Sustainable Investing

2026 Global Energy Transition Barometer: The Next Transition Trade

Our Energy Transition Barometer finds continued momentum, notably in China and Europe, but pathways are increasingly diverging. As clean capacity scales and generation economics improve, the investment opportunity is shifting to solving bottlenecks in the utilisation and distribution of energy.

Sustainable Investing
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Key takeaways

- **The energy transition is advancing globally, but investment opportunities increasingly differ by region.** Our Barclays Energy Transition Barometer finds momentum strengthening across every region covered, led by China and Europe (Figure 1). However, differences in power demand, infrastructure, energy resources and market structure mean that the most-attractive technologies and sectors vary considerably by market (Figure 2).

- **We see the next transition trade as tilted towards transmission, with grids, batteries and baseload power increasingly emerging as key bottlenecks requiring investment.** Growth in renewables is increasing the need for transmission and distribution networks, battery storage, interconnectors, demand management and firm generation, such as nuclear and geothermal. For investors, this broadens the transition opportunity from renewable generation into regulated utilities, capital goods and electrical equipment.

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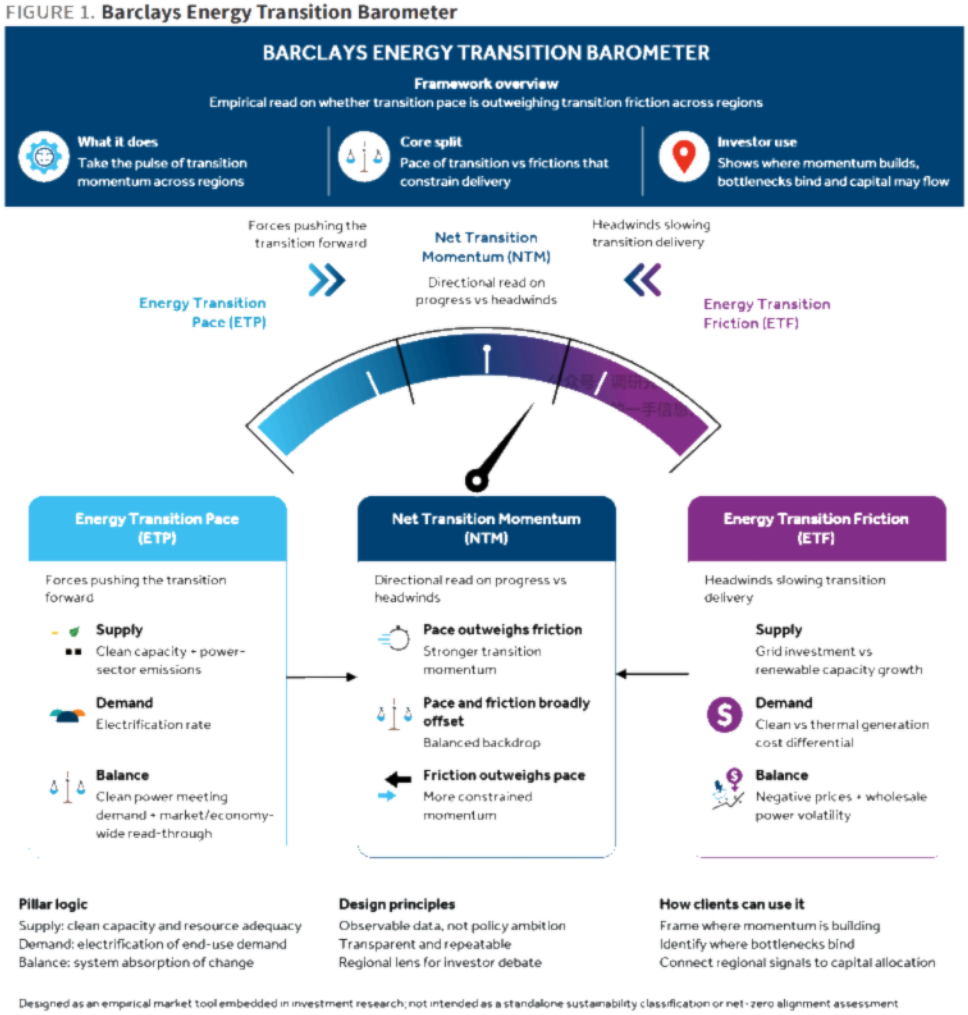
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- **China leads, creating opportunities across batteries, grids and clean-power operators.** Rapid renewable deployment is beginning to reduce coal's share of the power mix, but it is also increasing the need for transmission, storage and grid digitalisation. Renewable and nuclear operators are well placed, while overcapacity and pricing pressure require selectivity among solar, battery and other equipment manufacturers.
- **Europe follows, with its comparatively cleaner power system increasing the value of networks, batteries and electrification technologies.** Renewable deployment and generation economics have improved markedly since the Russia-Ukraine energy shock of 2022, but electrification of demand has lagged and grid balancing issues have become more acute. This supports regulated grids, battery storage, interconnectors, industrial electrification solutions and energy-management technologies.
- **North America is moving forward at a more incremental pace, with the opportunity set increasingly centred on supplying reliable power to data centres.** Clean capacity continues to grow despite policy uncertainty, while AI-related electricity demand is increasing the importance of rapid and dependable power delivery. Potential beneficiaries include regulated utilities, transformer and switchgear manufacturers, cables and grid equipment, on-site generation, battery storage and firm power sources, such as nuclear and geothermal.
- **For investors, the investible opportunity in the next phase of the transition is likely to centre on the enabling infrastructure around clean generation.** Renewable capacity remains an important growth market, but we view the investment opportunity increasingly expanding to the grids, batteries, power equipment, utilities and firm-generation technologies required to connect new supply and provide reliable electricity.

