through low-price competition is unsustainable, as Suntech's bankruptcy restructuring proved.

Stage 2 · 2013–2019

Scaled exports & early overseas plants

Domestic demand (Golden Sun, feed-in tariffs) built the world's largest market. To avoid US/EU duties, Trina, JinkoSolar and JA Solar built Southeast Asian module capacity — the first form of "Made in China + assembled in Southeast Asia." Chinese wind turbines began batch exports, and power-battery firms entered global supply chains as Japanese and Korean automakers opened up.

Stage 3 · 2020–2024

Full-chain reach & the "New Three"

Post-pandemic, the export structure changed historically: 2023 "New Three" exports hit USD 153.1B (RMB 1.06T), +29.9%. Power-battery firms built European plants (CATL's Thuringia plant produced in 2022); BYD built overseas car plants; PV firms extended Southeast Asia bases from modules to cells and wafers. Capital channels — A-shares, Hong Kong stocks, overseas bonds — opened for inverter, storage and component makers.

Stage 4 · 2025–

Deep localization & compliant operation

Three new features: deep localization (BYD's planned overseas capacity exceeds 2 million vehicles; CATL's Germany–Hungary–Spain cluster); "JV + tech licensing" models rising to hedge political sensitivity; and compliance systems becoming standard — carbon footprints, ESG, data and labor compliance are now built into the basic architecture of operating abroad.

From the first double-anti shock to today's deep-localization era, China's new-energy supply has moved from traded products to capacity inside other markets — and from price advantage to the integrated export of technology, standards and brands.

2001
PV export era begins after WTO entry

>50%
Chinese module share of global market by 2011

≈USD 144.5B
"New Three" exports USD 144.5B (RMB 1T), 2023

>2M
Planned overseas NEV capacity by 2025

2.1 middot; MILESTONES

Major events in China's new-energy supply reaching global markets (2020–2026)

Time	Event	Significance
2020	China announced the "dual carbon" goals	Domestic demand engine ignited, scale foundation for reaching global markets
2021	No new overseas coal-fired power projects	Belt and Road fully greened
2022	US IRA signed; CATL's German plant produced	Era of "subsidy competition"; battery capacity reaches global markets
2023	"New Three" exports > USD 153.1B (RMB 1.06T), +29.9%	Exports become a national trade narrative
Oct 2023	EU countervailing probe into Chinese EVs	European market rules turned
Jul 2024	Saudi PIF JVs with TCL Zhonghuan, JinkoSolar	"Chinese tech + Middle East capital" model established
Jul 2024	BYD Thailand plant produced	First overseas wholly-owned passenger-car base
Oct 2024	EU final countervailing duties (17.0%–35.3%)	Europe's "tariffs + localization" dual track
Apr/Jun 2025	US final double-anti on 4 SE-Asian PV nations	"Southeast Asia assembly for the US" model ended
May 2025	Germany replaces US as top lithium-battery market	Historic reconstruction of export flows
Nov 2025	CEE Hydrogen's Saudi JV; electrolyzer localization	Hydrogen equipment enters capacity stage
FY 2025	NEV exports 2.615M (+103.7%); New Three USD 184.9B (RMB 1.28T)	Export scale at a new level
Jan 2026	CBAM enters formal implementation	Carbon rules a hard trade constraint
Feb 2026	US prelim CVD on India, Indonesia, Laos PV	Barriers "pursue" third-country capacity

Source: compiled from public announcements, annual reports and authoritative media. The timeline shows a clear acceleration of both scale and policy friction after 2023.

2.2 middot; SCALE & STRUCTURE

Total volume: the “New Three” as a new trade engine

In 2025 China’s “New Three” exports reached USD 184.9B (RMB 1.28T), up 28% from about USD 144.5B (RMB 1T) in 2024. Lithium-battery exports were 530 million units worth USD 82.5B (RMB 570.86B), rising 15.7% in volume and 24.4% in value. NEV exports reached 2.615 million units, up 103.7% year on year (the CPCA broader caliber was 3.43 million, +70%). PV products, dragged by price declines, saw export value fall 7.3% — a third consecutive annual decline — though volume kept growing, with full-year module exports of 249.8 GW (+5.7%).

In the first half of 2026, export value of EVs and lithium batteries rose 68.7% and 37.6% respectively; NEV exports reached 2.355 million units (up 1.2 times), and CAAM expects full-year NEV exports to exceed 4 million. The picture is one of accelerating, structurally diverging growth.

“New Three” export value (RMB trillion)

2023 – 2025



Source: China Customs; report compilation.

> **The same supply reaching global markets, but three completely different story logics — the divergence of batteries, NEVs and PV is the central puzzle of this chapter.**

530M
Lithium-battery export units (+15.7% vol, +24.4% val)

+68.7%
H1 2026 EV export-value growth

2.355M
H1 2026 NEV exports (×1.2 YoY)

>4M
CAAM 2026 full-year NEV export forecast

2.2 middot; STRUCTURE

Product, regional, entity & investment structure

Key export indicator	2023	2024	2025
Total "New Three" exports	USD 153.1B (RMB 1.06T), +29.9%	~USD 144.5B (RMB 1T)	USD 184.9B (RMB 1.28T), +28%
Lithium-battery export value	—	—	USD 82.5B (RMB 570.86B), +24.4%
NEV export volume (CAAM)	1.203M	1.284M	2.615M (+103.7%)
PV module export volume	207.99 GW	235.93 GW (+13%)	~226 GW (Jan–Oct, +11%)
PV product export value growth	—	Decline	−7.3% (3rd yr)

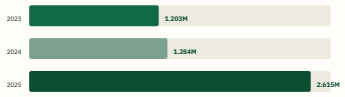
Regional: in 2024 about 47% of PV module exports went to Global South countries — for the first time on par with developed economies. Germany replaced the US as China's largest lithium-battery market in May 2025, ending America's five-year run from 2020. The top-ten NEV markets split roughly half developed, half emerging. Regional export capacity is highly concentrated in the Yangtze River Delta and new western bases — export clusters mirror domestic manufacturing clusters, so the competitiveness of China's new-energy supply abroad is essentially the spillover of domestic ecosystem strength.

Entity: all top global PV module shippers are Chinese (JinkoSolar 86.8 GW and LONGi 86.6 GW led in 2025; leading firms' overseas shipment share rose to 60.1% in H1 2026, +18pp). CATL has ranked first globally for nine years (30% overseas share in 2025); BYD sold ~1.05M vehicles overseas (+145%), with overseas revenue at 38.7%. Large numbers of SMEs "borrow ships" via chain owners, forming an echeloned ecosystem.

Investment: reaching global markets is now capital output. CATL's Hungary plant > EUR 7B; BYD's Szeged plant ~USD 5.78B (RMB 40B); JinkoSolar's Saudi module plant ~USD 1B. Middle Eastern sovereign funds reverse-invest in Chinese assets — a two-way capital cycle.

NEV export volume (CAAM, M units)

2023 – 2025



Source: CAAM.

2.3 middot; HOST-MARKET TOOLS AND CONDITIONS

Host-market tools and conditions

Phased domestic capacity surplus

Main-chain capacity utilization is under pressure; fierce price competition pushes capacity outward in search of margin. Electrolyzer makers, squeezed by a domestic price war, find notably higher gross margins overseas — so overseas revenue share tracks where earnings are.

Trade barriers force localization

When tariff cost exceeds localized-manufacturing cost, capacity moving abroad becomes an economic necessity. The top US double-anti rate on four Southeast Asian PV nations reached 3,521.14%, blocking the "Southeast Asia assembly for the US" model; EU duties pushed automakers based in China to turn European plants from plans into reality. As the transit role of Southeast Asia closes, the region's value shifts from a re-export platform to an end-market — with Singapore increasingly the regional headquarters and treasury node that suppliers based in China use to serve it (Chapter 4).

Explosion of overseas demand

Global PV, wind, storage and EV installation growth is the most fundamental pull. The "electricity access + industrialization + electrification" triple in emerging markets is the fastest-growing source of increment — exactly the demand base these solutions are built to serve.

Host-country industrial policy

The US IRA's 45X credit, India's ALMM/PLI, Thailand's EV3.0/3.5, Saudi Vision 2030 and Hungary's 45% equipment cashback — nations compete with subsidies for capacity and market access, directly incentivizing localized investment by suppliers based in China.

Window of supply-chain restructuring

Post-pandemic, countries pursue resilience and court leading suppliers based in China: Hungary gave BYD cashback and fast approvals; Saudi PIF proactively formed JVs.

Improving institutions & finance

RMB cross-border settlement, wider export-credit insurance, green Belt and Road project finance, and HK listings (CATL ~USD 4.97B (HKD 39.1B); BYD ~USD 5.53B (HKD 43.5B)) cut the cost of reaching global markets. The 2021 coal-power halt greened Belt and Road, raising policy banks' willingness to back overseas new-energy projects.

LOCALIZATION ECONOMICS

When local builds beat exporting

BYD's Hungary plant cost materially less than building in China and exporting to Europe, so localization shifted from a compliance cost to a business case. For host countries the same economics are the lever used to attract capacity; for buyers they change who stands behind local warranty and service.

CHAPTER 03 — SEGMENT DEEP DIVE

In-Depth Analysis of China’s New-Energy Supply by Segment

The five tracks are not equally mature in reaching global markets: PV started earliest and went deepest, and was also the first to encounter comprehensive containment by barriers; storage and hydrogen are the newest and fastest, with windows at their height; vehicles and batteries are in between, in a switchover period from product exports to system presence in other markets.

Five tracks at a glance — maturity & window

PV
Earliest & deepest; first hit by full-barrier containment. Pivoting from module exports to full-chain presence abroad.

Wind
Mid-maturity; turbines move from product to capacity abroad; offshore is the next growth frontier.

Storage
Fastest-growing; ~90% of global battery shipments are Chinese. Leap from cells to system brands.

NEVs & Batteries
In transition; from product exports to system presence in other markets. Overseas revenue share now >25%.

Hydrogen
Newest & fastest-rising; early signals of a PV-style curve abroad. Forward positioning.

Emerging
Perovskite, solid-state & sodium batteries, smart grids & integrated energy services — early-stage bets.

This chapter analyzes each track in turn — its logic of reaching global markets, competitive pattern, regional structure, and the barriers or opportunities that define its current window. Every figure is sourced from the references compiled in the appendix.

> Different maturity, different windows: PV fights for margin and structure, wind and vehicles cross the threshold from products to systems, while storage and hydrogen are still in the rapid-growth phase where first movers set the rules.
>
> — the organizing logic of this chapter

3.1 PV — from module exports to full-industrial-chain presence abroad

Market pattern: export volume rises while value falls — "using volume to offset price."

In 2024, China exported 235.93 GW of PV modules, up 13% year on year; full-year 2025 exports reached 249.8 GW, up 5.7% — another record high. But module prices fell sharply, so 2025 module export value was USD 23.7 billion, down 15.3% — the classic "rising volume, falling value." A bright spot was cells: 2025 cell exports were 111.2 GW (+90.6%), value USD 4.5 billion (+72.6%), with India and Indonesia together ~two thirds. This reflects a shift from exporting modules to exporting intermediate goods such as cells, forming a new division of labor with overseas local module capacity. In H1 2026, module exports were ~128.2 GW (roughly flat YoY) as the industry entered price renegotiation after export-tax rebates were canceled on April 1; cell exports were 59.8 GW (+37%), but fell markedly from June under India's new ALMM local-cell rules.

Competitive pattern: the strong stay strong, but rankings change

By InfoLink, JinkoSolar and LONGi tied for first in global module shipments in 2025 (both ~86.6 GW), followed by JA Solar (69.6 GW) and Trina Solar (67 GW+); the top four accounted for ~58% of ranked shipments. In H1 2026, LONGi, JinkoSolar, Trina and JA Solar held the top four. Leaders build barriers in high-end overseas markets via brand, channel and capital; smaller firms use differentiated products (BC, lightweight, anti-dust modules) for niche scenarios. During industry clearing, overseas orders clearly concentrate toward leaders — the "bankability" lists of owners and financial institutions naturally favor financially robust large manufacturers.

249.8 GW
PV module exports in 2025 (+5.7% YoY), a fresh record; value fell 15.3% to USD 23.7bn

111.2 GW
cell exports in 2025, up 90.6% YoY — the new growth pole

58 %
of ranked global module shipments held by the top four makers based in China in 2025

Capacity abroad: from Southeast Asia to the Middle East

The four Southeast Asian countries (Vietnam, Thailand, Malaysia, Cambodia) were once the main transit hub for US-bound exports, but the 2025 US final AD/CVD determinations (up to 3,521.14%) basically ended that function. The focus shifted to the Middle East: in July 2024, Saudi PIF formed JVs with multiple PV firms based in China; TCL Zhonghuan will build 20 GW/year of ingot and wafer capacity in Saudi Arabia, and JinkoSolar 10 GW/year of cell and module capacity. JinkoSolar's OXAGON (NEOM) plant totals nearly USD 1 billion and is expected into production in early 2026.

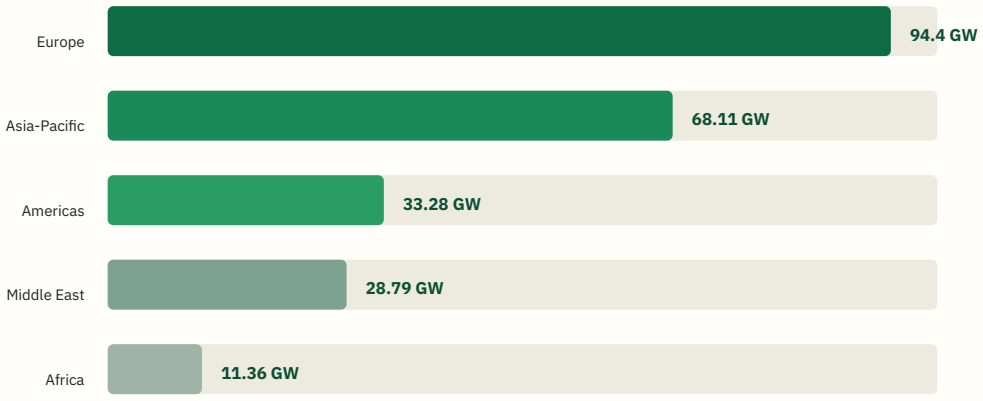
3.1 PV — regional structure & capacity abroad

Regional structure: Europe declines, the Middle East rises, the Global South takes over.

