

NEUBERGER



2026 State of Decarbonization Report

AN UNEVEN TRANSITION

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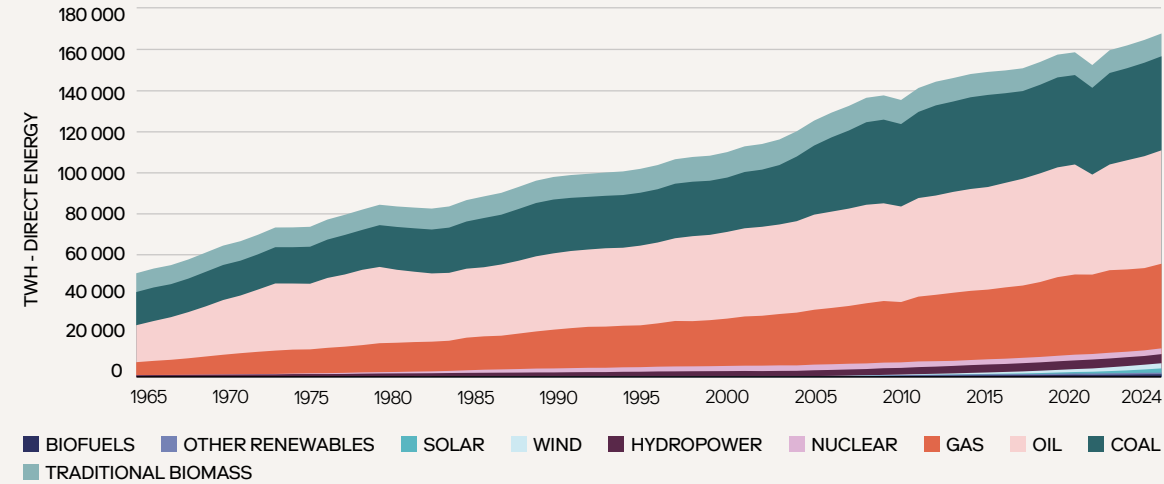


Introduction

Global decarbonization progress continues to be defined less by ambition and more by whether deployment, capital allocation, and policy are translating into real-world outcomes. While clean-energy investment and technology deployment reached new highs in 2025, rising structural pressures—particularly accelerating energy demand—continue to dominate emissions trends. The data show a widening gap between activity and outcomes, with implications for both transition alignment and physical climate risk.

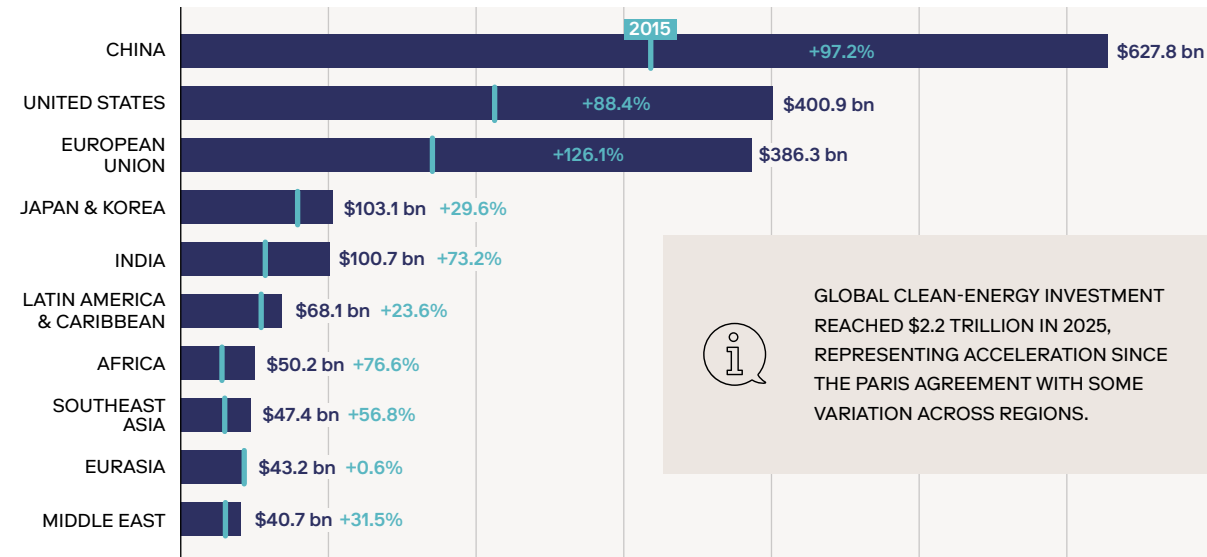
To help investors navigate this complex picture, we are pleased to present the third annual edition of ‘The State of Decarbonization’. Our work aims to help answer the questions that are most important to investors when it comes to managing capital in a decarbonizing economy.