FIGURE 1. **Barclays Energy Transition Barometer**



Source: Barclays Research

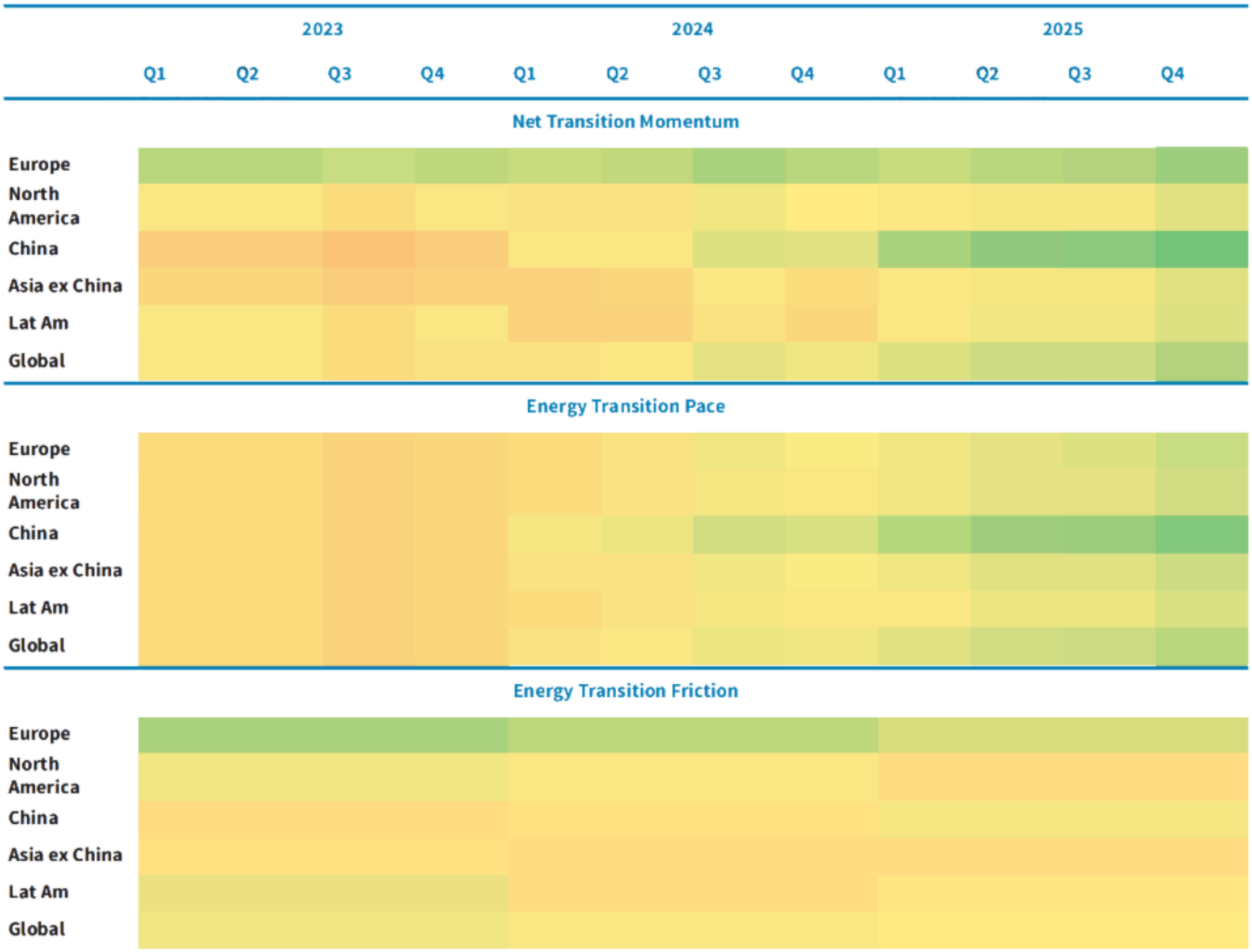
FIGURE 2. **Barclays Energy Transition Barometer: Signal and investment implications**

Region	Barometer signal	Investment implications
China	Strongest overall momentum, but rapid renewable growth is increasing pressure on grids and power markets.	Transmission and distribution networks, battery storage, grid digitalisation and renewable and nuclear power operators. Remain selective on solar, battery and other equipment manufacturers exposed to overcapacity and pricing pressure.
Europe	Cleanest power trajectory, but electricity demand and grid infrastructure are not keeping pace with renewable growth.	Regulated electricity networks, batteries, interconnectors, industrial electrification, electric heating and energy-management technologies.
North America	Slower transition momentum, but AI-related electricity demand is increasing the need for rapid and reliable power supply.	Regulated utilities, transformers, switchgear, cables and other grid equipment; on-site generation, battery storage, nuclear and geothermal power.
Asia ex-China	Electrification is advancing unevenly, with outcomes shaped by local grids, financing conditions and fossil-heavy power systems.	Country-specific opportunities in renewable and nuclear generation, transmission and distribution equipment, battery storage and gas-fired power where it replaces coal.

Region	Barometer signal	Investment implications
LatAm	Strong renewable resources support clean generation, but hydro variability and transmission constraints remain important.	Wind and solar generation, batteries, transmission networks and flexible power capacity, particularly where low-cost electricity supports mining and other energy-intensive industries.

Source: Barclays Research

FIGURE 3. **Our quantitative screen shows transition accelerating in all regions, led by China and Europe**



Green denotes higher momentum; shades towards red for negative momentum. For friction, green denotes lighter friction and red denotes higher friction. Measured relative to 2023 baseline.
Source: Barclays Research

Introducing the Barclays Energy Transition Barometer

Taking the pulse of the transition at a critical inflection point

We believe we are at an important juncture in the global energy transition. The first phase was defined by climate ambition, falling clean technology costs and rapid deployment, supported by a geopolitical environment broadly conducive to global coordination. This phase supported a lowering of the green premia and establishing clean power as the predominant source at the margin of the energy system (see Taking stock of the IEA World Energy Outlook and EI statistical review of world energy - key takeaways).

Energy security and competitiveness are now becoming structural transition drivers alongside sustainability. Countries are pursuing pathways shaped by their resource endowments, industrial priorities and energy security needs. Meanwhile, rising power demand is colliding with constraints in grids, flexibility and equipment supply. Together, these forces are widening regional differences and reducing the usefulness of a single global transition narrative (Sustainable Investing 2026 Outlook: Security, Sustainability, Scalability).

This shift leads us to propose a new analytical toolkit. We view the key question being posed now as whether the wider energy system can absorb that scale of clean technologies reliably and economically. If renewable capacity grows rapidly while grid investment lags, then clean power supply could accelerate while electrification struggles to keep pace. Clean generation would then become cheaper at the margin while system integration costs would rise. These mismatches matter for investors given implications for capital allocation, in our view.

Rhetoric vs reality: an empirical approach to assessing the transition

The Barclays Energy Transition Barometer provides an empirical view on whether transition progress is outweighing the headwinds that constrain delivery. It combines observable physical, economic and market inputs spanning clean supply, demand electrification, system balance, transition economics and equity market returns (see Methodology). We have designed this as an input into investment analysis, rather than as an alignment tool with a prescribed transition pathway.

Our framework is built around three core principles. Separate pace from friction, use hard data over qualitative policy indicators and prioritise transparency. Our aim is not to optimise a statistical relationship, but to provide a repeatable framework for measuring transition momentum and understanding the investment implications across regions.