In 2024, Europe imported 94.4 GW from China (–7%); Asia-Pacific 68.11 GW (+26%, led by Pakistan at 16.91 GW); the Americas 33.28 GW (+10%, Brazil 22.5 GW = 68%); the Middle East 28.79 GW (+99%, Saudi Arabia 16.55 GW +115%); Africa 11.36 GW (+43%). The Middle East surpassed the Americas as the third-largest regional market. In 2025, per Gaixi Consulting, EU imports rebounded to 113.5 GW (+20.3%); the Middle East continued high growth (+74.6%, UAE nearly doubling); India (–31%) and Brazil (–38.8%) contracted under local-manufacturing policy and tariffs.

Figure 6 — Major regional markets for China's PV module exports, 2024

GW imported from China



Source: custom Chinese PV module export statistics by region, 2024; compiled by World Trade Center Singapore.

Middle East capacity layout of PV suppliers based in China

Company	Link	Capacity	Location	Progress
JinkoSolar	Cells + modules	10 GW	OXAGON, NEOM, Saudi Arabia	Total investment ~USD 1bn; production expected early 2026
TCL Zhonghuan	Ingots & wafers	20 GW	Saudi Arabia	JV with PIF underway
Trina Solar	Trackers	3 GW	Jeddah, Saudi Arabia	Capacity in place
Arctech	PV brackets	5 GW	Jeddah, Saudi Arabia	Phase I started Sept. 2024
Other firms	Polysilicon, cells, aux.	—	Saudi Arabia, Oman, etc.	~20 companies; full four-material + auxiliary coverage

Source: company announcements, 2024–2025; compiled by World Trade Center Singapore. Table 4 — Middle East capacity layout of Chinese PV companies.

3.1 PV — technology, model innovation & profitability

Technology routes: faster iteration reshapes the competitive pattern.

Over three years, cell technology completed the mainstream switch from PERC to TOPCon, with conversion efficiency approaching the crystalline-silicon theoretical limit. BC scales in high-end distributed markets on appearance and efficiency; HJT competes to be the next mainstream via process simplification and bifaciality; perovskite tandem cells move from labs to pilot lines as the key to breaking the silicon ceiling. New-technology gaps are the core bargaining chip for suppliers based in China against new local entrants in the US/EU; meanwhile patent-licensing models (Trina × HoloSolis) mark a refined trade-off between "technology secrecy" and "technology monetization."

Model innovation: patent licensing & asset-light export

In September 2025, Trina signed a patent-license agreement with French start-up HoloSolis, authorizing its n-type TOPCon technology for a 5 GW-class plant in France — a landmark shift from "product export" to "IP export." DAS Solar set up its European HQ and EU operations center in Madrid, close to the policy and market frontier.

Price & profitability: the rationality of reaching global markets amid clearing

From 2023–2025, main-chain prices fell sharply; domestic links were generally loss-making, and the industry entered deep clearing. Low-price modules objectively accelerated global installation penetration, but profitability pressure weakened SMEs' ability to invest overseas, concentrating suppliers reaching global markets faster toward leaders. Since 2025, policy guidance against cutthroat competition has led the industry back to value creation — the same module sells at significantly higher price and gross margin in high-end European/US markets and large Middle Eastern projects.

Technology iteration reconstructs competitiveness

In 2025, all companies on the global module shipment list were based in China, shipping ~536 GW in total; TOPCon's shipment share was already close to 95%. In H1 2026, leading companies' overseas shipment share rose to 60.1%, up ~18 percentage points year on year.

~95%
TOPCon share of Chinese module shipments, 2025

536 GW
total 2025 shipments of suppliers based in China on the global module list

60.1%
leading makers' overseas shipment share, H1 2026 (+~18pp YoY)

3.1 PV — BUYER PERSPECTIVE

Concentration is a dependency risk as well as a cost advantage

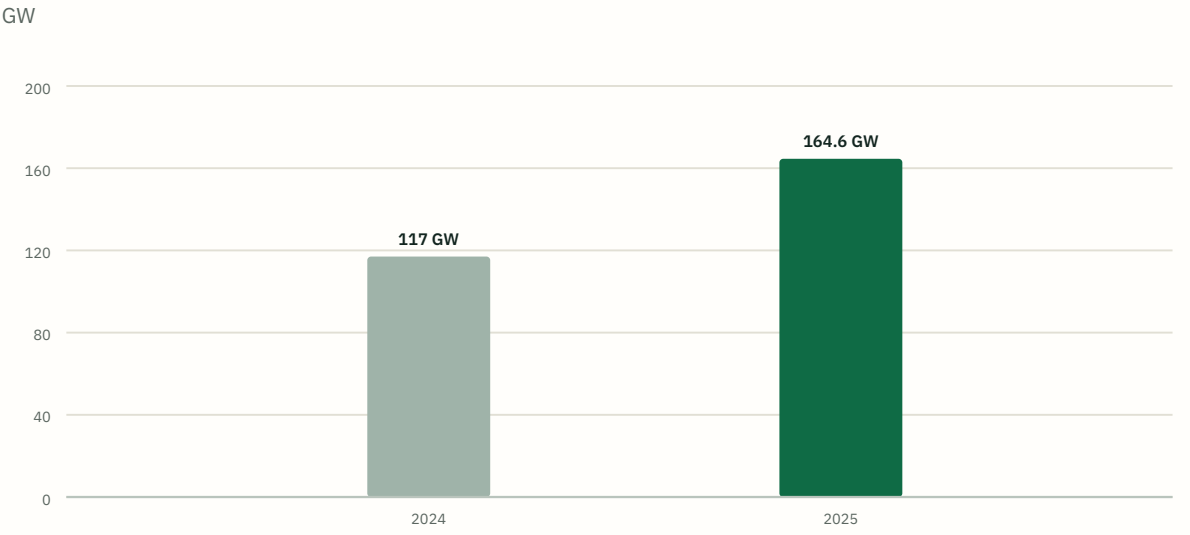
PV supply is concentrated across every chain link (>80% of global capacity) and the top four makers hold ~58% of ranked module shipments. Buyers gain from falling module prices (module exports rose in volume while export value fell 15.3%). The same concentration puts detention review (UFLPA), stacked tariffs above 109% and bankability lists that favor large manufacturers on the buyer's side of the ledger.

3.2 Wind power — turbine presence abroad & the offshore frontier

Global market: new installations hit a record high; emerging markets take over.

In 2025, the world added 164.6 GW of wind power (+40% YoY); cumulative installations reached 1,299 GW. China (~120 GW), the US, Germany, India and Brazil were the top five. Onshore wind in Africa and the Middle East grew ~50% and ~32% YoY — the most dynamic incremental regions. GWEC forecasts ~969 GW of additions from 2026–2030 (~194 GW/year); 2030 additions reach 211.8 GW, with offshore rising to 16%.

Global wind power additions, 2024 vs. 2025



Source: GWEC Global Wind Report; compiled by World Trade Center Singapore.

164.6 GW
global wind additions in 2025, up 40% YoY — a record

1,299 GW
cumulative global installations at end-2025

16 %
offshore share of additions by 2030 (GWEC forecast)

Turbines based in China: from product to capacity abroad

Europe is the largest overseas market, with Eastern and Southern Europe as short-term breakthrough points; orders in India and the Caspian region scale rapidly — Envision holds >10 GW of India orders and, with SANY Renewable, lays out local capacity via technology licensing. In the Middle East, Envision won 3.6 GW of Saudi orders and plans local capacity in JV form; Goldwind, Mingyang, Windey expand in South Korea, Vietnam and the Philippines. Components reach global markets too — Ailang's Morocco blade base has achieved batch delivery.

3.2 Wind — competitive gap, offshore & the road ahead

Competitive pattern: the gap is not products but certification, track record and financing insurability.

Relying on the world's largest home market, makers based in China already occupy most seats in global new-installation rankings, yet their overseas share (especially in Europe and the US) remains limited. The breakthrough path: build track records in emerging markets with cost performance and delivery (Envision's 10 GW-scale India orders).

Offshore wind: European experience, Chinese opportunity

European offshore wind has entered a new auction cycle, but local supply (Siemens Gamesa, Vestas) is high-cost and tight on delivery — an opening for Chinese-made turbines and components. "Price advantage + delivery capability" competing in European offshore is moving from idea to reality, but three thresholds remain: certification, bankability and geopolitics.

Components & O&M services reach global markets together

China is the world's largest wind-component supply base; castings, main shafts, towers, blades, gearboxes are deeply embedded in the global supply chain. As turbines reach global markets at scale, blades (Ailang's Morocco base), towers and submarine cables follow; meanwhile O&M, retrofit and spare-parts markets for overseas wind farms accumulate. A turbine's 20+-year life cycle makes O&M a "slow business with long flowing water" — an increasingly important part of overseas revenue.

Key overseas moves by wind suppliers based in China

India	Envision Energy holds >10 GW of orders; local capacity via technology licensing with SANY Renewable	*largest single overseas market build-out*
Saudi Arabia	Envision wins 3.6 GW of orders; local capacity planned in JV form	*"Chinese tech + Middle East capital"*
Morocco	Ailang Technology's blade base achieves batch delivery	*components follow turbines out*
KR · VN · PH	Goldwind, Mingyang Smart Energy, Windey actively expanding	*multi-market diversification*

Source: company announcements and public reporting; compiled by World Trade Center Singapore.

> The core contradiction of wind supply reaching global markets is not demand but trade and financing barriers — the "security review" narrative around turbines based in China in Europe and the US is heating up. Technology licensing, local JVs and deep binding with host-country developers prove more durable than direct exports.
>
> — wind supply trend judgment

3.2 WIND — BUYER PERSPECTIVE

Ranking leadership, limited overseas share

Chinese-made turbines took the top six places in global new hoisting in 2025, with Goldwind first at 29.3 GW, yet their overseas share in Europe and the U.S. remains limited. Buyers gain on price and delivery; certification, bankability and ‘security review’ of remote O&M and software are where the exposure sits.

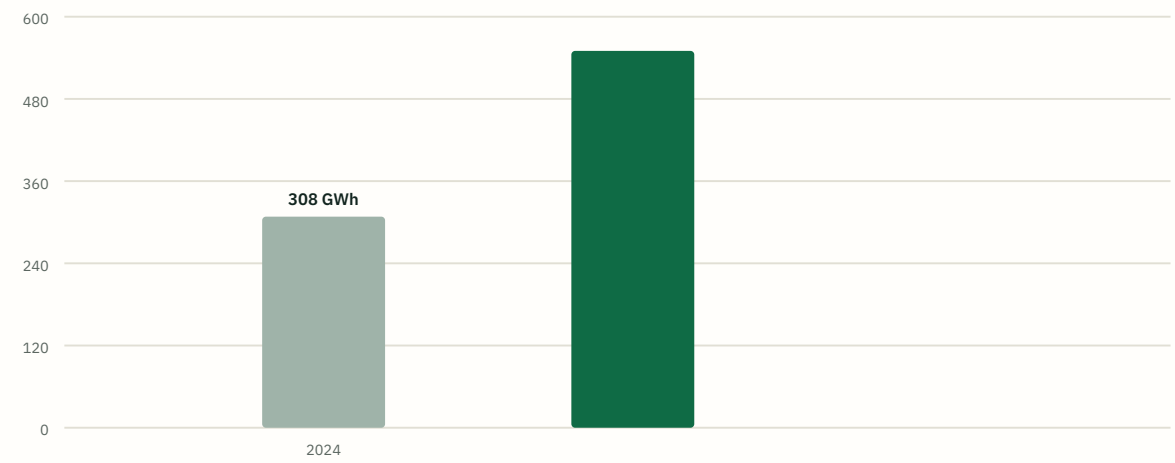
3.3 Energy storage — the fastest-growing track reaching global markets

Logic of the global market explosion: storage is rigid infrastructure for high-renewable grids.

In 2025, global energy-storage battery shipments were ~550 GWh (+79% YoY); the US (57.6 GWh, +29%), Europe (27.1 GWh, +45%) and Australia (4.9 GWh) all set records. AI data-center power, grid frequency regulation, capacity markets and mandatory "PV with storage" policies form multiple demand engines. In H1 2026, global shipments were 461.3 GWh (+71%); half-year exceeded all of 2024, and the full year is expected to approach 1 TWh.

Global energy-storage battery shipments

GWh



550 GWh 2025 **461.3 GWh** H1 2026

Source: CESA Energy Storage Application Branch; industry shipments data, 2024–H1 2026; compiled by World Trade Center Singapore.

Supplier strength: full-chain advantage from cells to systems

Chinese-made storage batteries account for ~90% of global shipments; CATL has ranked #1 for five consecutive years (30.4% share in 2025). Per CESA, new overseas orders for Chinese-made storage reached 353 GWh in 2025 (+94%), including 346 GWh of EPC, systems and batteries. In H1 2026, Chinese suppliers signed 298 GWh of overseas storage orders (+83%) — Europe first at ~120 GWh (> one third), Australia ~30 GWh, then the Middle East, India and Chile.

~90%
of global energy-storage battery shipments originate in China

353 GWh
new overseas orders & cooperation signed by storage suppliers based in China in 2025 (+94%)

30.4%
CATL's global storage-battery market share in 2025 — #1 for five straight years

The "energy-need" scenarios of emerging markets (South Africa, Pakistan, Lebanon, Nigeria): with unstable supply, "PV + storage" is no longer an environmental choice but a rigid need — outage costs far exceed system LCOE. First movers build durable advantage via channel depth and after-sales networks.

3.3 ENERGY STORAGE — BUYER PERSPECTIVE

~90% supply share cuts cost and raises a question

Chinese-made storage batteries account for about 90% of global shipments. Buyers gain on price and availability; the same concentration means project availability, safety certification and grid compliance rest on a narrow supplier set whose carbon-footprint and due-diligence data buyers now verify themselves.

3.3 Storage — paths diverge & the regulation wall

Competitive pattern: the leap from cell manufacturing to system brands.

The protagonists expand from cell suppliers (CATL, BYD, EVE) to system integrators (Sungrow, HyperStrong) and supporting firms in thermal management, fire protection and PCS. In large-storage value distribution, cells are ~half; integration, grid connection and long-term O&M are the other half — precisely the higher-margin, stickier part, and the main battlefield for moving from "selling equipment" to "selling systems and services."