GLOBAL ENERGY DEMAND



ALTHOUGH THE SHARE OF FOSSIL FUELS IN THE ENERGY MIX HAS BEEN DECREASING, THE RISING ENERGY DEMAND WILL LIKELY RESULT IN PROLONGED RELIANCE DESPITE INCREASED SUBSTITUTION WITH RENEWABLES.

GLOBAL ENERGY CAPEX



GLOBAL CLEAN-ENERGY INVESTMENT REACHED \$2.2 TRILLION IN 2025, REPRESENTING ACCELERATION SINCE THE PARIS AGREEMENT WITH SOME VARIATION ACROSS REGIONS.

47%

COMPANIES WITH A STATUS OF "ALIGNING" OR HIGHER IN MSCI WORLD

3.5%

ANNUAL ENERGY-DEMAND GROWTH THROUGH 2030

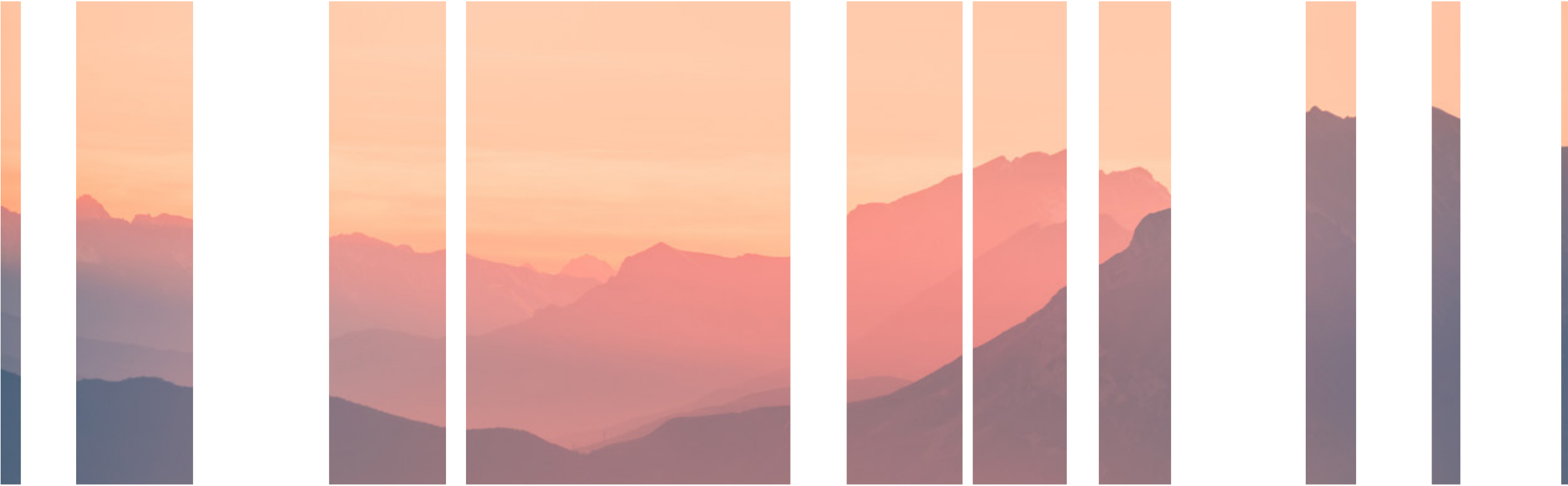
~60%

2030 PROJECTED EMISSIONS GAP UNDER CURRENT POLICIES

Source: World in Data, IEA, Neuberger, Climate Action Tracker

Real-World Decarbonization

Looking Back at 2025



THE INDICATOR

How it works

To enable a robust bottom-up assessment of a company’s transition toward net zero, we created the Neuberger Net-Zero Alignment Indicator in 2023. It was designed to assess companies’ net-zero alignment status based on their ambitions and decarbonization efforts. Developed in partnership with clients who have decarbonization targets, the indicator incorporates specific sub-indicators that were informed by the high-level expectations of the Institutional Investor Group on Climate Change’s (IIGCC) Net-Zero Investment Framework. Since inception, we have reviewed over 2,000 companies across our fixed-income and equity holdings. The Indicator allows us to understand corporate alignment at the company level and at the macro level.