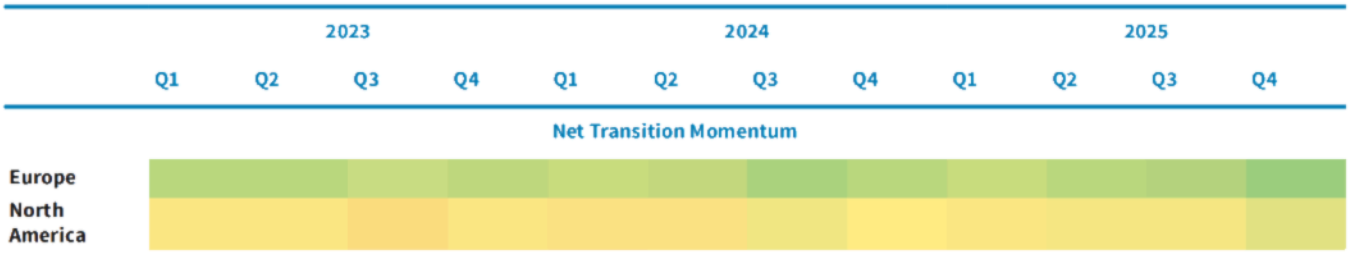
Our key takeaway from this analysis is that global transition momentum is building, but bottlenecks are emerging and regional variations are compounding. The opportunity set is increasingly regional: China's scale is creating demand for system integration, Europe's clean power build-out is increasing the value of flexibility, North America's load growth is elevating the importance of speed-to-power, while Asia ex-China and LatAm require more-selective investment approaches. We examine these Regional investment implications later in the report.

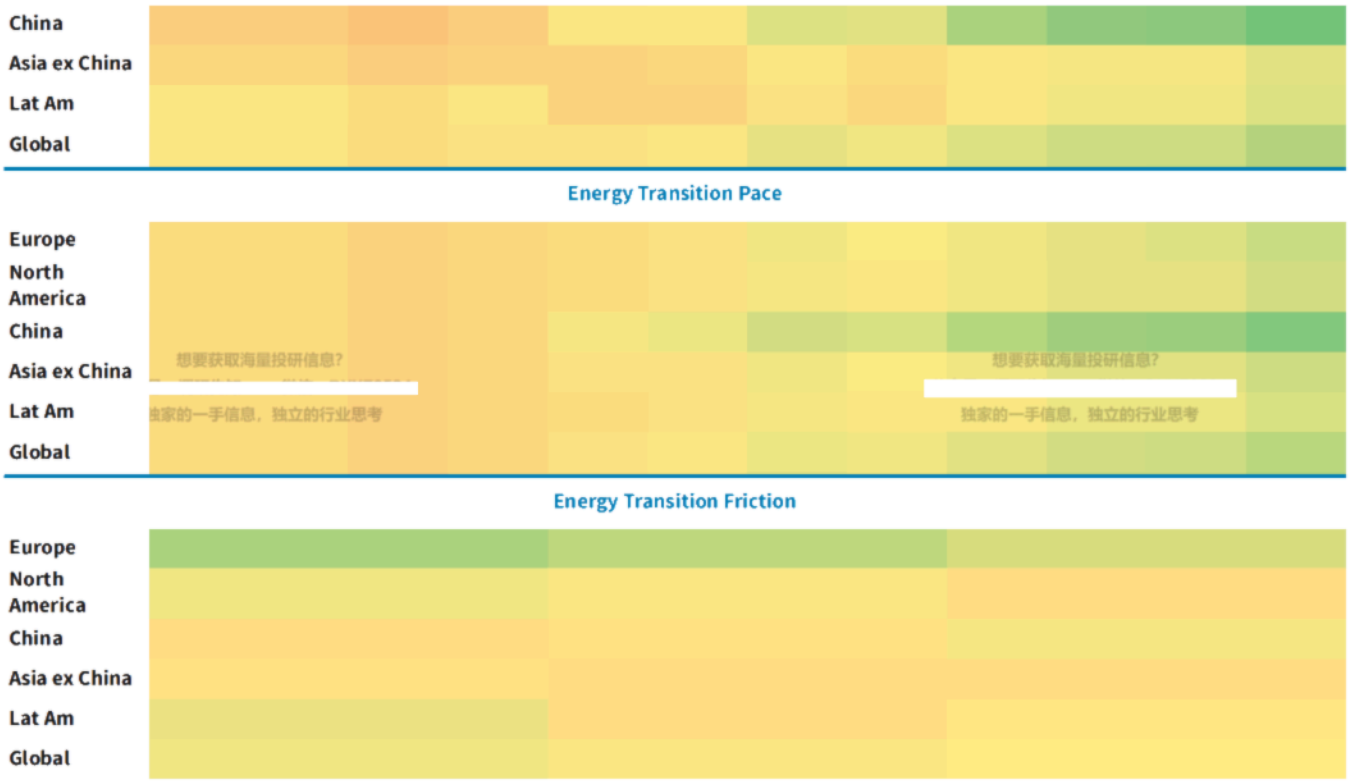
Understanding momentum drivers in a bifurcated transition

Overall transition momentum: Same direction, different speeds

Figure 4 shows transition momentum strengthening across all regions covered, but at different speeds and with increasingly distinct sources of friction. Our screens are therefore categorised according to our three pillars: Net Transition Momentum (transition pace - transition friction), Energy Transition Pace and Energy Transition Friction. For a full explanation and more granular breakdown of the data inputs we use, please see the Methodology section.

FIGURE 4. **Net Transition Momentum: Quantitative screen**





Green denotes higher momentum; shades towards red for negative momentum. For friction, green denotes lighter friction and red denotes higher friction. Measured relative to 2023 baseline.
Source: Barclays Research

All regions are advancing, but momentum is increasingly regionally divergent. Net transition momentum is improving across every region, with China and Europe leading while North America and LatAm are advancing more gradually. However, the positive transition trajectory is being met by greater friction and leads us to view the constraint as shifting from clean power deployment towards system absorption and utilisation. This increases the value of network capacity, flexibility and reliable power delivery, particularly in regions where clean supply is scaling faster than supporting infrastructure (see our three-part series on Network Security).