Residential storage

Depends on	**channels & brands**
Europe	**demand recovered post-clearing**
Edge	**high electricity prices**

C&I storage

Depends on	**financial solutions**
Models	**storage-as-a-service, leases**
Markets	**mature EU & US**

Large storage

Depends on	**project delivery**
Scale	**moving to GWh level**
Need	**consistency, fire, O&M**

Off-grid large storage

Scenario	**tourist / mining areas**
Example	**Saudi AMAALA 760 MWh**
Region	**Middle East**

Access thresholds: certification, standards, grid rules

The invisible barriers lie in national grid-connection standards (Germany's VDE, UK's G99, US UL9540/NFPA855), battery carbon-footprint rules (the EU Battery Regulation) and localization requirements (US IRA domestic-content bonus).

BOX — THE EU BATTERY REGULATION & BATTERY PASSPORT

Regulation (EU) 2023/1542: the "master rulebook" for batteries reaching global markets

Phased carbon-footprint declarations begin in 2025 (EV batteries first); a "battery passport" recording material origin, carbon footprint and recycled content begins in 2027; progressive due-diligence and recycled-content targets follow (minimum recycled content from 2031). For battery suppliers based in China, the passport is essentially a "race of data capability" — trusted full-chain data from mine to recycling makes the threshold a data-capability test for suppliers, and a verification task for buyers.. Leading firms are already building zero-carbon factories and recycling systems in Europe.

2027
battery passport takes effect — full-chain data becomes a barrier

2031
minimum recycled-content targets begin

3.4 NEVs & batteries — from product export to system presence in other markets

Export scale leaps: third consecutive year as world's #1 vehicle exporter.

In 2025, China exported 7.098 million vehicles (+21.1%); NEV exports were 2.615 million (+103.7%). Structurally, PHEV exports were 969,000 (+226.5%, the fastest segment); BEV exports 1.646 million (+66.7%). Average export price was ~USD 16,000 — clear cost-performance advantage, and a story of structural upgrading toward more sophisticated NEV models.

Powertrain	2025 export volume	YoY growth
Battery electric (BEV)	1.646 million units	+66.7%
Plug-in hybrid (PHEV)	969,000 units	+226.5%
NEV total	2.615 million units	+103.7%

Source: China Association of Automobile Manufacturers (CAAM). Table 5 — Powertrain structure of China's NEV exports, 2025. PHEV's tripling reflects both a "transition-tech dividend" under uneven charging infrastructure and a product-switch strategy tied to EU countervailing duties (BEVs only).

Power-battery overseas share

Figure 7 — Global power-battery installation market share, 2025



Source: SNE Research / company disclosures; compiled by World Trade Center Singapore. Of 463 GWh installed overseas, six Chinese suppliers held 218 GWh (47.2%, +~10pp YoY).

3.4 NEVS & BATTERIES — BUYER PERSPECTIVE

70.4% of installations, one sourcing question

Six of the global top ten by power-battery installations in 2025 were Chinese-made, with combined share above 70.4%. Lower pack cost accelerates fleet electrification; it also concentrates a vehicle's most strategic component in few hands, so buyers weigh local content, warranty continuity and second-source options.

Market & competitive pattern

Top five NEV export markets in 2025: Belgium, the UK, Mexico, Brazil, the Philippines. Competition among automakers based in China is replicated overseas (Thailand alone gathers SAIC, Great Wall, BYD, GAC, Changan). The open question is whether the domestic "price war" gets exported too, and whether the premium of brands based in China holds. In the power-battery chain, CATL's German plant is at full production, Debrecen (Hungary) phase I complete, Spain and Indonesia advancing; leading lithium-battery firms' overseas revenue share generally exceeds 25%.

3.4 NEVs & batteries — strategy after the EU duties

Strategy adjustment after the EU countervailing investigation.

In Oct. 2024, the EU imposed countervailing duties atop the 10% base tariff: BYD 17.0%, Geely 18.8%, SAIC 35.3%, other cooperating 20.7%, non-cooperating 35.3% (Tesla 7.8%). Three responses: (1) localized production — BYD's Szeged (Hungary) plant (phase I 150,000 units/year, ~USD 5.78B (RMB 40B)) went into production in Q4 2025, with comprehensive cost >30% lower than China-made exports to Europe; (2) product-switch — PHEVs are not covered by the duties and became a buffer; (3) China-EU minimum-price undertaking talks preserve an export channel.

International competition: the state of rivals matters too

European electrification twisted in 2024–2025; Japanese and Korean battery growth slowed — from Jan–Apr 2026, the combined share of LG Energy Solution, SK On and Samsung SDI fell to 15.6% (–2.1pp YoY). Rivals' share contraction narrows the choice available to European and American automakers. — but Europe and America's policy support and customer protection will not disappear. Competition is a long run, not a sprint.

BYD's overseas manufacturing bases

Base	Capacity (planned)	Start	Positioning
Rayong, Thailand	150k/yr (→300k+)	Jul 2024	ASEAN & RHD; reverse-exports to Europe from Aug 2025
Jizzakh, Uzbekistan	50k → 300–500k	Jun 2024	Central Asia & Middle East
Camaçari, Brazil	150k → 600k	Jul 2025	South America; USD 1.05B (BRL 5.5bn) total
Szeged, Hungary	150k → 500k	Q4 2025	Europe's first passenger-car base; ~USD 5.78B (RMB 40B)
Subang, Indonesia	150k	2026	"nickel — battery — vehicle" chain
Sihanoukville, Cambodia	10k (phase I)	Q4 2025	low-cost assembly node
Manisa, Turkey	150k	2027	USD 1bn; radiates Europe
Perak, Malaysia	CKD assembly	H2 2026	ASEAN supplementary node

Source: company announcements; compiled by World Trade Center Singapore. Table 6 — BYD's overseas manufacturing bases.

Commercial vehicles are an easily overlooked advantage: Chinese electric buses enter European, Latin American and Middle Eastern fleets in batches; full life-cycle cost (TCO) is the core scoring item in government/operator tenders. Integrated system exports now pull charging piles, battery-swap stations and after-sales networks overseas together.

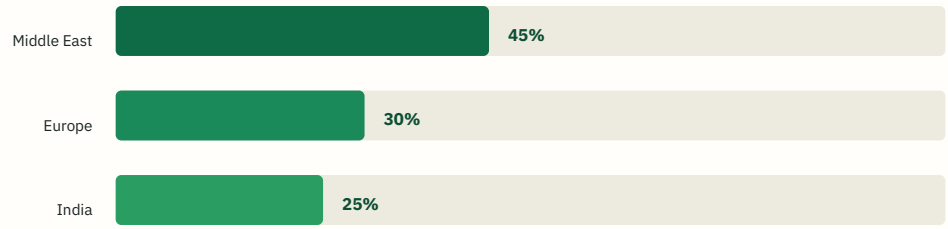
3.5 Hydrogen & emerging tracks — forward positioning

Electrolyzers: early signals of replicating the PV-style curve of reaching global markets.

China holds ~60% of global electrolyzer capacity; alkaline systems are priced at only 1/4–1/3 of comparable European products, PEM 20%–40% cheaper. In 2024, China's overseas electrolyzer awards were 683 MW, share jumping from ~1% (2023) to 36%; in 2025, domestic public tender demand expanded to 6,055 MW (+~1.6x). Leading firms' overseas order share has reached ~28% and is expected to exceed 50% within three years. In the overseas order structure, the Middle East (Oman, Saudi Arabia) is 45%, Europe 30%, India 25%.

Overseas electrolyzer order structure, 2025

share of overseas orders



Source: Xiangehui Hydrogen Database; company announcements; compiled by World Trade Center Singapore.

Middle East green-hydrogen & emerging technology bets

Saudi Vision 2030 plans USD 50bn in hydrogen investment; Sungrow Hydrogen won Oman's 320 MW green-ammonia project, and Hydrogen Energy and LONGi Hydrogen secured Saudi/Oman/Morocco orders. In Nov. 2025, CEE Hydrogen and Saudi GECI formed a JV — the first Chinese electrolyzer localization in the Middle East, retracing PV's "product export → local manufacturing" path. Next-generation technologies (perovskite tandem, solid-state, sodium-ion) are on the eve of industrialization; CATL plans sodium-ion mass production in 2026, using cost and low-temperature performance to open broader scenarios.

> **Green-hydrogen demand is clarifying: short-term green ammonia, green methanol and refining substitution commercialize first (Middle East/North Africa/Australia exporting to Europe, Japan, Korea); medium-term green-H2 metallurgy (DRI) and SAF rise under European carbon rules. The opportunity lies not only in selling equipment, but in entering export-oriented projects with an "equipment + engineering + green-power" package. Smart grids and integrated energy services — UHV, smart meters, VPP — are soft-power reach: small per project, but sticky and standard-driving.**
>
> — hydrogen & emerging tracks outlook

3.5 Hydrogen & emerging tracks — BUYER PERSPECTIVE

An early track, watched before it concentrates

China holds ~60% of global electrolyzer capacity and alkaline systems are priced at 1/4–1/3 of comparable European products. Buyers gain cost and delivery speed; the track is still early, and it is worth watching before supply concentrates as it has in PV and storage.

3.6 Concentration, from the buyer

Why buyers value it

~90% of storage supply, a PV chain above 80%, power batteries at 70.4% of installations and a top six of wind makers that is all Chinese add up to the same buyer case: cost, delivery speed and full-chain completeness.

Both readings are true at once.

Why buyers watch it

The same concentration reads as a single point of failure. Procurement review reaches into critical software and remote O&M, and standards set by one supply base can mean lock-in.

CHAPTER 4

Deep Map of Regional Markets

No two markets in the world are the same. This chapter scans six regional markets through one unified lens — what each host market gains, what access conditions it sets, and what exposure it bears as the globalization of China's new-energy supply extends into each market.

Reading each market, keep three clues in view: first, is demand real and sustainable, or a subsidy pulse? Second, what form do the barriers take — tariffs, localization rates, or certification and standards? Third, how concentrated is the supplying side, and what that means for the buyer's own resilience?

Southeast Asia
Nearshore capacity hinterland & demand growth pole

Middle East
Energy-transition upstart, capital hot land

Europe
High-standard market; attack & defense on rules

Latin America
Resources + markets; exchange-rate risk

Africa
Long-term, electricity-access driven

North America
Highest value, thickest barriers

In this chapter

4.1 Southeast Asia — capacity hinterland and demand growth pole; Thailand's EV capacity versus sales gap, Indonesia's RUPTL demand wave, Singapore as the observation vantage.

4.2 Middle East — the fastest-growing region; sovereign-capital JVs and the IKTVA localization scorecard.

4.3 Europe — rules, not tariffs: NZIA, CBAM and the Battery Regulation as systemic thresholds.

4.4 Latin America — resources and markets together; Brazil's tariff-for-manufacturing leverage.

4.5 Africa — the electricity-access story; off-grid and microgrid demand matching Chinese-made new-energy systems.

4.6 North America & others — the closed door and the three remaining channels; Australia's storage boom.

4.7 Attractiveness matrix — the six markets placed on one map, with segment-level priorities (Table 7).

4.8 Four policy orientations — EU, US, Gulf and ASEAN policy stances stated side by side.

4.1 Southeast Asia — a nearby capacity hinterland

What the host markets gain. Southeast Asia gains lower installed cost of clean power and faster power access as China's new-energy supply locates production close to demand. Under the RCEP framework, regional zero tariffs and geographic proximity let capacity land near multiple markets, while accelerating industrialization in Indonesia, Vietnam and the Philippines is building a real local market: in 2025, China's NEV exports to Indonesia, Thailand and the Philippines all entered the global top ten. The ten ASEAN countries have a combined population of nearly 700 million, and most have formulated carbon-neutrality targets and renewable-energy plans, so capacity built in one market can radiate the region under RCEP zero tariffs. Thailand is Southeast Asia's NEV manufacturing center — BOI's EV3.0/EV3.5 subsidies attracted 27 and 10 automakers respectively, and BYD's Rayong plant (150,000 units/yr, production started July 2024) is its first overseas wholly owned passenger-car base.

~700 M
combined population of the ten ASEAN countries

5.5 ×
Thailand's BEV capacity (386k units/yr) versus 2024 local sales (~70k)

3 mkts
Indonesia, Thailand & the Philippines — all in China's NEV export top ten, 2025

What access conditions they set. Market entry runs through incentives and localization thresholds rather than open tariffs. Thailand's BOI EV3.0/EV3.5 subsidies drew automakers in; Vietnam and Malaysia, long receivers of PV modules and battery materials, saw their U.S.-bound function shrink under U.S. AD/CVD measures, pushing positioning toward regional markets and intermediate goods. Malaysia, while keeping its module base, is attracting data-center power and storage investment.

What exposure they bear. The risk is overcapacity and homogeneous competition within the region. Thailand currently has 21 BEV production projects with annual capacity of 386,000 units, while local BEV sales in 2024 were only about 70,000 units. Vietnam's northern industrial-zone outages are pushing C&I PV-storage demand up rapidly, and the Philippines, with power shortages and high electricity prices, is releasing PV and storage demand quickly; Malaysia's data-center construction boom is making it an emerging buyer of Chinese-made power equipment and storage systems.

2024.07	BYD Rayong plant starts production — 150,000 units/yr	*first overseas wholly owned PC base*
2025	NEV exports to Indonesia, Thailand, Philippines all enter global top ten	*demand pole confirmed*
2025 Q4	BYD Cambodia plant phase I (10,000 units/yr) into production	*low-cost assembly node*
2026	BYD Subang plant (150,000 units/yr) targets "nickel — battery — vehicle" chain	*resource-linked layout*

4.1 Southeast Asia — the Singapore anchor & Indonesia's demand wave

Singapore as vantage, not demand. Singapore is where we observe, not where demand is. It plans to deploy at least 2 GWp of solar by 2030 and import up to 6 GW of low-carbon electricity from abroad by 2035, and through regional grid interconnection and a green-finance ecosystem it is becoming Southeast Asia's trading, dispatch and financing center for clean energy. Demand for new-energy equipment concentrates in the region's larger markets; Singapore's own procurement is small. *WTC Singapore, one of the joint publishers of this report, is an important node in this observation network.*

Reading the region. From this Singapore vantage, the regional scan turns to Indonesia's demand wave and the exposure that follows concentrated supply.