NET-ZERO ALIGNMENT INDICATOR – PROCESS OVERVIEW

1 QUANTITATIVE SCORES ACROSS SIX SUB-INDICATORS ARE OVERLAID WITH ANALYST INPUT

LONG-TERM AMBITION	EMISSIONS PERFORMANCE	DECARBONIZATION STRATEGY
SHORT- AND MEDIUM-TERM TARGET	DISCLOSURE	CAPITAL ALLOCATION

2 EACH SUB-INDICATOR IS ASSIGNED A FINAL ADJUSTED SCORE OF 1 TO 5



3 THE TOTAL SCORE ACROSS THE SUB-INDICATORS RESULTS IN THE COMPANY'S OVERALL ALIGNMENT STATUS

ACHIEVING NET ZERO	ALIGNED TO A NET-ZERO PATHWAY	ALIGNING TOWARD A NET-ZERO PATHWAY
COMMITTED TO ALIGNING	NOT ALIGNED	DO NOT KNOW OR NOT YET ASSESSED



2,283
TOTAL HOLDINGS REVIEWED¹



766
REVIEWS SUBMITTED WITH
EXPERT ANALYST JUDGEMENT¹

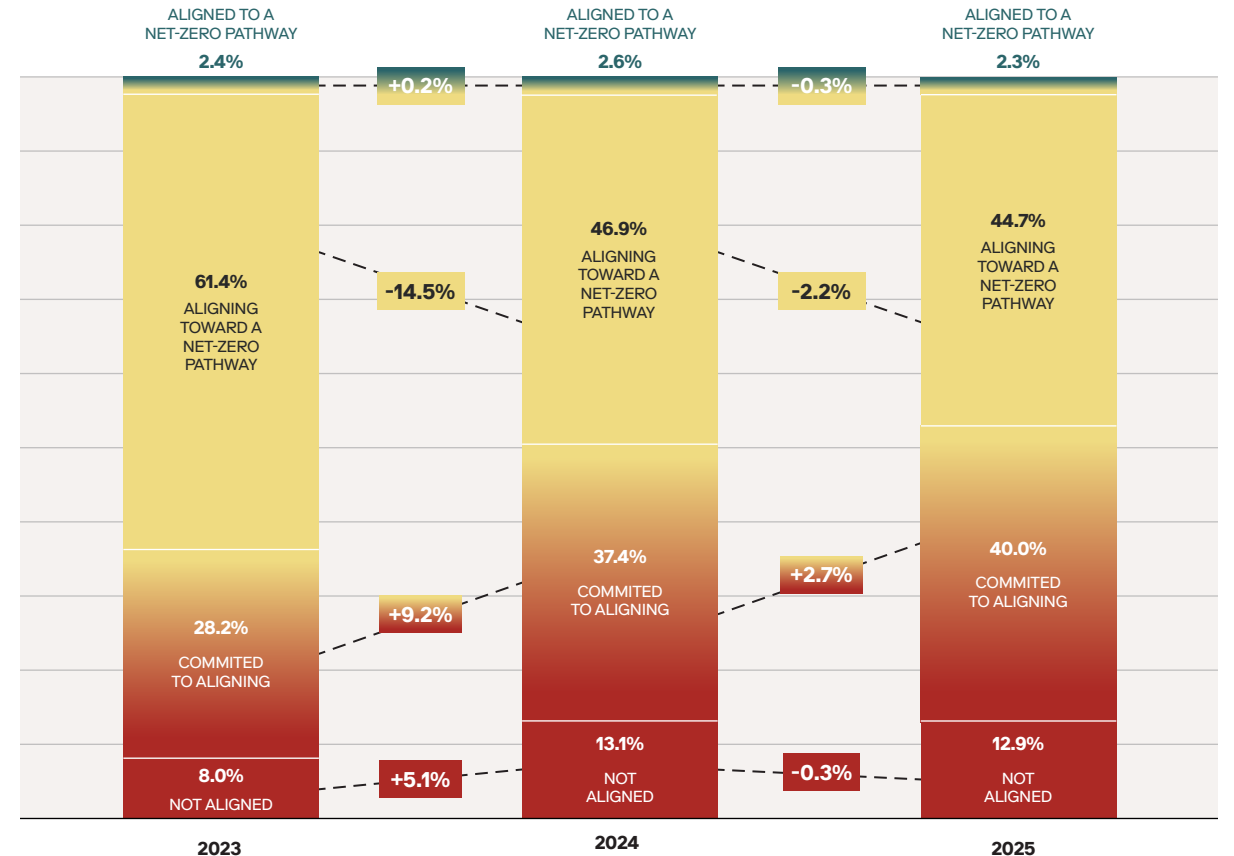
1. As of December 2025 across equity and fixed income. Excludes cash and derivatives (including U.S. Treasuries), CLOs and supranational debt.