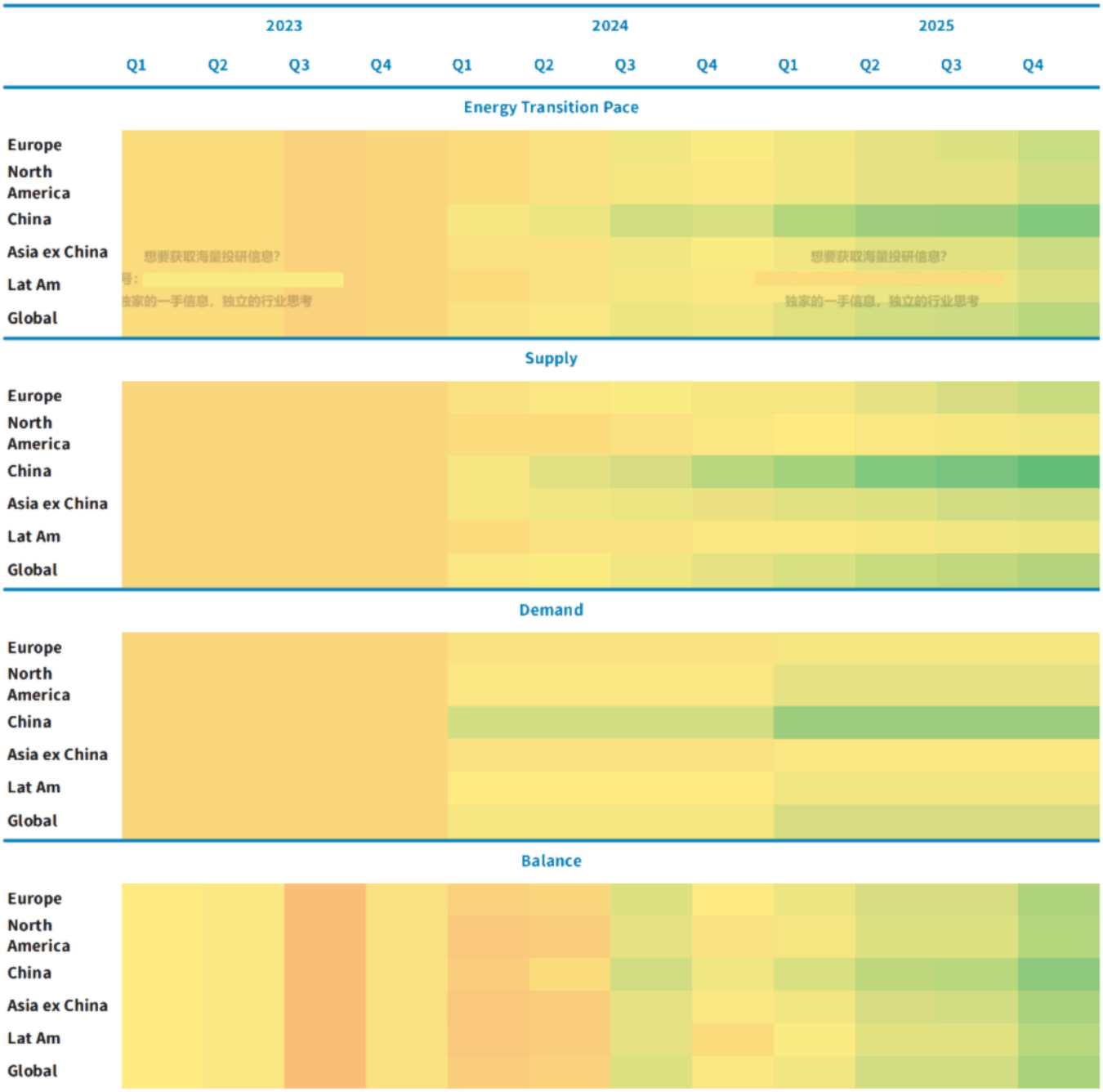
China and Europe screen strongest, but transition drivers differ markedly: China demonstrates the strongest net momentum, reflecting the scale of clean capacity growth and electrification (see China's green transition: gains and opportunities). Europe also screens strongly, supported by cleaner power supply and improving generation economics, but rising system balancing friction makes the region more of a flexibility and market-design story.

North America is also moving forward, but at the slowest pace of the regions in the screen. The region screens positive but less strongly than other regions, with a more-measured transition path and emerging signs of AI-related system stress. For investors, this points to a more selective opportunity set centred on grid equipment, data-centre power demand and clean baseload (Investing in nuclear: From baseload to breakthroughs).

Transition Pace: Renewables lead, electrification follows

We analyse the drivers of transition across three subcomponents: Supply, Demand, Balance (please see the Methodology section for more details). We present the screen for Transition Pace in Figure 5.

FIGURE 5. **Energy Transition Pace: Quantitative screen**



Green denotes higher momentum; shades towards red for negative momentum. Measured relative to 2023 baseline.
Source: Barclays Research

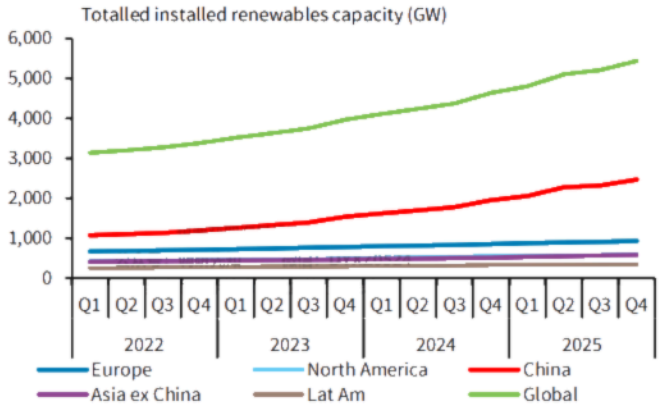
- **Supply momentum remains the strongest and most broad-based transition tailwind.** China in particular stands out, having nearly doubled installed renewable capacity (wind, solar, hydro) in less than three years (Figure 6). The scale of this deployment matters both domestically and globally. China's renewable build-out is beginning to displace coal in the power mix, while its manufacturing scale continues to lower global clean technology costs. Europe has also made material progress with renewable installed capacity rising by roughly a third, while North America's installed base has expanded at a similar rate despite policy headwinds over the past 18 months (Taking stock of US power post-OBBB). The data show physical deployment remaining resilient despite less-supportive policy initiatives in selected markets.

- **Demand momentum is strengthening, but lags supply growth.** China's supply-side expansion is being reinforced by rising electrification, enabling clean power to begin displacing thermal energy. However, Europe is progressing more slowly. Its transition strategy is centred on combining clean energy deployment with wholesale electrification, but electricity accounts for roughly the same share of total useful energy demand as three years ago.[1] North America continues to electrify incrementally, although the emerging energy challenge is more firmly centred on meeting rising power demand from AI, where speed and reliability are key (Powering AI: The new space race), rather than simply substituting existing fossil demand.

- **Balance is strongest where clean capacity, electrification and emissions outcomes are moving together.** China screens strongest because all three ETP pillars are advancing. Clean capacity is scaling, end-use is becoming more electrified and the power mix is gradually becoming less emissions-intensive. However, coal's continued importance in the power mix (>50% of generation) means this decline comes from a high level; Chinese electricity generation is still the most carbon-intensive of the regions we track (Figure 7). In contrast, Europe presents a different picture, with the ramp-up in renewables deployment and push to decouple from imported natural gas post-Ukraine war having accelerated its power-sector decarbonisation. North America is more mixed in this dimension, with clean capacity growing but the emissions intensity improving less decisively as electrification only occurs incrementally.