Indonesia — nickel resources anchor the case. BYD's Subang plant (150,000 units/yr, production in 2026) targets the "nickel ore — battery — vehicle" chain; CATL's Indonesia battery industrial-chain project has an investment scale at the industry forefront. The government requires a 40% component localization rate (TKDN) before 2026, and PV projects with 40% localization can receive a tariff uplift — so far, the prevailing form of entry pairs local manufacturing with Chinese-made capability.

69.5 GW
new generation capacity in the 2025–2034 RUPTL — Indonesia's "greenest ever" plan

76 %
of new capacity from renewables & storage — 42.6 GW renewables + 10.3 GW storage

$185.5 bn
total plan investment, ~73% undertaken by independent power producers

The plan creates almost all-round demand for PV, storage, transmission and transformation, and power-engineering capability. With more than 900 inhabited islands and a dispersed grid structure, off-grid "PV + storage" solutions are a rigid need — precisely the field where Chinese-made new-energy systems are most complete and cost-performance strongest. Across the region the entry logic is turning from tariff arbitrage to serving real domestic demand.

> **WTC Singapore observation: the logic is shifting from tariff avoidance to serving domestic demand, yet homogeneous capacity competition within the region is visible — Thailand's EV capacity already runs well ahead of market absorption.**

4.2 The Middle East — transition upstart & capital hot land

What the host markets gain. The Gulf gains transition capital deployment at scale: oil revenue funds energy transition, the world's lowest sunlight costs provide project economics, sovereign funds provide partners, and large centralized projects provide order scale — making this the fastest-growing region for China's new-energy supply reaching global markets in 2024–2026. Saudi Vision 2030 plans more than 100 GW of renewable energy; in 2024 Saudi Arabia imported 16.55 GW of PV modules from China, up 115% year on year, and from January to October 2025 the UAE imported 8.18 GW. NEV imports are scaling rapidly, with the UAE entering China's NEV export top ten in 2025; storage is moving from PV procurement to integrated PV-storage, marked by Saudi AMAALA off-grid storage (760 MWh). Green-hydrogen projects have started in Oman and Morocco (Sungrow Hydrogen won Oman's 320 MW green-ammonia project).

What access conditions they set. Entry runs through localization scoring and sovereign-capital joint ventures. IKTVA (In-Kingdom Total Value Add) scores bidders' local procurement, employment, R&D and training against bid qualification and price preference; PIF has formed joint ventures with TCL Zhonghuan (20 GW wafers) and JinkoSolar (10 GW cells and modules), localizing core manufacturing links. The prevailing cooperation model pairs Chinese-made technology, Middle Eastern capital and local resources, with joint ventures as the mainstream form.

What exposure they bear. Projects are large and payments good, but IKTVA and Saudization bars rise yearly, and Japanese, Korean, European and American EPCs compete fiercely; contract performance and compliance capability are the key deciders. Renewables tenders in Qatar, Kuwait and Oman are also accelerating, broadening the field of competitors.

BOX · THE LOCALIZATION LEVER

Saudi IKTVA — the "scorecard" logic of localization

IKTVA (In-Kingdom Total Value Add) is the core tool of Saudi localization policy: tenders score bidders' local procurement, employment, R&D and training against bid qualification and price preference.

Read: IKTVA works as a competitive lever rather than a fixed compliance burden — higher scorers win price preference. JinkoSolar and TCL Zhonghuan traded JV plants for PIF binding; CEE Hydrogen led with local electrolyzer manufacturing.

> **Note: projects are large and payments good — but IKTVA and Saudization bars rise yearly, and Japanese, Korean, European and American EPCs compete fiercely. Contract performance and compliance capability are the key deciders.**

4.3 Europe — attack & defense in a high-standard market

What the host market gains. Europe is the developed market with the most stable demand and the birthplace of green rules. Its 27 countries plus the UK form a ~500-million-person high-purchasing-power market with legislation-locked decarbonization targets — the world's highest demand certainty. Germany is the storage locomotive; the UK leads large-storage and offshore wind; Southern Europe (Spain, Italy, Greece) drives ground-mounted PV and green-hydrogen; Eastern Europe (Hungary, Poland) draws vehicle and battery capacity on cost.

What access conditions it sets. Rules, not tariffs, form the threshold. The NZIA (effective 2024) targets local manufacturing meeting 40% of demand by 2030; CBAM took formal effect on January 1,2026; and the Battery Regulation's carbon-footprint rules have phased in since 2025. Countervailing duties (17.0%–35.3%, on top of the 10% base tariff) changed the cost equation for NEVs, pushing localized production (BYD Hungary, Chery Spain, Leapmotor using Stellantis' Poland capacity) and PHEV switching as the two hedging paths.

What exposure it bears. Europe holds the densest overseas footprint of China's battery supply — CATL (Germany, Hungary, Spain), Gotion (Germany), CALB (Portugal), EVE Energy and Sunwoda (Hungary) form a clustered supply system close to Volkswagen, BMW, Mercedes-Benz and Stellantis, with CATL's European share close to 40%. In 2025 China exported 113.5 GW of modules to the EU (+20.3%); residential storage recovered after inventory clearing and large storage added 27.1 GWh (+45%); technology licensing (Trina × HoloSolis) became a new asset-light entry model. Europe is also the largest overseas market for Chinese-made wind turbines — and the same rule density that raises entry cost also raises the buyer's own compliance exposure.

BOX · ENTRY RULES IN THE CARBON-TARIFF ERA

Understanding CBAM

CBAM took formal effect on January 1, 2026: importers buy certificates at EU ETS prices, covering electricity, hydrogen, steel, aluminum, cement and fertilizers (a 2025 simplification exempts ~90% of small importers via a 50-ton threshold).

For Chinese-made supply the impact is twofold: direct carbon-cost accounting for included categories (green hydrogen, electricity), and the precedent that "carbon" is now a trade-pricing dimension — foreshadowing downstream carbon rules for batteries, modules and vehicles.

> **WTC Singapore observation: the essence of the European market is not tariffs but rules — carbon-footprint accounting, CSDDD due diligence, GDPR and CRMA supply-chain requirements form systemic thresholds that bind both suppliers and buyers.**

4.4 Latin America — an emerging hot land valuing resources and markets

What the host markets gain. Latin America combines new-energy power markets (Brazil and Chile's PV and wind), NEV markets (Brazil, Mexico) and key mineral resources (lithium in Chile and Argentina, nickel and graphite in Brazil). The region holds the world's richest lithium resources — the "lithium triangle" accounts for more than half of global reserves — plus superior wind and solar and an auto market of 650 million people. Brazil, Latin America's largest auto and power market, imported 22.5 GW of PV modules from China in 2024 (68% of the Americas); in H1 2026 it became China's largest NEV export market (~300,000 units).

What access conditions they set. Brazil's policy of gradually raising EV import tariffs uses tariff leverage to exchange for local manufacturing — BYD's Camaçari plant (phase I 150,000 units; planned 600,000; USD 1.05B (BRL 5.5bn)) entered production in July 2025, with its 100,000th vehicle rolling off in July 2026. Mexico jumped to China's first vehicle-export destination in 2025 on its USMCA location value, though political sensitivity surrounds a local plant; Chile and Argentina are moving from raw-material procurement to "resources + processing + battery materials" cooperation, with Argentina's market-oriented reforms reopening energy investment.

What exposure they bear. The region is known for exchange-rate volatility and policy swings; resource nationalism has resurged under left-wing governments (the lithium-nationalization debate). Colombia and Peru are at the start of distributed-PV demand, and Chile's Atacama solar creates storage arbitrage from grid curtailment — Latin America's new-energy story has just opened its first page.

2025.07	BYD Camaçari plant (phase I 150,000 units; planned 600,000; USD 1.05B (BRL 5.5bn)) into production	*Brazil*
2026.07	100,000th vehicle rolls off the Camaçari line	*Brazil*
2025	Mexico becomes China's #1 vehicle-export destination	*largest NEV increment*
2026 H1	Brazil becomes China's largest NEV export market (~300,000 units)	*Brazil*

> **WTC Singapore observation: exchange-rate swings are large and resource nationalism is resurging under left-wing governments (the lithium-nationalization debate), so host markets weigh local manufacturing, local employment and local equity cooperation as risk-mitigation terms rather than as a supplier strategy.**

4.5 Africa — a long-term market driven by electricity access

What the host market gains. Africa holds the world's largest power gap — more than 600 million people without electricity — and demand shows a unique "off-grid + microgrid + distributed" structure that matches Chinese-made new-energy systems. In 2024 Africa imported 11.36 GW of modules from China (+43% YoY); Jan–Oct 2025 reached 14.17 GW (+57%); and Jan–May 2026 added about 10.9 GW — keeping Africa the world's fastest-growing regional market.

600 M+
people without electricity access — the world's largest power gap

14.17 GW
module imports from China, Jan–Oct 2025 (+57% YoY)

~1.4 bn
population, rapidly getting younger — a product market and testing ground

Where the demand is

Market	Active segment	Signal
Egypt	Wind & large PV	794 MW of wind added in 2024; single-month module imports now rival South Africa's
South Africa	C&I PV-storage	3.05 GW imported; responding to power rationing
Morocco	Green hydrogen / ammonia	Export projects face Europe directly — "African resources + Chinese manufacturing + European demand"
East Africa	Off-grid systems	Blended finance with World Bank / AfDB funds increasingly mature

What access conditions it sets. The core constraints are payment capacity and sovereign credit; the working model pairs the packaged "products + engineering + financing" capability of Chinese-made new-energy systems with blended finance from World Bank and AfDB funds, now increasingly mature. South Africa was long the absolute leader of African new energy, but since 2024 North African countries such as Egypt and Algeria have come from behind.

What exposure it bears. Payment capacity and sovereign credit are the binding limits; export-credit insurance, local-currency settlement and installment-model innovation matter more than the credit standards used in European and American markets.

4.6 North America — the closed door & the three paths

What access conditions it sets. The United States is the world's largest single high-value market but is essentially closed to direct Chinese-made new-energy exports: stacked PV tariffs exceed 109%; Section 301 tariffs on EVs reach 100%; lithium-battery tariffs are 58.4%. Three realistic channels remain — technology licensing (CATL's LRS model with Ford), U.S. local plant building under compliance frameworks, and third-country capacity serving the U.S. market — but the Southeast Asia path is blocked by AD/CVD, and in February 2026 the United States made preliminary countervailing determinations against India, Indonesia and Laos.

BOX · U.S. SUBSIDY POLICY

IRA and the "One Big Beautiful Bill Act" — retreat and retention

The 2022 Inflation Reduction Act built a ~USD 369 billion clean-energy subsidy system — the 45X advanced-manufacturing credit (by output), 45Y/45E clean-electricity credits, the 30D vehicle credit (USD 7,500, with FEOC exclusion), and the 45V hydrogen credit (up to USD 3/kg).

The OBBBA (July 2025) substantially adjusted this: the 30D EV credit ended September 30, 2025; wind and solar credits phase down faster; FEOC "material assistance" restrictions extend to manufacturing and electricity credits; storage credits are relatively preserved.

Result: the U.S. market remains closed to Chinese-made products and capital, but storage retains policy certainty — and technology licensing (CATL–Ford LRS) is one of the few channels through the barriers.

BOX · THREE NEW WALLS IN 2026

From tariffs to "access" containment

① **UFLPA escalation** — since 2025, polysilicon and module makers (JA Solar Donghai, Hongyuan, Jiangsu Meike, Baotou Meike, Shuangliang) joined the UFLPA Entity List; products face a "rebuttable presumption" and entry bans. Following an August 2026 White House enforcement report, U.S. Customs widened AI-assisted review of solar imports, and UFLPA detentions of solar cells at U.S. ports continued.

② **Inverter controls** — in April–May 2026 the EU named China a "high-risk country," barring EU funds from projects using Chinese inverters (April 15, 2027 deadline), though >60% of European PV uses them; on July 28 the U.S. FCC added foreign networked inverters to its covered-equipment list. ③ **UHV & large equipment** — Executive Order 14420 (August 26, 2026) declared a national emergency, barring procurement, import or installation of certain foreign critical power equipment.

What exposure it bears. Chinese-made suppliers' share in the U.S. main-grid market above 69 kV is small, so direct displacement is limited; the real exposure is on the buyer side — detailed rules pulling "critical software and remote O&M" into review, with bans spilling to distribution and user sides. The paradox sits with the host: while the U.S. faces AI-data-center electricity thirst and transformer lead times beyond three years, it has closed the door to the most cost-competitive supply, pushing order spillover to non-U.S. markets and the "Mexico/Southeast Asia capacity + U.S. user-side" gap channel (see JST Power, Chapter 7).

4.6 Canada, Central Asia & Asia-Pacific

Canada is closely linked with U.S. market policy and also maintains high tariff barriers against Chinese new-energy products; realistic opportunities concentrate in indirect supply of components and storage systems. Central Asia: Uzbekistan (BYD Jizzakh plant, planned expansion to 300,000–500,000 units) and Kazakhstan are emerging manufacturing nodes under the Belt and Road framework, radiating CIS markets. Australia is a high-quality market with excellent resources and rules — pulled by federal subsidies, new storage installations in 2025 were 4.9 GWh, exceeding the combined total of the previous eight years, with residential and large storage exploding simultaneously; mature electricity-market trading mechanisms (spot arbitrage + capacity mechanisms) give storage projects clear business models, and Sungrow's Cunderdin DC-coupled PV-storage project went into operation in April 2025. Japan & South Korea have high market-access thresholds and strong local-brand protection, but Chinese-made wind-turbine makers are gradually gaining in markets such as South Korea and Vietnam, and supply cooperation for storage batteries is deepening.

4.7 Where demand and access conditions align

Combining the five dimensions of market size, growth potential, policy environment, access barriers and risk level, this report maps the priority markets on two axes — demand scale and growth against access-barrier level.

Figure 8 — Where demand and access conditions align: priority markets



Figure 8. Qualitative placement of priority markets by demand scale and growth against access-barrier level.

4.8 Four policy orientations

Middle East and Southeast Asia sit where demand scale and access conditions are most aligned; Europe and Latin America pair stable or large demand with higher rule or macro thresholds; Africa and Central Asia are smaller or earlier-stage demand; North America combines high value with the thickest barriers.