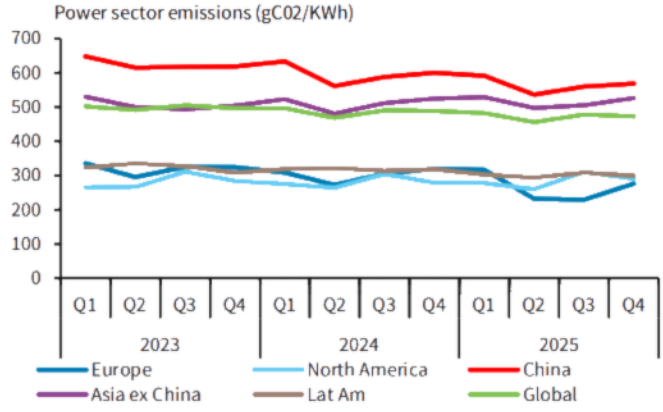
- **For investors, regional dynamics are key.** China's deployment supports global equipment volumes and lower technology costs, but overcapacity may weigh on supplier margins. Europe's increasingly decarbonised power mix concentrates the opportunity in power absorption and flexible assets capable of connecting abundant clean supply with a slower-moving demand base (What if... EU electrification gets catalysed). In North America, accelerating load growth shifts the opportunity towards utilities, grid equipment, behind-the-meter supply and clean firm capacity, such as nuclear (Nuclear progresses from conviction to construction). We develop these regional conclusions further in the next section.

FIGURE 6. **China's rapid deployment of renewables domestically is driving global decarbonisation outcomes...**



Source: Barclays Research, Ember

FIGURE 7. **...although Europe, North America, and LatAm are making more progress in decarbonising power supply**



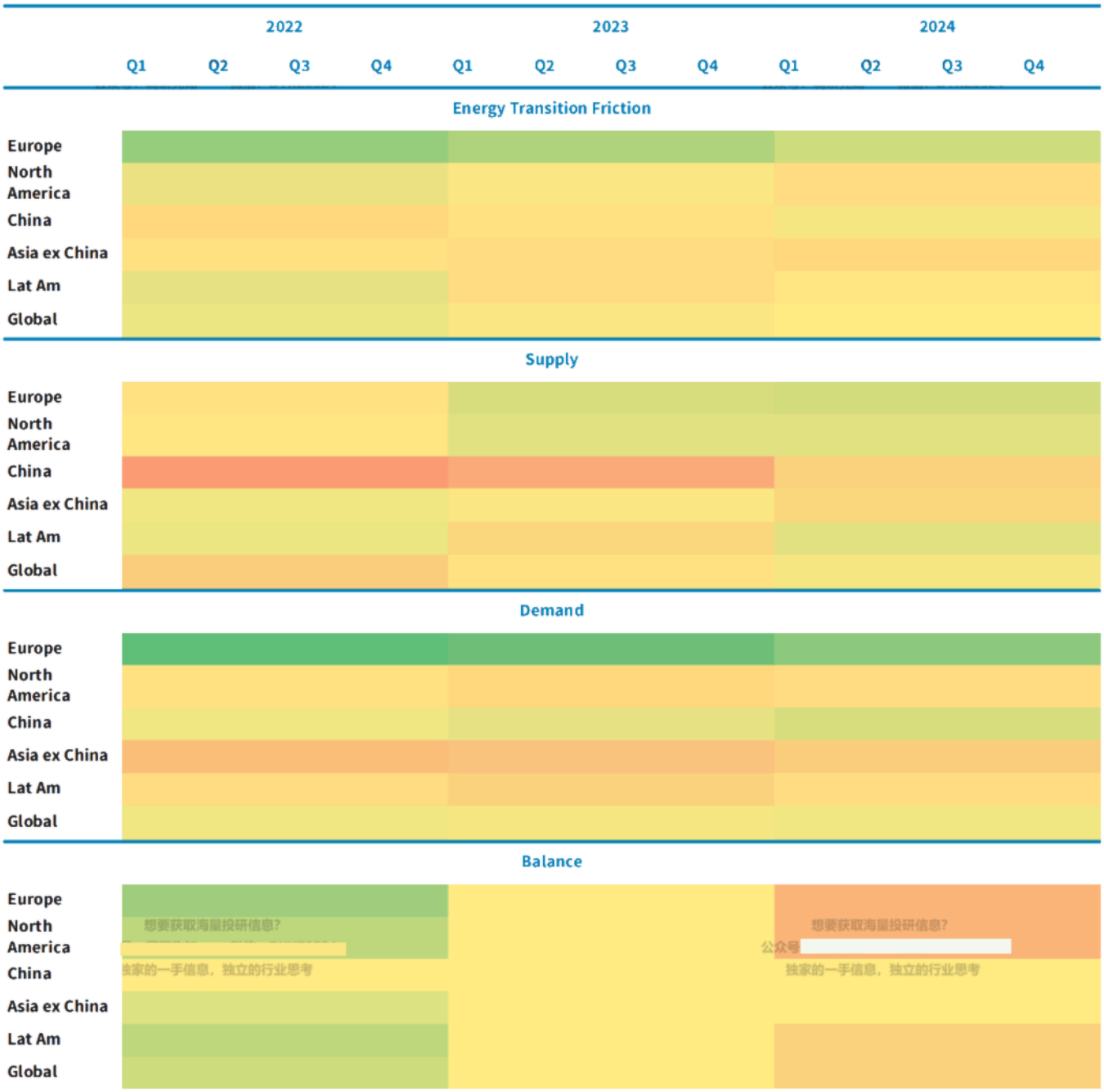
Source: Barclays Research, Ember

[1] FT. Europe's slow electrification is a 'major mistake', warns IEA chief

Transition friction: From generation economics to system integration

We separate our analysis of Energy Transition Friction across Supply, Demand, and Balance. Our screens in Figure 8 suggest that the economics of generation is no longer the key headwind. Instead, grid investment and system flexibility are emerging as critical challenges, particularly as it relates to keeping pace with renewable deployment. This resulting friction is increasingly visible through congestion as well as negative and volatile power prices.

FIGURE 8. **Energy Transition Friction: Quantitative screen**



Green denotes lower friction, and red denotes higher friction
Source: Barclays Research

- **Supply friction remains most visible where renewable deployment is running ahead of grid investment.** The grid screen compares renewable capacity growth with the corresponding growth in grid investment, capturing whether network development is

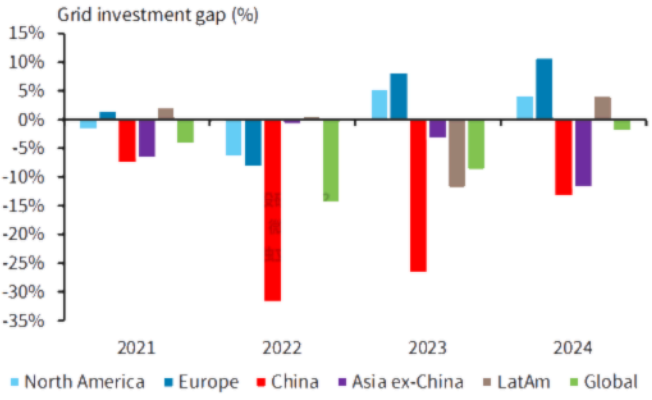
keeping pace with the clean power being added to the system (Figure 9). China and Asia ex-China show the clearest supply-side pressure, reflecting the challenge of expanding transmission, distribution and inter-regional connectivity quickly enough to absorb such rapid renewable capacity growth. Europe and North America appear comparatively less constrained on this particular measure given the less drastic growth rate of renewables deployment, although connection queues, permitting and local network congestion remain relevant investment considerations (Network security #2: If renewables are the problem, cables are the solution)

- **Demand friction is generally easing as clean generation economics become more competitive.** On a generation-only basis, the clean-versus-thermal cost differential is most supportive in Europe and China, suggesting that the standalone economics of clean power are no longer the primary constraint on deployment in those regions. Europe's clean generation discount has deepened materially (Figure 10), driven both by elevated imported hydrocarbon costs and a rapidly improving electro-tech stack, which is increasingly geared towards meeting the continent's critical infrastructure needs beyond just decarbonisation (Climate Tech: From decarbonisation to critical infrastructure). Demand friction is more visible across Asia ex-China and parts of LatAm and North America, where financing costs, fuel price dynamics, technology mix and local market structures can affect relative competitiveness. We, therefore, interpret this pillar narrowly as a measure of relative generation-cost friction, rather than as an assessment of whole-system cost or physical balancing requirements.

- **Balance friction is emerging as the most important headwind in higher-penetration markets.** This pillar captures negative wholesale prices and power-price volatility, signals that clean generation is at times exceeding local demand or available system flexibility. Europe shows the clearest deterioration, as rapid renewable deployment has increased the value of storage, interconnection, flexible demand and dispatchable capacity. Balance pressure is also visible in China and North America, as well as Asia ex-China and LatAm, although comparisons should be treated cautiously because market structures differ and regulated tariffs can suppress observable price signals.

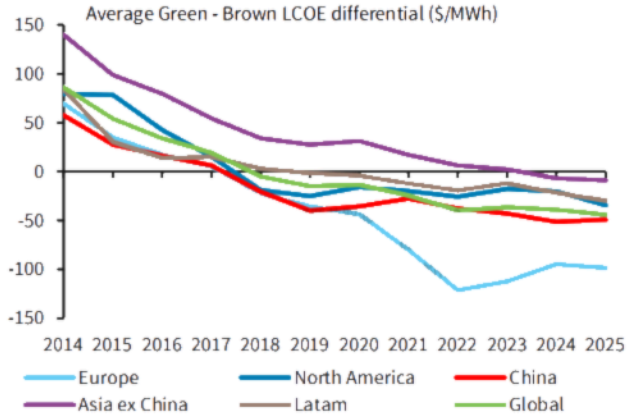
- **Transition friction is creating investible scarcity beyond renewables.** The regional screens point to different stages of the same system challenge: China and Asia ex-China need infrastructure to connect and absorb rapid deployment, Europe requires flexibility to manage an increasingly decarbonised power mix and North America's rising AI-load growth raises the value of reliability and grid capacity.

FIGURE 9. **Rapid renewables growth has outstripped grid investment growth, particularly in China and wider Asia**



Grid investment gap is computed as the difference between grid investment and renewable capacity growth rates. See Methodology for more details.
Source: BloombergNEF, Ember, Barclays Research

FIGURE 10. **Green generation premiums have fallen across all regions, particularly in Europe, which now benefits from a green generation discount**



LCOE focuses only on generation costs and not wider systems costs. For more details, please see the Methodology section.
Source: BloombergNEF, Barclays Research

Regional investment implications

The screens point to an increasingly differentiated regional opportunity set. Transition momentum is positive across all markets covered, but differences in power demand, resource endowments, market structure and system constraints lead to distinct investment conclusions (Figure 11).

FIGURE 11. **Barclays Energy Transition Barometer: Signal and investment implications**

Region	Barometer signal	Investment implication
China	Strongest broad-based momentum; rapid deployment is increasing absorption challenges.	Transmission, storage, grid digitalisation, renewable and nuclear operators; remain selective on equipment manufacturers exposed to overcapacity.
Europe	Cleanest power trajectory, but progress is supply-led, accentuating grid balancing friction.	Industrial electrification, storage, demand flexibility, energy management and regulated networks.
North America	Positive but slower momentum; rising AI load is shifting the focus to speed and reliability.	Speed-to-power: regulated utilities, electrical equipment, on-site generation and clean firm capacity.
Asia ex-China	Electrification is advancing unevenly across a highly diverse region, with grids, financing and fossil-heavy power systems shaping country-level outcomes.	Country-specific opportunities in renewables and nuclear capacity, grid & storage infrastructure and coal-to-gas conversion
LatAm	Supportive clean-resource base, but hydro variability and transmission constraints remain material.	Low-cost clean power for mining and industry, supported by complementary renewables, storage and flexible capacity.

Source: Barclays Research

- **China: execution at scale, with selective opportunities across the power ecosystem.** Coal's continued importance and the pace of clean capacity deployment create challenges

around utilisation, curtailment and market absorption. We see the clearest opportunities in energy storage, grid digitalisation, flexible industrial demand and clean firm generation. Domestic equipment overcapacity and pricing pressure mean physical deployment momentum may not always translate directly into supplier margins, requiring greater selectivity.

- **North America: speed-to-power for AI data centres is the central opportunity.** The region's more incremental transition path has so far limited some of the balancing pressures visible in Europe, but rapidly rising electricity demand, particularly from AI, is increasing the premium on speed-to-power and around-the-clock solutions (Powering AI: Bring Your Own Power ('BYOP') as AI Party Continues). This supports utilities able to expand their asset base while maintaining regulatory and balance-sheet discipline, as well as providers of electrical equipment, on-site generation and energy optimisation. Near term, long lead times for turbines and grid connections strengthen the case for on-site generation and solar-plus-storage. Over a longer horizon, geothermal, nuclear uprates and life extensions, as well as potentially small modular reactors, could broaden the speed-to-power opportunity.