Table 7 — Where demand and access conditions align, by segment

Segment	Higher alignment	Other markets in view	Key constraints
PV	Middle East, Asia-Pacific	Latin America, Africa	High trade barriers in Europe & the U.S.
Wind turbines	Europe (Eastern/Southern), India, Middle East	Southeast Asia, Latin America	Security reviews & certification barriers
Energy storage	Europe, Australia, Middle East	U.S. (compliant path), South Africa	Grid-connection certification & fire standards
NEVs	Southeast Asia, Latin America, Middle East	Europe (localized production)	EU countervailing duties; U.S. 100% tariff
Hydrogen equipment	Middle East (Oman, Saudi Arabia)	Europe, India	Project landing pace & certification

Table 7. Synthesized from the six-market scan in this chapter; underlying sources are compiled in the appendix.

The chapter in three import numbers

16.55 GW
Saudi Arabia's PV-module imports from China, 2024 (+115% YoY)

113.5 GW
EU module imports from China, 2025 (+20.3% YoY)

14.17 GW
Africa's module imports, Jan–Oct 2025 (+57% YoY)

CHAPTER 4 · TAKEAWAYS

① **Southeast Asia** — the logic is shifting from tariff avoidance to serving domestic demand, and Thailand's EV capacity already outruns its market absorption. ② **Middle East** — localization works as a scoring lever in tenders rather than a fixed burden. ③ **Europe** — the binding constraint is rules rather than tariffs. ④ **North America** — closed to products but open to licensing; LRS-style technology deals remain a working channel.

4.8 Four policy orientations

EU

NZIA 40% local clean-tech manufacturing benchmark by 2030; CBAM in formal implementation from 2026; Battery Regulation carbon-footprint declarations and battery passport; EV countervailing duties 17.0%–35.3%.

US

IRA 45X; OBBBA adjustments; stacked PV tariffs above 109%; EV 100%; batteries 58.4%; UFLPA; FEOC.

Gulf

Vision 2030 above 100 GW; IKTVA localization scorecard; PIF joint ventures; no major barriers to Chinese supply.

ASEAN

Thailand EV3.0/3.5; Indonesia TKDN 40%; RCEP zero tariffs within the region.

Four orientations, four different mixes of incentive, rule and access; suppliers, buyers and host countries meet each one on different terms.

> **Both readings are true at once: the same concentration that lowers cost for host markets also narrows their supplier base, so the buyer's resilience question is not whether to buy, but how to buy without a single point of failure.**

CHAPTER 5

Landing Modes and the Conditions Host Countries Can Negotiate

With a market map of China's new-energy supply reaching global markets, we still need to understand how it lands. This chapter observes five landing modes — and the conditions a host country can negotiate when that supply arrives.

Five landing modes at a glance

01	**Product export & channel distribution**
02	**Overseas plant building & capacity localization**
03	**M&A integration & joint-venture cooperation**
04	**EPC contracting & investment–construction–operation**
05	**Technology standards, brands & ecosystems abroad**

In this chapter — 5.1 Evolution map of landing modes · 5.2 How a host country can read a landing decision · 5.3 Evaluating a foreign-invested project · 5.4 What host markets receive, and at what cost

5.1 Evolution map of landing modes

The five landing modes rarely appear alone in a single market. The mix a project eventually takes depends on the host market's barrier height, the investor's resources, and how much control the investor seeks to retain.

01 Product export & channel distribution

The most basic form — suited to dispersed-demand, low-barrier markets (African off-grid products, Southeast Asian residential storage). For a host country, the channel model brings immediate supply and price competition, but limited local value capture; it also leaves the buyer exposed to sourcing concentration that later localization requirements are meant to address. Pure direct exports of vehicles and modules are already hitting policy ceilings in Europe and the U.S.

In practice the pure-trade space keeps shrinking: July 2025 single-month PV-cell exports to the U.S. were negligible at just **USD 0.065B (RMB 452M)**, while India, Indonesia and Turkey absorbed most intermediate-goods exports. The channel model's next step is branding and servitization — from “selling products” to “selling solutions.”

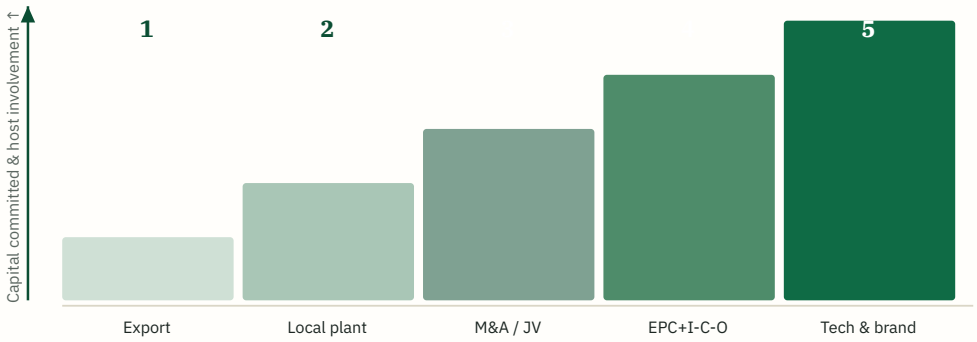
Watch the trade model's “invisible ceiling”: even without explicit tariffs, pure imports lose scoring in host-government tenders and SOE procurement — localization track records are becoming an invisible qualification line. The trade model has not died; its role is shifting from “capital ship” to “reconnaissance ship,” scouting intelligence and relationships for later localization.

02 Overseas plant building & capacity localization

The mainstream barrier-driven model. **BYD averaged only 15–16 months** from signing to production, and its Brazil plant took just 15 months from construction start to first vehicle off the line — a speed that signals how replicable China's manufacturing system has become. For the host country, a greenfield plant delivers jobs and local supply-chain development, but the core risks are local supply-chain matching rate, labor management and cost absorption during ramp-up.

Figure — the five landing modes form a ladder

Ascending order of capital committed and host involvement



Conceptual illustration of 5.1; ascending order reflects capital commitment and control, not a quantitative scale.

Source: company disclosures and China Customs export data, July 2025 (PV-cell and intermediate-goods flows); report compilation.

5.1 middot; continued

Three higher-order models

Modes 3–5 are the higher-order forms — they commit more capital and local presence in exchange for control over margins, standards and the long game.

03 M&A integration & joint-venture cooperation

Joint ventures are a common landing form where politics block wholly-owned control: JinkoSolar and TCL Zhonghuan's JVs with **Saudi PIF**, and CEE Hydrogen's JV with **Saudi GECI**, trade equity stakes for local legitimacy and resource support. M&A suits acquiring brand, channel and certification assets — e.g., automakers buying European dealer networks. For the host country, a JV can secure local legitimacy and resource commitments, while diluting the investor's unilateral control.

Best where politics block wholly-owned control.

04 EPC contracting & investment–construction–operation

Power central SOEs and private developers join emerging-market station development via **EPC+F, BOT and IPP**, driving equipment exports and long-term O&M revenue; the investor upgrades from equipment supplier to "project organizer." Its upgrade path is full-chain binding of investment, construction and operation. Financing needs are highest, but so is revenue stickiness — a plant's **25–30-year** operating life means decades of electricity-fee or service-fee cash flow. For the host country, this mode brings the most capital and the longest-lived asset, but also the deepest financing exposure and the hardest exit.

Highest financing need, strongest revenue stickiness.

05 Technology standards, brands & ecosystems abroad

The highest-order form. Trina Solar's patent license to France's HoloSolis, CATL's battery-technology license (LRS) to Ford, and the international push of China's **ChaoJi** charging and battery-swap standards show China's new-energy supply has begun exporting "rule assets" to global industry.

The end game: shape the rules, not just the market.

> **From exporting goods to exporting rules: the five landing modes form a ladder — each step commits more capital and local presence in exchange for more control over margins, standards and the long game.**

5.2 How a host country can read a landing decision

No landing mode fits all, but common evaluation dimensions exist: host-country involvement, capital committed, political exposure and exit flexibility. Trina's patent license to HoloSolis and Jinko's heavy-asset Saudi JV look opposite, yet follow the same logic a host country can read as: technology output stays controlled while capital and political risk shift to local partners.

A host country can note that an investor spreading thinly across many markets may under-commit locally — breadth of footprint is not the same as depth of local investment.

Four angles for the host country

These four lenses help a host country read a proposed landing before terms are set.

Involvement /

How much the host country is drawn in — local content, equity, permits. Who decides, and how much?

Capital /

Committed and funding capacity. Can the project carry its own balance sheet?

Political /

Exposure and jurisdiction risk. Where could policy bite the host too?

Exit /

Flexibility to unwind. What stays local if the investor leaves?

Postures and evaluation dimensions drawn from 5.2 of the source report, recast from the host-country side.

5.2 middot; continued

Entry-mode decision & what the host country can ask for

The choice among greenfield, M&A, JV and licensing hinges on four variables a host country can read: its own barrier height (higher barriers → deeper localization demanded), the investor's resource endowment (capital-rich → greenfield; technology leaders → licensing), host-country equity restrictions and localization requirements, and the investor's need for control. A useful read: technology-sensitive links (batteries, cells) → controlled plants the host typically vets closely; politically sensitive markets → joint ventures; mature brand markets → licensing.

The four modes sit on a spectrum of control versus speed:

Table 8 — Comparison of four entry modes

Synthesis of the 5.2 entry-mode decision framework

Entry mode	Host-country involvement	Capital committed	Time to production	Political sensitivity	Typical practice
Greenfield plant	High	High	Slow (15–24 months)	High	BYD Hungary plant
M&A	Medium–high	High	Fast	Medium–high	Automakers acquiring overseas channel & brand assets
Joint venture	Medium	Medium	Medium	Low	JinkoSolar × PIF Saudi joint venture
Technology / patent licensing	Low	Low	Fast	Lowest	Trina × HoloSolis; Envision India tech licensing

Source: report synthesis of 5.2 entry-mode decision framework.

Assessment dimensions are WTC Singapore observations.

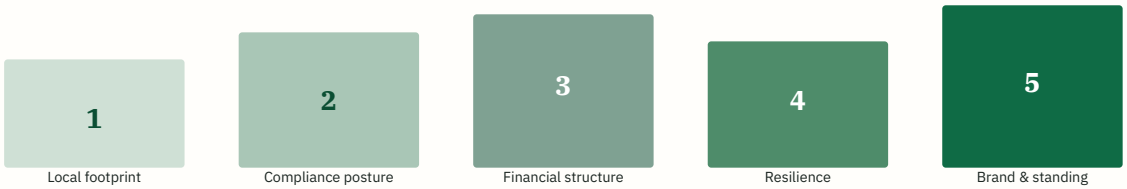
Organizational read. A host country can look at the investor's organizational setup as an indicator: whether it has moved from an export desk to a regionalized operating unit, with local authority for country managers and overseas-plant GMs, and with localization in key posts (Saudization, Indonesia's localization rate). Cross-border compliance structured as three lines of defense tends to surface risks earlier than restructuring after a compliance or tax shock.

5.3 Evaluating a foreign-invested project

Landing modes are only as durable as what sits behind them. Five indicators help a host country tell a project that merely ships from one that will operate and embed locally.

Figure — five evaluation indicators

What a host country can look for in a foreign-invested project



Conceptual framework of 5.3; no quantitative values implied.

1 Local operating footprint

A host country can look at local supply-chain development (whether localization rates are met and costs controlled), cross-cultural employment (Saudization, Indonesia's localization rate) and relations with local government. BYD's component supply agreements with Uzbek mining and steel firms are one sample of supply-chain localization.

Three things to watch. (1) Localization by grade — bulky, high-logistics-cost components (body structures, brackets, towers) tend to localize first, while technology-dense cores (cells, chips) often stay in China or controllable chains; the host country captures value mainly at the localized end. (2) A local management backbone matters more than expatriate staffing over time. (3) Professional government relations turn the host's own development demands (employment, tax, technology spillover) into the negotiation's substance. The host-country cost is real: the more localized the plant, the more the host takes on labor, supplier-development and adjustment risk.

2 Compliance posture

A host country can screen trade compliance (rules of origin, customs classification, export controls), ESG and carbon (CBAM, battery passport, CSDDD due diligence), data (GDPR, cross-border vehicle data) and labor / human-rights (UFLPA-type reviews). Compliance considerations belong at the investment-decision stage, not remedied after the fact.

The interval between most market-access legislation and its enforcement is when a host country's own enforcement capacity is tested.

5.3 middot; continued

3 Financial structure

A host country can examine cross-border financing structures (Hong Kong offshore platforms, as used by CATL's and BYD's HK financings), multi-currency balance-sheet management, exchange-rate hedging, and use of export-credit and political-risk insurance.

Three points to check. Watch for: domestic entities giving external guarantees (raising group risk); unsmooth repatriation of overseas profits; and unhedged FX exposure. In the cases observed, financing structures pursued “limited recourse + local-currency matching” for project finance, repatriation was confirmed with host tax authorities at the investment-agreement stage. The host-country side: a project that hedges and matches local currency is less likely to fail on FX shocks, but the host still carries contingent liability if a guarantee is called.

4 Resilience

Multi-base, multi-currency, multi-jurisdiction operations demand global ERP, customs systems and supply-chain visualization. Since 2025, from the Red Sea shipping crisis to the accelerating U.S. tariff expansion, sudden supply-chain shocks have become normal; investors that can rapidly switch — “one country restricted, multiple nodes backing each other up” — minimize the hit from trade barriers. For the host country this cuts both ways: a multi-node investor rides out shocks that would stall a single-site plant, but a local plant that is one interchangeable node among many can also be deprioritized when the network reroutes.

5 Brand & local standing

A recognized brand is built through long-term investment: international exhibitions (Intersolar, CWP), local sports and cultural marketing, ESG narratives and media, and participation in industry organizations and standards agendas. Brand premium shows up in project-financing costs and government-procurement qualifications. For the host country, a strong brand eases procurement and financing, but also raises the dependency and visibility questions any concentrated supplier brings.

The five indicators compound: a local operating footprint feeds compliance readiness, compliance readiness lowers financing costs, and financing credibility strengthens the brand a host country sees.