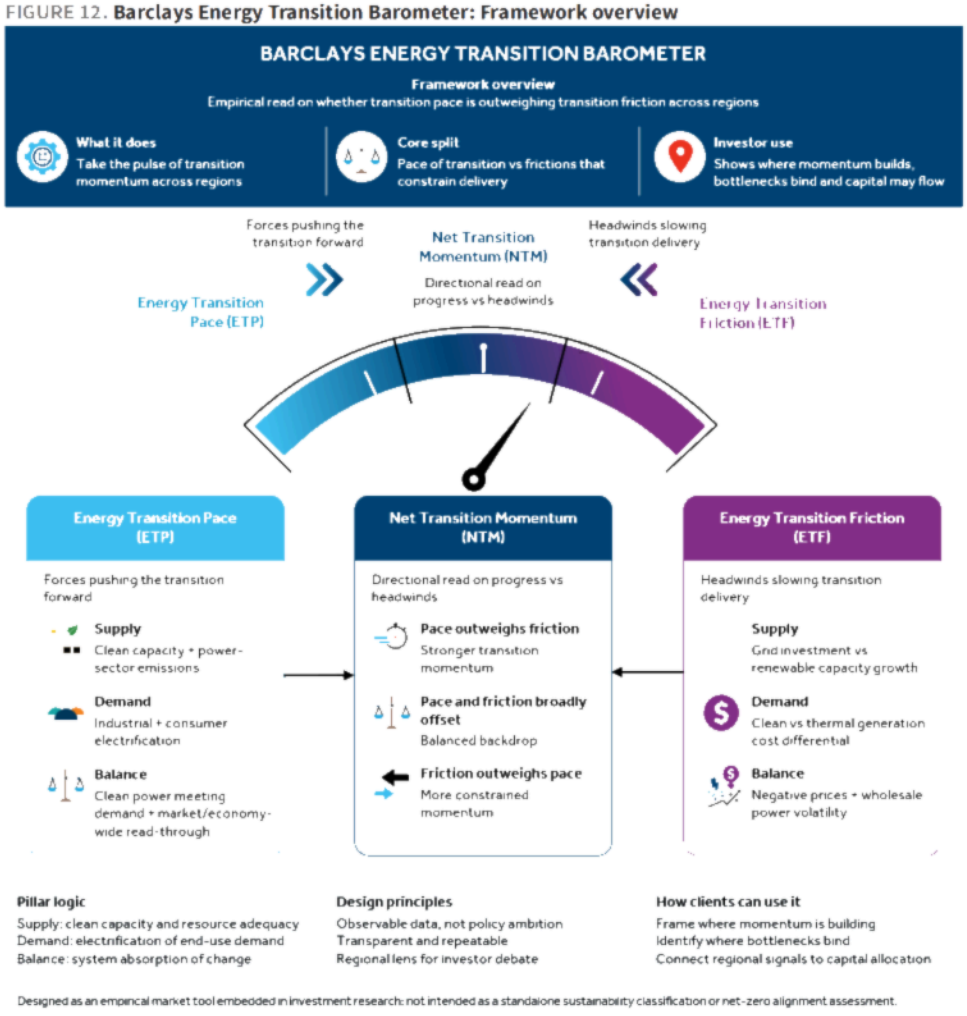
- **Europe: converting clean power momentum into productive demand.** Europe has made the clearest progress in decarbonising electricity supply, but end-demand electrification has moved more slowly and higher renewable penetration is increasing balancing requirements. Alongside generation, networks and storage, we think the opportunity set is expanding to include technologies that increase the productive use of clean electricity: industrial electrification, electric heating, flexible consumption, energy management and cross-border power optimisation. The rising friction in Europe, however, serves as a reminder that the transition will likely not be linear and that hydrocarbons will likely still form part of the wider energy mix, particularly when they can be sourced within the bloc.

- **Asia ex-China: modest electrification progress favours selective, locally tailored opportunities.** Economy-wide electrification is advancing, but at a more-measured pace than in several other regions. Fossil-heavy marginal generation, varied market structures and funding constraints also mean that rising electricity use will not automatically deliver decarbonisation. The opportunity set is therefore highly country-specific, favouring renewable developers where procurement is supportive, electrical-equipment providers in industrialising economies, and storage where variable generation is rising.

- **LatAm: resource quality supports generation, but diversification determines value.** LatAm's resource advantage is most investible where low-cost clean power can strengthen industrial competitiveness, particularly in mining and other power-intensive activities. Moreover, hydro variability and weather exposure increase the value of a more-diversified capacity mix (EM Sovereign Credit Strategy Navigating the Super El Niño). This favours complementary solar and wind, batteries and flexible capacity that can support industrial demand while reducing exposure to hydrological volatility.

Methodology

FIGURE 12. **Barclays Energy Transition Barometer: Framework overview**



Source: Barclays Research

The Energy Transition Barometer assesses whether the energy transition is gaining enough pace to overcome frictions. We construct a quantitative screen that treats transition momentum as the interaction between the pace of transition progress and the frictions constraining delivery (Figure 12).

- **Energy Transition Pace (ETP)**: assesses progress in clean supply, end-demand electrification and the balance between clean power and electricity demand.
- **Energy Transition Friction (ETF)**: measures the extent to which constraints and bottlenecks are slowing the transition.

The result of these two forces is **Net Transition Momentum (NTM)**, which provides a directional read on whether transition progress is outweighing the measured headwinds.

ETP and ETF are each assessed across supply, demand and balance. The transition is driven by the interaction of energy supply and demand, as well as the ability of the system to manage imbalances. Clean supply needs to scale, final energy demand needs to electrify and the power system needs to absorb that shift without creating new bottlenecks.

This structure is designed to separate the main moving parts of the transition while preserving a system-level view. It helps investors see not just whether the transition is progressing, but

where momentum is coming from and where frictions are emerging. We use a 2023 benchmark to avoid anchoring the framework to the exceptional disruptions created by the pandemic and the Russia-Ukraine energy shock.

Energy Transition Pace

Energy Transition Pace is an equal-weighted average of three pillars:

ETP = ⅓ Supply Pace + ⅓ Demand Pace + ⅓ Supply-Demand Balance

We use equal weights at the pillar level to keep the framework transparent.

1. ETP Supply

FIGURE 13. **Components of ETP — Supply**

Component	Weight	Description
Renewable Capacity Momentum	60%	Total installed wind, solar and renewable hydro capacity versus each region's average 2023 installed renewable capacity baseline
Nuclear Capacity Momentum	20%	Total net installed nuclear capacity versus each region's 2023 baseline
Power-Sector Emissions Intensity Momentum	20%	Trailing 4Q power-sector emissions intensity versus regional 2023 baseline

Source: Barclays Research

The ETP Supply pillar assesses whether the installed power fleet is becoming cleaner and whether that change is reducing the emissions intensity of electricity generation. It does so by looking at both renewables and nuclear capacity, with renewables carrying the largest weight because they represent the principal recurring source of new clean capacity. Renewable capacity includes wind, solar and renewable hydro. This is then computed by comparing each region's current installed renewable capacity with its average 2023 installed renewable capacity baseline.

We use a stock-based capacity measure because it avoids comparing capacity additions with prior capacity additions — a "growth of growth" problem. It also reduces quarter-to-quarter volatility and better captures the structural build-out of the clean power system.

Nuclear is treated separately because it has different economics and commissioning cycles. We measure total net installed nuclear capacity versus a 2023 baseline, capturing the fleet trajectory after additions, retirements, restarts and closures.

Power-sector emissions intensity acts as an outcome check. Capacity can grow, but the transition only matters if the power mix is becoming cleaner. This metric, therefore, measures whether power-sector emissions intensity is improving versus the 2023 baseline.

2. ETP Demand

FIGURE 14. **Components of ETP — Demand**

Component	Weight	Description
Energy demand electrification	100%	Electricity generation as a share of Total Energy Supply, versus the 2023 baseline

Source: Barclays Research

The ETP Demand pillar assesses changes in the role of electricity within the overall energy system. We use an economy-wide electrification proxy calculated as electricity generation divided by total energy supply. Electricity generation is converted from TWh to EJ using a factor of 0.0036 before calculating the share, with 2023 used as the baseline year. Higher electricity share means greater electrification and, therefore, faster demand-side transition pace.

We keep Demand Pace focused on the electrification of end demand, rather than clean electricity penetration. Clean power supply as a share of electricity demand specifically (as opposed to broader energy demand) is captured separately in the Balance pillar. This avoids double-counting clean power generation inside the demand pillar and preserves a clean distinction between demand shifting to electricity and the power system becoming clean enough to support that shift.

3. ETP Supply-Demand Balance

FIGURE 15. **Components of ETP — Balance**

Component	Weight	Description
Clean Share of Power Demand	50%	Clean power supply as a share of total electricity demand, versus 2023 baseline.
Clean vs Conventional Energy Index Performance	25%	Relative performance of clean (SPGTCED) versus conventional energy index (MXWO0EN)
Emissions Intensity of GDP	25%	Broader economy-wide emissions intensity outcome check (kg CO_2 per USD of GDP, PPP-adjusted), measured relative to 2023 baseline

SPGTCED Index = S&P Global Clean Energy Transition Index, MXWO0EN Index = MSCI World Energy Sector Index
Source: Barclays Research

The Supply/Demand Balance pillar assesses whether clean electricity supply is keeping pace with demand, while incorporating wider market and economy-level outcomes.

Clean Energy Share of Demand is the core physical balance screen. It measures clean power generation as a share of total electricity demand. This is placed in the Balance pillar because the metric has supply in the numerator and demand in the denominator. It is, therefore, not a pure demand measure; it measures whether the clean power system is scaling fast enough relative to the size of the power market.

Relative clean-versus-conventional energy equity performance provides a market-facing read on whether public markets are rewarding the transition theme. We do this by measuring the relative performance of the S&P Global Clean Energy Transition Index (SPGTCED) with that of a conventional energy-focused index (MSCI World Energy Sector Index, MXWO0EN).

Emissions intensity of GDP provides a broader economy-wide outcome check, complementing the framework's focus on power and electrification. We construct GDP-weighted regional values using PPP-adjusted output, with lower emissions per unit of GDP indicating a greater decoupling of economic activity from emissions. This tests whether transition progress is extending beyond the power sector into the wider economy.

Energy Transition Friction

Energy Transition Friction is an equal-weighted average of three pillars:

ETF = ⅓ Supply Friction + ⅓ Demand Friction + ⅓ Supply-Demand Friction

The logic is the same as for Energy Transition Pace, in that it assesses how bottlenecks to transition outcomes are progressing across the supply and demand side of the energy system, as well as accounting for balancing issues. Progress is then measured against a 2023 baseline, once again to account for the exogenous shocks of 2020-22.

1. ETF Supply

ETF Supply assesses whether grid investment is keeping pace with renewabl
We do this by looking at the grid investment gap, since concerns over networ
increasingly dictating the extent to which clean capacity can come online an
displace thermal generation.

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Grid gap = grid investment growth — renewable capacity growth

This measures the extent to which grid investment is keeping up with the growth in installed renewable capacity, given the strain on the grid that variable generation introduces. This is an important friction element to the energy transition, with grid stability having emerged as an increasingly important issue for policymakers and investors alike as renewables become a dominant component in many countries' power matrix (Network security (part 1): Blackouts).

We think looking at the delta between grid investment and renewable capacity growth represents a cleaner friction metric than grid capex alone, because the transition bottleneck is not simply whether grid spending is rising, but whether it is rising fast enough relative to the clean capacity being added to the system. A region with high grid investment may still face rising friction if renewable capacity is expanding faster, while equally a region with more moderate grid spend may face less pressure if clean capacity growth is also more measured. This metric is therefore designed to capture the relative adequacy of grid investment, making it a more direct proxy for clean-capacity bottlenecks.

2. ETF Demand

The Demand Frictions pillar assesses the significance of hurdles to decarbonising energy demand. We think the main determinant of this is the relative competitiveness of clean versus conventional generation costs, measured as the spread between green and thermal LCOE[2]:

Green LCOE — thermal LCOE

LCOE is one of the most recognised metrics for comparing the relative economic cost of power generation across different technologies. We choose this metric given the breadth and depth of data availability, which allows for cross-regional comparison. LCOE does, however, have limitations and should not be seen as the full picture of the relative cost of power generation technologies. The most common critique of LCOE is that it favours renewables by focusing only on marginal generation costs, ignoring the wider systems cost associated with their variability. We partially address this by including storage costs while recognising that the measure does not capture the full network, flexibility and balancing costs of variable generation. Those pressures are assessed separately in ETF Supply and Balance

3. ETF Supply-Demand Balance

FIGURE 16. **Components of ETF — Balance**

Component	Weight	Description
Negative Power Price Prevalence	50%	Share of hours with negative wholesale electricity prices, versus 2023 baseline.
Wholesale Power Price Volatility	50%	Normalised hourly price spread, versus 2023 baseline.

Source: Barclays Research

The Balance Frictions pillar measures the extent to which power markets are showing signs of integration stress. Negative prices capture periods where supply exceeds demand or system flexibility is insufficient. Wholesale price volatility captures broader instability in power-market balancing. Both are benchmarked against 2023 because absolute levels are less comparable across market designs.

Cross-market comparison requires caution. Negative power prices are most directly comparable in liberalised wholesale markets. In regulated or semi-regulated markets, the absence of negative prices does not necessarily mean the absence of system stress. Tariff structures can

[2] The levelized cost of electricity (LCOE) is a measure of the average net present cost of electricity generation for a generator over its lifetime. It is one of several cost metrics used for investment planning and to compare different methods of electricity generation on a consistent basis.

suppress price signals. For that reason, ETF Balance should be interpreted as a directional integration-stress proxy, not as a perfect global measure of power-market efficiency.

Net Transition Momentum

We estimate net transition momentum by comparing the assessments of Energy Transition Pace (ETP) and Energy Transition Friction (ETF). Net transition momentum is calculated as the difference between these two components, designed to give a directional read on whether transition progress is outweighing the measured headwinds in each region.