5.4

BOX · HOST-COUNTRY GAINS AND COSTS

What host markets receive, and at what cost

Host markets receive three measurable gains from China's new-energy supply: lower installed cost of clean power, faster expansion of power access, and local capacity build-out — seen in Thailand's EV manufacturing base and Indonesia's nickel-to-battery chain. The costs they bear are likewise concrete: sharper local competition, price competition spilling into tenders abroad, and concentration of supply in a single external source. The landing effect is visible in Thailand, where 386,000 units/yr of BEV capacity sits against about 70,000 units of 2024 local sales. Employment and technology transfer are present in these projects but are treated qualitatively in this report, to be assessed market by market.

CHAPTER 6

Risks, Challenges and How They Are Shared

If the first five chapters ask where the opportunities are and how to reach them, this chapter asks what pitfalls lie on the road. This chapter sets out where each risk falls.

Four risk layers & a response system

6.1 Trade & investment barriers — tariffs, non-tariff measures, investment review

6.2 Geopolitical & compliance — side-choosing, sanctions, FEOC, standards

6.3 Market & supply-chain — demand, competition, bottlenecks, stranding

6.4 Operating & financial — execution, FX, receivables

6.5 How risk is distributed across the parties — buyer, host country, supplier

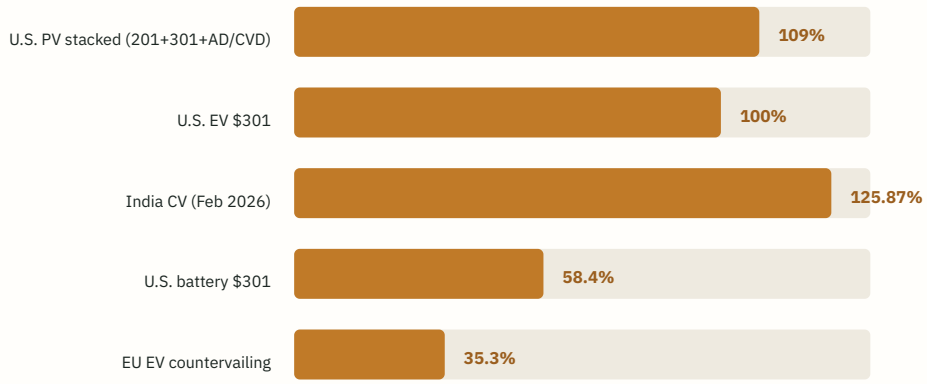
In this chapter — 6.1 Trade and investment barriers · 6.2 Geopolitical and compliance risks · 6.3 Market and industrial supply-chain risks · 6.4 Operating and financial risks · 6.5 How risk is distributed across the parties

6.1 Trade and investment barriers

Trade measures have extended from direct tariffs to third-country capacity. Direct U.S. tariffs on PV from China's new-energy supply (double-anti + Section 201 + Section 301) stack to **more than 109%**; final double-anti measures on four Southeast Asian countries reached a combined **3,521.14%** (Cambodian firms) and took effect in June 2025; in February 2026 the U.S. issued preliminary countervailing duties on PV from India, Indonesia and Laos (India up to **125.87%**). Tariffs now follow capacity into third countries as an observed pattern. The EU's countervailing duties on Chinese-made EVs are **17.0%–35.3%**; emerging markets such as Brazil, Turkey and India use tariff leverage to extract local manufacturing — a lever that also raises costs for local buyers.

Figure — headline tariff rates on China's new-energy supply

Ad valorem equivalents, selected measures (2025–2026)



Sources: U.S. Commerce / USTR determinations; EU Commission countervailing registry; report compilation. SEA four-country combined maximum (3,521%) excluded for scale — see Table 9.

Non-tariff barriers are more hidden and more durable: localization-rate requirements (Saudi IKTVA, Indonesia TKDN, U.S. IRA domestic content), carbon-footprint thresholds (CBAM, EU Battery Regulation), forced-labor supply-chain reviews (U.S. UFLPA on Xinjiang polysilicon), and certification / grid-connection standards.

BOX — UFLPA

Supply-chain review with reversed burden of proof

The U.S. Uyghur Forced Labor Prevention Act (effective June 2022) applies a "rebuttable presumption" to Xinjiang-related goods: anything mined, produced or manufactured wholly or partly in Xinjiang is presumed forced-labor and barred unless the importer proves innocence with "clear and convincing" evidence. About half the world's polysilicon comes from Xinjiang, so module imports face long-term detention review. The burden reversal forces full-chain traceability from quartz sand to module — and suppliers that can submit complete traceability files get materially better clearance cycles and detention rates: compliance investment shortens clearance cycles for suppliers, and lengthens buyer lead times where files are incomplete. For buyers, the reversed burden lengthens lead times and shifts compliance cost into module prices.

6.1 middot; continued

Major trade and investment barriers

Table 9 — Major trade and investment barriers

Selected measures across markets (2025–2026)

Measure	Initiator	Products	Key content
Stacked double-anti + 201 + 301	United States	PV cells & modules	Combined >109%; direct exports essentially cut off
Double-anti, 4 SE Asian countries	United States	Silicon PV cells & modules	Effective June 2025; max combined 3,521.14%
Preliminary CV determination	United States	PV from India, Indonesia, Laos	Feb 2026; India up to 125.87%
Countervailing duties	EU	Chinese-made BEVs	17.0%–35.3% atop 10% base, 5 years
Section 301	United States	EVs, lithium batteries	EVs 100%; batteries 58.4%
UFLPA review	United States	Xinjiang polysilicon PV	Detention-style; reversed burden of proof
CBAM	EU	Power, H_2, steel, aluminium	Formal from January 2026
Stepwise import tariffs	Brazil	NEVs	Tariff leverage for local manufacturing
ALMM / PLI	India	PV modules, cells	Local-list access + production incentives

Source: report compilation of 6.1; see Appendix 2 for full citations.

Investment review is a politicized access gate. Foreign-investment security reviews in Europe and the U.S. (CFIUS, the EU FDI Screening Regulation) are tightening; M&A and greenfield projects by China's new-energy supply there face longer cycles and added conditions, and some countries bar equipment from China's new-energy supply from grid and communications-coupling fields on “critical-infrastructure security” grounds.

6.2 Geopolitical and compliance risks

Under the supply-chain “de-risking” narrative, host countries may demand asset-, data- and even equity-level separation between China and Western markets. FEOC rules already deny U.S. subsidies to vehicles with batteries containing content from China's new-energy supply. Yet “de-risking” is not “decoupling”: Europe’s dependence on PV modules and storage from China's new-energy supply has no short-term substitute, and its tools mostly “raise local-share benchmarks” rather than “ban imports” — leaving room to exchange localization and compliance for market access.

6.2 middot; continued

Sanctions, standards and policy continuity

Sanctions & export-control transmission. Russia-related business (exports of vehicles to Russia have proactively contracted) and project execution in sensitive regions may trigger secondary sanctions and financial-channel risks; the weaponization of the dollar settlement system raises settlement-channel exposure for any supplier routed through it.

BOX — FEOC

The definition war over "Chinese content"

Foreign Entity of Concern rules are the core U.S. legal tool to exclude supply chains from China's new-energy supply: any entity 25% or more owned by the governments or companies of China, Russia, North Korea or Iran, or under "effective control" (including via technology-license agreements), is an FEOC. From 2024, vehicles with FEOC battery components lose the 30D tax credit; from 2025 this extends to critical minerals; the "One Big Beautiful Bill Act" adds a "material assistance" standard to the 45X / 45Y / 45E credits. The elasticity of "effective control" makes de-control design in licensing terms a key legal-engineering task — for the supplier, a structural constraint on how capacity can be organized abroad.

Technological decoupling & standards fragmentation. If major economies form incompatible rule camps on battery passports, charging interfaces and carbon accounting, suppliers face rising "one product, multiple compliances" cost.

Host-country politics & policy continuity. Latin American government swings, ASEAN subsidy phase-downs (localization quotas after Thailand's EV3.0 expires), and Middle East royal-politics generational risk all raise policy-continuity exposure for projects. For groups with a regional treasury and settlement centre, these host-country risks surface as group-level compliance and cross-border settlement exposure — the exposure is therefore managed at group level rather than project by project.

6.3 Market and industrial supply-chain risks

01 Demand volatility

Subsidy-driven demand is pulsed: the 2023–2024 European residential-storage inventory cycle, Thailand's EV capacity outrunning local absorption, and U.S. subsidy phase-down all stress long-term cash-flow models. More negative-price periods in spot markets erode station yields, while storage arbitrage fluctuates with market rules.

02 Competition & price war

Domestic "involution" is replicated abroad: multiple automakers from China's new-energy supply share one Thai stage; in Middle East PV tenders, bidders undercut each other and price competition is spilling into tenders abroad. Host-grown local capacity (India PV, Indonesia batteries) and regrouping European, American, Japanese and Korean peers all become tomorrow's competitors. For host-country buyers, keener competition lowers tender prices but raises the risk of supplier default and stranded after-sales support.

6.3 middot; continued

03 Supply-chain security

Price swings and export controls on lithium, nickel and cobalt; Red-Sea-style freight spikes; IGBT supply concentration — all amplify along the chain. Immature overseas supply ecosystems lengthen cost ramp-up. For host countries, concentration in a single external source is the matching exposure.

04 Asset stranding

Routes switch fast: PERC capacity depreciated rapidly in the TOPCon shift — the lesson is not far away. Once solid-state, sodium-ion or perovskite industrialization accelerates, overseas capacity invested today risks being "obsolete on commissioning." Mainstream-route certainty and retrofit flexibility are prerequisites.

6.4 Operating and financial risks

Overseas project execution. Construction delays, cost overruns and grid-connection uncertainty are the three high-frequency points. Failed cases share "three underestimations" — permit cycles (European environmental & grid permits counted in years), labor-culture differences (strong unions), localization cost ramp-up (early yield worse than at home). Thailand's EV capacity has significantly exceeded local demand, a reminder to see through "policy heat" to the "market bottom."

Three underestimations

Permit cycles (years, not months) · labor-culture gaps (strong unions) · localization cost ramp-up (early yield worse than at home).

Exchange rates, interest and remittance. Currency depreciation and exchange controls in some African and Latin American markets erode returns; a high-rate environment raises overseas financing cost.

Receivables & credit. Sovereign and offtaker credit are weak in Africa and Latin America, with high default risk; export-credit-insurance coverage and claims efficiency belong in business decisions.

From the cases observed, front-loaded due diligence, local teams and insurance are the least-cost protection against these risks.

Each of these risks is priced into the terms of access.

6.5 How risk is distributed across the parties

The four risk layers do not fall on one side; they are shared, and how they are shared shapes each party's exposure. The three cards below map what the buyer, the host country and the supplier each bear — drawing only on facts set out in 6.1–6.4.

Buyer / offtaker

Bears tariff-passed cost: U.S. stacked PV tariffs above 109% and EU EV countervailing duties of 17.0%–35.3% ultimately feed into landed cost. Faces supply-continuity risk — about half the world's polysilicon comes from Xinjiang and module imports face UFLPA detention review — and demand volatility (the 2023–2024 European residential-storage inventory cycle; Thailand's EV capacity outrunning local absorption). Keener competition lowers tender prices but raises supplier-viability and after-sales risk.

Host country

Uses tariff and localization leverage (Brazil, Turkey, India; Saudi IKTVA, Indonesia TKDN) to build local industry, but takes on policy-continuity risk (ASEAN subsidy phase-downs, Latin American government swings, Middle East generational risk). Local content raises domestic capacity yet can deepen single-source dependence, and immature ecosystems lengthen ramp-up. Host-country politics surface as compliance and settlement exposure for groups operating there.

Supplier — China's new-energy supply

Bears tariff escalation and third-country pursuit: U.S. stacked tariffs above 109%, the four-SEA-country combined 3,521.14%, India CV up to 125.87%, and EU EV duties of 17.0%–35.3%. FEOC rules exclude supply at a 25% ownership or "effective control" test, costing the 30D credit from 2024 and critical minerals from 2025. Also bears FX and remittance erosion (African and Latin American depreciation; a high-rate financing environment), weak sovereign and offtaker credit in Africa and Latin America, and asset stranding (PERC to TOPCon; the advance of solid-state, sodium-ion and perovskite). Compliance — UFLPA traceability, CBAM from January 2026, battery passports — becomes a priced cost of access.

None of the three can fully offload its share; the practical question is which party prices each risk and carries it.

CHAPTER 7

Benchmark Case Studies

Cases are not conclusions — they are the evidence. This chapter examines ten instances where China's new-energy supply reached global markets, spanning eight tracks and six entry models, and records what each host market received, and on what terms.

What this chapter covers

7.1 Case-selection criteria & research method

7.2 Ten typical cases — from power batteries to transformers

7.3 What the host markets received — ten records, no prescriptions

Selection is based on model representativeness, not an evaluation of companies' investment value. Sources: company announcements, annual reports and authoritative public media.

7.1 middot; 7.2

Selection criteria & the ten cases

The ten cases cover eight tracks — PV, energy storage, NEVs, power batteries, wind, hydrogen, digital energy and transmission equipment — and models from greenfield plants and sovereign-fund JVs to technology licensing and system-solution export. Geographically they concentrate on Europe, the Middle East and other markets where China's new-energy supply reached global markets most deeply; ASEAN's demand logic and the Singapore hub that connects it are examined in Chapter 4.

Each case follows one chain: *decision background → key actions → quantified results → what the host market received, on what terms.* Information is compiled from company announcements, annual reports and authoritative media, focusing on the complete arc. Case selection reflects model representativeness, not an investment verdict.

> **Ten instances, eight tracks, six entry models — observed together, they show what host markets received and on what terms.**

Ten cases at a glance

01	**CATL**	Power Batteries
02	**BYD**	NEVs
03	**JinkoSolar × PIF**	PV
04	**Envision Energy**	Wind
05	**Sungrow**	Storage
06	**CEE Hydrogen**	Hydrogen
07	**Arctech & Ailang**	Supporting
08	**Huawei Digital Power**	Digital
09	**TBEA**	Transmission
10	**JST & Huapeng**	Transformers

Eight tracks

PV · Wind · Storage · NEVs · Power batteries · Hydrogen · Digital energy · Transmission

Six models

Greenfield plant · Sovereign-fund JV · Tech licensing · Patent licensing · EPC+investment · System-solution export

How to read this chapter

Greenfield plant	Build owned capacity abroad — BYD's eight-country factories; highest control, highest risk.
Sovereign-fund JV	Partner host-state capital — JinkoSolar × PIF; solves capex, legitimacy, orders at once.
Tech / patent licensing	License IP or tech — CATL–Ford, Envision; lowest political cost for sensitive tech.
EPC + investment	Engineering contracting plus manufacturing — TBEA; turns one sale into a track record.
System-solution export	Sell integrated systems — Huawei, Sungrow; competes on engineering, not just price.

7.2 middot; Cases 1–2

Power batteries & complete vehicles

01 CATL

Power Batteries

39.2%	31.44%	USD 4.97B
2025 global share, 9 yrs #1	Overseas gross margin vs 24.00% domestic	2025 Hong Kong listing raised USD 4.97B (HKD 39.1B)

Decision background. As the absolute global leader, CATL needed to convert scale into durable overseas share while easing U.S. political exposure.

Key actions. A "cluster" path: Germany Thuringia at full output; Hungary Debrecen (>EUR 7B) phase I done; Spain JV with Stellantis; Indonesia nickel-to-battery chain. U.S. market entered asset-light via Ford LRS. Storage is the second curve — #1 in global storage shipments for five years at 30.4% (2025).

Quantified results. 661 GWh sales (+39.16%), revenue USD 61.20B (RMB 423.7B), net profit USD 10.43B (RMB 72.2B); overseas power-battery share 30%, Europe ~40%; 18 of the top-20 automakers are core customers.

> **What the host market received, on what terms:** Europe received local cell capacity and a deeper supplier base, on terms that bind automakers through long-term relationships and local plants while keeping the technology-sensitive U.S. market at arm's length via Ford licensing. Host markets gain supply security and investment, but concentrate battery sourcing on a supplier that already holds ~40% of European demand.

02 BYD

NEVs

1.05M	1.21M/yr	15–16 mo
Overseas sales 2025 (+145%)	Overseas capacity, >2M long-term	Signing-to-production (Thailand 11 mo)

Decision background. With domestic growth slowing, BYD treated overseas markets as a cycle hedge and a second growth curve.

Key actions. An "eight-country factory" system: Thailand (150k, 2024), Uzbekistan, Brazil (150k→600k, USD 1.05B (BRL 5.5bn)), Hungary (USD 5.78B (RMB 40B), Q4 2025), Indonesia, Cambodia, Turkey (USD 1B, 2027) and a Malaysia CKD plant. Localization advances layer by layer — CKD first, then battery lines and local supplier agreements.

Quantified results. 2025 overseas revenue USD 44.88B (RMB 310.74B) (+40.1%), 38.7% of total. H1 2026: 789,400 overseas (+67.92% YoY), share >40%; H-share raise USD 5.53B (HKD 43.5B). Thailand plant reverse-exported to Europe in Aug 2025.

> **What the host market received, on what terms:** Host markets received operational vehicle plants and, in several cases, reverse exports back to Europe, on terms that layer localization from CKD kits to local battery lines and supplier agreements. Buyers and host governments gain jobs, faster capacity and price competition, but import a concentrated Chinese-made vehicle presence whose rapid scale can crowd local industry and reshape trade flows.

Sources: company announcements, annual reports and public media. See Appendix 2 for full citations.

7.2 middot; Cases 3–4

Sovereign capital & technology licensing

03 JinkoSolar × PIF

PV

10 GW/yr	~USD 1B	20 GW
Cell+module capacity in Saudi	OXAGON (NEOM) plant	TCL Zhonghuan wafer (parallel)

Decision background. JinkoSolar sought to lock Middle East demand and legitimacy without bearing the full capex and geopolitical risk of a solo heavy-asset plant.

Key actions. In July 2024, Saudi PIF formed JVs with several Chinese-made PV suppliers; JinkoSolar builds 10 GW/yr cell+module capacity, with the OXAGON plant — its largest overseas investment — to start production early 2026. TCL Zhonghuan laid 20 GW of ingot/wafer; Arctech and Trina brackets landed in parallel.

Quantified results. A full-chain PV layout from wafer to module took shape in the Middle East, turning scattered projects into an integrated local ecosystem.

> **What the host market received, on what terms:** Saudi Arabia received a full local PV value chain from wafer to module, on terms where sovereign capital (PIF) co-owns the assets and secures orders, reducing the host's capex and geopolitical exposure. The host gains industrial footprint and supply, while binding a large share of its solar build-out to a single foreign supply source.

04 Envision Energy

Wind

>10 GW	3.6 GW	EnOS
India orders (tech licensing)	Saudi orders + JV plant	IoT platform as digital gateway

Decision background. Wind turbines connect directly to host grids and are easily labeled "critical infrastructure," making direct heavy-asset entry politically costly.

Key actions. Envision leads with smart turbine technology and the EnOS energy-IoT platform, substituting technology licensing and local cooperation for plant building. It won >10 GW of India orders via licensing and 3.6 GW in Saudi Arabia with a planned JV plant.

Quantified results. Fast scale in emerging markets while sidestepping many access restrictions; EnOS establishes a digital entry point for overseas asset O&M and power-market services.

> **What the host market received, on what terms:** India and Saudi Arabia received wind capacity and a local manufacturing footprint, on terms that substitute technology licensing and the EnOS digital platform for direct heavy-asset control, lowering political friction. Host grids gain deployed capacity, but import remote O&M and software dependency that several markets now subject to security review.

Sources: company announcements, annual reports and public media. See Appendix 2 for full citations.

7.2 middot; Cases 5–6

Storage breakthroughs & hydrogen first-movers

05 Sungrow

Energy Storage

160MW/760MWh	353 GWh	128 MWdc
Saudi AMAALA off-grid	2025 Chinese storage orders	Cunderdin PV+storage (Australia)

Decision background. Storage is shifting from cell supply to system integration and scenario solutions; the value is migrating to complex, high-environment engineering.

Key actions. Sungrow won Saudi AMAALA's off-grid 160 MW/760 MWh + 165 MW inverters under extreme stability specs, and Australia's Cunderdin 128 MWdc PV + 55 MW/220 MWh (operational Apr 2025). It reuses PV-inverter channels and after-sales for storage.

Quantified results. Of 353 GWh of 2025 storage orders placed with China's new-energy supply reaching global markets, Europe, Australia, the U.S. and the Middle East were the four main markets; Sungrow competes with cell giants on the order list via reuse of existing channels.

> **What the host market received, on what terms:** Host markets received off-grid and extreme-condition storage systems, on terms that reuse existing inverter channels and after-sales rather than greenfield investment. Buyers gain fast, engineered solutions at lower cost.

06 CEE Hydrogen

Hydrogen

36%	1%→36%	6,055 MW
Overseas electrolyzer share 2024	2023→2024 overseas share jump	2025 domestic public tenders

Decision background. Overseas electrolyzer demand surged; the Middle East emerged as the largest single market, but localization had to come first to capture it.

Key actions. In Nov 2025 CEE Hydrogen formed a JV with Saudi GECI — the first Chinese-made electrolyzer localized in the Middle East. Chinese-made alkaline units are priced at one quarter to one third of European products, with "order in 2025, production in 2026" delivery.

Quantified results. Overseas electrolyzer orders rose from ~1% (2023) to 36% (2024); the Middle East took 45% of overseas orders; 2025 domestic tenders reached 6,055 MW.

> **What the host market received, on what terms:** The Middle East received its first locally built Chinese-made electrolyzer, on terms where a 2025 order maps to 2026 production and pricing sits at one quarter to one third of European equipment. Host projects gain cost and speed, but a nascent local industry becomes anchored to a single foreign supplier early in the market's life.

Sources: company announcements, annual reports and public media. See Appendix 2 for full citations.

7.2 middot; Cases 7–8

SMEs & digital-energy systems

07 Arctech & Ailang

Supporting

5 GW	10 GW	Morocco
Jeddah bracket plant	Delivery capability built	Ailang base, into EU supply

Decision background. Not every participant is a giant; supporting suppliers entered unfamiliar overseas markets by attaching to an anchor customer rather than building a standalone presence.

Key actions. Arctech built a 5 GW bracket plant in Jeddah (phase I Sept 2024) and a 10 GW delivery capability radiating Middle East PV supply. Ailang's Morocco base delivers in batch, following turbine customers into the European supply chain.

Quantified results. Both transplant domestic cost and process advantages overseas, then develop third-party clients from the local base — a repeatable "follow the chain owner" playbook.

> **What the host market received, on what terms:** Middle Eastern and European supply chains received bracket and tracker capacity, on terms that follow an anchor customer into the host market and then sell to third parties from a local base. Host markets gain localized input supply at Chinese cost levels, but see local ecosystem development deferred to the schedule of a foreign chain owner.

08 Huawei Digital Power

Digital Energy

176 GWac	1.3 GWh	<USD 0.10
#1 inverter shipments 2024	Red Sea New City storage	LCOE /kWh (~1/3 diesel)

Decision background. Huawei aimed to convert ICT leadership into energy-scenario system capability rather than stay a single-equipment vendor.

Key actions. The Saudi Red Sea New City 400 MW PV + 1.3 GWh storage is the world's largest PV-storage microgrid and first city-level 100%-clean project; smart string grid-forming storage delivered GW-level black start and 24×7 stability. Chinese participation contracts totaled ~USD 1.23B (RMB 8.5B).

Quantified results. From inverter to "smart PV + grid-forming storage + smart microgrid," Huawei defines a digital-energy form within the globalization of China's new-energy supply — while also being first sniped by Western "security reviews."

> **What the host market received, on what terms:** Saudi Arabia received the world's largest PV-storage microgrid and a city-level 100% clean-power system, on terms where Chinese contractors delivered ~USD 1.23B (RMB 8.5B) of work and the digital-energy architecture. The host gains a flagship reference and low LCOE, but imports grid-control software and remote-management layers that several Western buyers now pull into security review.

Sources: company announcements, annual reports and public media. See Appendix 2 for full citations.

7.2 middot; Cases 9–10

Transmission equipment & the AI-data-center pull

09 TBEA

Transmission

90+	USD 2.4B	~USD 11.56B
Countries with product exports	Saudi Electricity 7-yr framework	Orders on hand, ~40% AI-compute, USD 11.56B (RMB 80B)

Decision background. Transmission equipment within the globalization of China's new-energy supply needs trust built project by project, then locked with long-cycle frameworks.

Key actions. TBEA exports transformers/cables to 90+ countries; Jan–Sep 2025 international transmission contracts reached USD 1.24B (+80%). It won Saudi Electricity's seven-year framework for UHV transformers and reactors — a record single overseas order. The model is a dual wheel of EPC + high-end manufacturing + localized service.

Quantified results. Under the AI-compute wave, ~USD 11.56B (RMB 80B) of orders on hand, ~40% AI-related; the narrative is shifting from "grid transformation" to "computing infrastructure."

> **What the host market received, on what terms:** Saudi Arabia and 90+ markets received UHV transformers, reactors and cables, on terms anchored by a seven-year framework that converts one-time sales into cross-cycle revenue and qualifies the supplier for the next grid project. Host grids gain delivery certainty amid a global power shortage, but concentrate critical transmission equipment and AI-data-center build-out on a single foreign supplier.

10 JST & Huapeng

Transformers

27 yr	USD 0.74B	10 mo
JST rooted in North America	JST overseas on-hand (57.1%), USD 0.74B (RMB 5.14B)	Huapeng Ohio 765 kV (vs 18–24)

Decision background. AI data centers pushed transformers to the center of the globalization of China's new-energy supply; two suppliers show two paradigms.

Key actions. JST Power — the "deep cultivator": 27 years in North America (since 1998), supplies GE/Siemens Gamesa/Vestas and Amazon/MS/Google AIDC; Q1 2026 overseas orders USD 0.33B (RMB 2.25B) (+280.7%); Mexico+Thailand plants + UL cert hedge the U.S. ban. **Huapeng** — the "speed school": 110 kV #1 in China 10 years, #1 global single-plant 5 years; 2025 new export orders USD 0.90B (RMB 6.2B); Ohio 765 kV delivered in 10 months.

Quantified results. Both turn the rapid-response capability of Chinese-made equipment into scarce delivery capacity amid a global power shortage.

> **What the host market received, on what terms:** North American and other markets received transformer capacity at delivery speeds of 10 months versus 18–24 (Ohio 765 kV), on terms where JST's 27-year local presence and UL certification hedge U.S. restrictions while Huapeng competes on full-spectrum speed. Buyers gain relief from a global power shortage, but concentrate critical grid equipment on foreign suppliers whose access can be reshaped by policy shifts.

Sources: company announcements, annual reports and public media. See Appendix 2 for full citations.

7.3 What the ten cases show

Recorded, not prescribed: across ten cases, host markets received capacity, investment and lower-cost systems — on terms that ranged from sovereign co-ownership to licensing to local plants.

What host markets received

Local manufacturing and jobs (BYD; JinkoSolar × PIF; Envision), supply security and faster delivery (TBEA; JST; Huapeng), flagship clean-energy references (Huawei; Sungrow), and a first local foothold for emerging tracks (CEE Hydrogen; Arctech).

On what terms — host-side exposure

Supplier concentration (CATL ~40% of European battery demand), software and remote O&M dependency subject to security review (Envision; Huawei), and access that can be reshaped by policy shifts (JST; Huapeng). The same cases show the benefit and the cost sit with the same counterparty.

> The ten records are evidence, not advice. They let each host market, buyer and member of the WTCA network weigh what China's new-energy supply brings, and what it asks of local industry, rules and resilience.

Chapter 8 reviews how the terms of market access are shifting across major host markets.

CHAPTER 8

Trend Outlook and Open Questions

The final chapter looks ahead at China’s new-energy supply reaching global markets. We summarize eight observed shifts over the next five years, then set out what each audience may want to weigh — host countries, buyers, investors and the WTCA network. The observations here are WTC Singapore’s; the decisions are not ours to make.

What this chapter covers

8.1 Trend judgments for the next five years — eight observed shifts

8.2 The role of WTCA and World Trade Center Singapore

8.3 Singapore as observation position

8.4 Questions for the WTC network

8.5 Conclusion — the globalization of China’s new-energy supply as an observed process

8.1 Trend judgments for the next five years (1–4)

1 Overseas share keeps rising; the globalization of China's new-energy supply moves into deeper water

Domestic market competition is unlikely to ease within five years, while overseas margins keep drawing investment — CATL's overseas gross margin of 31.44% vs. domestic 24.00%. For major Chinese-made product lines, overseas revenue share is expected to move from today's 25%–40% toward **50%** during the 15th Five-Year Plan period. Capital markets now price internationalization itself: BYD's overseas revenue share rose from 28.6% to 38.7% within one year. From a buyer's side, a more externally oriented Chinese supply means more sourcing options but also deeper exposure to one country's industrial system.

2 Supply chains regionalize into a multi-centered manufacturing map

Global manufacturing becomes a multi-centered network: **China** (R&D + core links) + **Southeast Asia / Central Asia** (regional assembly) + **Middle East** (energy-cost-sensitive links) + **Europe** (customer-close capacity) + **Americas** (policy-driven capacity). Geographic redundancy changes from an efficiency loss into a compliance necessity. For host countries, local assembly brings jobs and technology transfer but also ties them to a single supplier's ecosystem; for buyers, redundancy improves supply security while raising the cost of qualifying more sites.

3 Competition shifts from products to standards, brands and ecosystems

Charging interfaces, battery passports, battery-swap standards, electrolyzer certification — the standards contest has begun. Suppliers that only export products without joining standard-setting risk being locked into the lower reaches of the value chain once rules are written. Suppliers that join standard-setting shape the rules; buyers see less room to switch where one supply base sets them.

4 Green trade rules reset; compliance becomes a third competitive axis

With CBAM formally implemented, EU battery carbon-footprint grading and stricter ESG disclosure, carbon and ESG data become a third competitive dimension alongside price and quality. As rules differ by market, we expect both broad integrators and region-focused specialists to emerge. Compliance adds cost and paperwork for all entrants and can lift prices for buyers, even as it rewards suppliers that built product-level carbon-footprint accounting early.

> The next decade of growth will be decided less by whether supply goes abroad and more by how rules, capital and localization reshape the route.

8.1 middot; continued

Trend judgments for the next five years (5–8)

5 The Global South becomes the main demand growth engine

In 2024 the Global South took **47%** of China's PV module exports; in H1 2026 the overseas shipment share of leading module makers rose to 60.1%. Power and electrification demand in the Middle East, Africa, Latin America and ASEAN grows faster than in developed markets — the mix of low cost, engineering capability and financing that Chinese-made equipment brings is hard to replace there. For these markets, lower-cost equipment accelerates electrification, but concentrated sourcing raises long-term dependency and exposure to one supplier's policy shifts.

6 The AI-computing revolution reshapes the demand map

Demand expands from "grid side + residential side" to the **computing side**: transformers, gas turbines, storage, PV-storage microgrids and even SMRs become scarce links in computing infrastructure. Tech giants building their own power open "user-side, off-grid" markets; segments with fewer trade barriers open to Chinese-made equipment, and buyers gain faster, cheaper compute power; host grids take on new load and new security review of the equipment.

7 Security reviews normalize; "trusted supply chains" become a new threshold

From UFLPA enforcement to the FCC covering inverters to Executive Order 14420 on grid equipment, access review now reaches software, firmware, remote O&M and equity. Over five years, **"trusted" will stand beside "low-carbon"** as the two compliance axes: cyber certifications, data-localization plans and auditable traceability become required qualifications. For buyers, "trusted" criteria raise assurance but can narrow the supplier field and lift prices.

8 Industry-finance coordination deepens; capital becomes a strategic variable

Sovereign-fund JVs, overseas listings, M&A and industrial funds are embedding into model design itself. "Equity for access" and "capital for market" structures will multiply; competition upgrades from capacity scale to capital-structure design. Supply that draws on international and host-country capital can extend its reach with a lighter balance sheet. Host countries gain investment and jobs, but also take on exposure to foreign-controlled assets and capital-flight risk.

> In the next five years, "trusted" and "low-carbon" will stand together as the twin gates of global trade — and capital structure will matter as much as capacity.

8.2 The role of WTCA and World Trade Center Singapore

In an era of higher trade barriers, the value of trade-promotion networks lies in three concrete functions: market information, counterparty due diligence, and dispute prevention. WTCA's network covers nearly **100 countries and regions, 300+ cities** and **750,000+** business members; WTC Singapore is its only authorized member in Singapore — and from here we observe how China's new-energy supply reaches global markets and convene members across the China–ASEAN–Global value chain.

8.2 · Three functions of the WTC network

Market information — tracking where demand and access conditions align across nearly 100 countries and regions, so members see shifts in rules and opportunity early.

Counterparty due diligence — local WTC business networks provide background checks on partners, channels and professional services before members commit capital.

Dispute prevention — early-warning on trade barriers, compliance coaching and structured channels to reduce cross-border friction before it becomes litigation.

THE NETWORK IN NUMBERS

~100
Countries & regions covered

300+
Cities with World Trade Centers

750,000+
Connected business members

Only authorized member in Singapore
WTC Singapore

8.3 Singapore as observation position

Singapore is where we observe, not where demand is.

8.3 · What we can see from here

Singapore plans at least **2 GWp** of solar by 2030 and up to **6 GW** of low-carbon electricity imports by 2035; demand for equipment sits in the larger regional markets around it.

Singapore functions as a trading, dispatch and financing center for the region.

The WTCA network spans nearly **100 countries and regions, 300+ cities** and **750,000+** business members.

WHAT WE DO NOT REPRESENT

This observation does not represent China's new-energy industry, any supplier, or any government. It is not investment, legal or business advice.

8.4 Questions for the WTC network

BOX — QUESTIONS FOR THE WTCA NETWORK

What each city can ask itself

Are we a buyer, a host country, an investment destination, or a transit node for China’s new-energy supply? Which of our members are affected — importers, local manufacturers, EPCs, financiers, buyers? Which access conditions have changed in our market — localization, trust and security review, carbon rules? These are qualitative prompts; no new figures are added.

WTC Singapore invites member WTCs to share how these questions look in their own city, and is open to joint briefings or member matchmaking.

8.5 Conclusion: the globalization of China’s new-energy supply as an observed process

Looking back over the past twenty years, China’s new-energy industry completed a shift from “both ends outside” to global leadership; looking forward ten years, the globalization of this industrial force has only begun. Trade barriers will change the *form* of the globalization of China’s new-energy supply, not reverse its direction — because global transition demand is real, and demand, cost and delivery are real for buyers, as are the dependencies they bring; the way the two combine is the only negotiable variable.

Returning to the three questions at the start of this report: **How far has the globalization progressed?** — To the midfield from trade globalization to industrial globalization. **How are opportunities and risks distributed?** — Opportunities layer across the Global South and rule-based markets; risks concentrate where barriers escalate and capabilities fall short. **What capabilities does the landscape reward?** — Localized operational capability, globalized compliance capability and ecosystem-level organization are what host markets and buyers now screen for.

THE REPORT IN ONE LINE

Observed, not endorsed

For every market the question is no longer whether China’s new-energy supply reaches it, but on what terms — and who bears the cost. Energy transition has no borders, and a zero-carbon future is a shared human aspiration.

APPENDIX

Appendix

Reference material for the working reader: a policy quick-reference across twelve markets, the report's data sources, introductions to the joint publishing institutions, a glossary, and the disclaimer.

A1 Quick reference — new-energy policies & trade measures in major countries/regions

A2 Main data sources and references

A3 Introduction to joint publishing institutions

A4 Glossary and abbreviations · Disclaimer · Contact

A1

New-energy policies and trade measures in major countries/regions

Country/Region	Industrial policy / incentives	Trade measures toward China	Localization requirements
EU	NZIA (2030 benchmark: 40% local manufacturing); carbon-emission standards driving electrification	EV countervailing duties 17.0%–35.3% (atop 10% base); CBAM formally implemented from 2026	Battery carbon-footprint declaration and battery passport, step by step
United States	IRA 45X manufacturing tax credit (partial phase-down after 2025)	Combined PV tariffs >109%; $301 tariff on EVs 100%; lithium-battery tariff 58.4%; double-anti on four SE-Asian countries up to 3,521%	FEOC restrictions; domestic-content bonus
Saudi Arabia	Vision 2030; renewables target >100 GW; hydrogen investment USD 50B	No major barriers toward China	IKTVA localization rate; Saudization employment
Thailand	EV3.0/3.5 subsidies; import-tariff reductions	No major barriers	Local production quota requirements after 2024
Indonesia	EV import-tariff exemptions and VAT preferences	U.S. preliminary countervailing determination on its PV (2026): 85.99%–143.3%	40% component localization (TKDN) before 2026
Brazil	Local-manufacturing tax incentives	Stepwise increases in EV import tariffs	Tariff leverage guides local plant building
India	PLI production-linked incentives; ALMM list protection	High tariffs on PV cells/modules; U.S. preliminary countervailing determination (2026) up to 125.87%	ALMM local module list; wind technology-licensing cooperation
UAE	Mega PV project tenders; free-zone preferences	No major barriers	Local-content scoring in tenders
Germany	Europe's largest large-storage market; strict carbon-footprint rules	Implemented within EU framework	EU Battery Regulation applies
Australia	Federal storage subsidies; mature electricity-market mechanisms	No major barriers	Grid-connection certification and local-service requirements
Mexico	Complete auto industrial cluster; USMCA location	Policy toward China swings with the United States	Local production enjoys regional zero tariffs
Uzbekistan	Tax reductions, land preferences, EV import-tariff exemption	No major barriers	Progressive localization requirements

Source: report compilation of Chapters 2, 4 and 6; see Appendix 2 for full citations. Data as of August 2026.

A2

Main data sources and references

1. Import and export statistics and press releases, General Administration of Customs of China

2. Production and sales data, China Association of Automobile Manufacturers (CAAM caliber)

3. Passenger-car market analysis, China Passenger Car Association (CPCA)

4. Installation data, China Automotive Power Battery Industry Innovation Alliance

5. IEA, *World Energy Investment 2025*; *Global EV Outlook 2025/2026*

6. IRENA, *Renewable Capacity Statistics 2026*

7. GWEC, *Global Wind Report 2026*

8. SNE Research global power-battery and energy-storage battery statistics

9. InfoLink Consulting analysis of China's PV module exports

10. CESA Energy Storage Application Branch going-global order statistics

11. European Commission final determination, countervailing case against Chinese EVs

12. U.S. Department of Commerce final double-anti determinations (four SE-Asian countries) and preliminary countervailing determinations (India, Indonesia, Laos)

13. SNE Research, global power-battery installation statistics, Jan–Apr 2026

14. Caixin Data Express, "BYD's Global Map"

15. CLS.cn, "A-share wind companies: from product going global to capacity going global"

16. Arab-China Industry Research Institute, "Chinese electrolyzers break into the Middle East"

17. Shanghai Council for the Promotion of International Trade, "New-energy industry going global — PV volume"

18. Annual reports and announcements of relevant listed companies; reports by mainstream financial media

A3

Joint publishing institutions

The World Trade Centers Association (WTCA), headquartered in New York, connects World Trade Centers in nearly 100 countries and regions, 300+ cities and 750,000+ business members — known as the "United Nations of business." Relying on Singapore's hub status and ASEAN's green-finance and trade-center functions, **World Trade Center Singapore** provides trade-promotion, connection and information services to its members as they engage with the globalization of China's new-energy supply — from Singapore we observe, we do not originate demand.

Contacts: Bruce Dong — Secretary General & COO (brucedong@wtcasg.org); Zhu Xiaolan — Chief Representative & CEO (zhuxiaolan@wtcasg.org).

Hejun Consulting is a leading comprehensive management consulting firm in China, with businesses covering strategic planning, organizational control, capital operation and industrial research. The Power & Electrical Business Unit is deeply engaged in the power and new-energy industries, providing strategy, investment and internationalization consulting services to source-grid-load-storage enterprises.

Hejun Consulting's Power & Electrical Business Unit is the co-publisher of this report.

A4

Glossary and abbreviations

CBAM	— EU Carbon Border Adjustment Mechanism	**IRA**	— U.S. Inflation Reduction Act
FEOC	— Foreign Entity of Concern	**NZIA**	— EU Net-Zero Industry Act
ODI	— Outbound direct investment	**EPC+F**	— Engineering, procurement and construction plus financing
IKTVA	— Saudi In-Kingdom Total Value Add program	**TKDN**	— Indonesia local-content requirement
LRS	— License Royalty Service model	**New Three**	— NEVs, lithium batteries and PV products
LFP / NCM	— Lithium iron phosphate / nickel-cobalt-manganese routes	**TOPCon / HJT / BC**	— Three high-efficiency crystalline-silicon cell technologies
BESS	— Battery energy-storage system	**PCS / BMS / EMS**	— Power conversion / battery management / energy management systems
GW / GWh	— Gigawatt (power) / gigawatt-hour (energy)	**PLI**	— India Production-Linked Incentive scheme
ALMM	— India Approved List of Models and Manufacturers	**PIF**	— Saudi Public Investment Fund
RCEP	— Regional Comprehensive Economic Partnership	**TCO**	— Total cost of ownership
CKD / IKD	— Completely / incompletely knocked down assembly	**UFLPA**	— U.S. Uyghur Forced Labor Prevention Act

DISCLAIMER · CONTACT

This report is jointly researched and published by World Trade Center Singapore of the World Trade Centers Association and Hejun Consulting's Power & Electrical Business Unit. It is based on public information and the authors' research judgment; it strives for but does not guarantee the accuracy and completeness of information. The content does not constitute any investment, legal or business decision advice. Data are as of August 2026; in case of any discrepancy with the latest official releases, the official caliber shall prevail.

Bruce Dong — Secretary General & COO brucedong@wtcasg.org

Zhu Xiaolan — Chief Representative & CEO zhuxiaolan@wtcasg.org

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NOTE

Editorial notes

DATA CUTOFF

Data current to August 2026.

CURRENCY CONVERSION

RMB, HKD and BRL figures converted to USD using World Bank 2026 annual average official exchange rates (period average): USD/CNY = 6.923; USD/HKD = 7.86; USD/SGD = 1.32; USD/BRL = 5.2204; original figures published in RMB/HKD/BRL are shown in parentheses. EUR figures retained in original.

INFORMATION BOUNDARY

Judgments in this report are WTC Singapore observations based on public information current to August 2026. They do not represent China's new-energy industry or any government.

POSITION STATEMENT

References to third-country tariffs, entity listings and security reviews describe public government actions and do not represent a position of WTC Singapore or the WTCA.