GLOBAL ALIGNMENT SNAPSHOT

Net-zero alignment status of the MSCI World Index

Real-world progress toward decarbonization remains uneven. While the indicator shows headline alignment statuses remained relatively stable year over year, the underlying momentum is fragile. Digging into the indicator reveals a landscape where long-term ambition and targets remain relatively widespread, but near-term strategy and capital allocation often lag behind.

ALIGNMENT STATUS MSCI WORLD (MV WEIGHTED) – YEAR-ON-YEAR CHANGE 2023², 2024³, & 2025⁴



Source: Neuberger

2. As of December 31, 2023

3. As of December 31, 2024

4. As of December 31, 2025

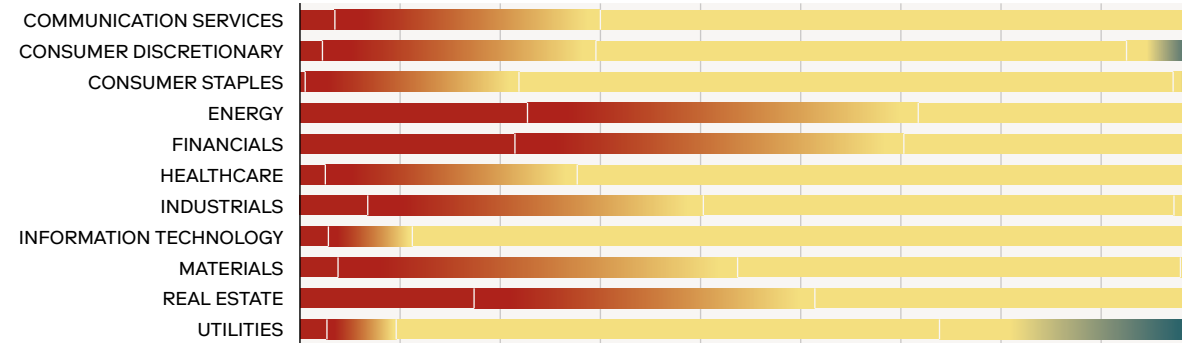
Macro and policy dynamics, particularly in the U.S., shaped the year’s results. In the U.S., political polarization and uncertainty around climate policies created hesitation among companies that rely on regulatory clarity to justify long-term capital commitments. This contributed to a modest retreat in science-based target adoption, particularly for companies’ long-term targets, as well as decarbonization strategies. The pullback was less pronounced in Europe and APAC where policy frameworks remain more consistent.

2025 also saw continued sector level divergence, with the largest deterioration trend seen in the energy sector. This comes primarily from oil and gas majors, many of whom continue to maintain headline net-zero targets but have scaled back the pace and scope of their decarbonization plans. Financials experienced another year of decline in alignment statuses, much as they did in 2024. While some banks maintain public commitments to net zero, others have scaled back their transition plans, with some dropping their targets entirely. These shifts, coupled with the recent announcement by the Net-Zero Banking Alliance that they will immediately cease operations and transition to a framework initiative, underscore the downgrades in alignment.

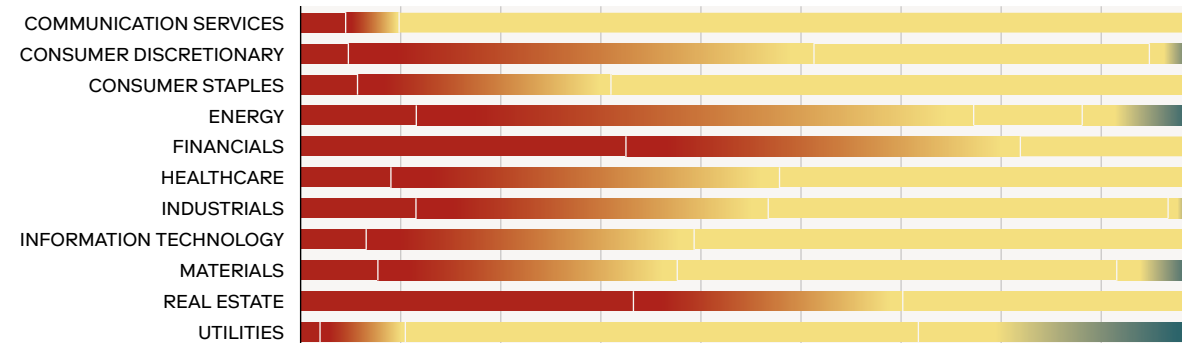
Looking across the landscape, 2026 begins with a clear message: the decarbonization transition is no longer defined by aspiration but by credibility. Corporations (and investors) will likely shift focus from ambition alone to how these companies are aligning capital allocation and strategy with their targets.

ALIGNMENT STATUS MSCI WORLD (MV WEIGHTED) BY SECTOR

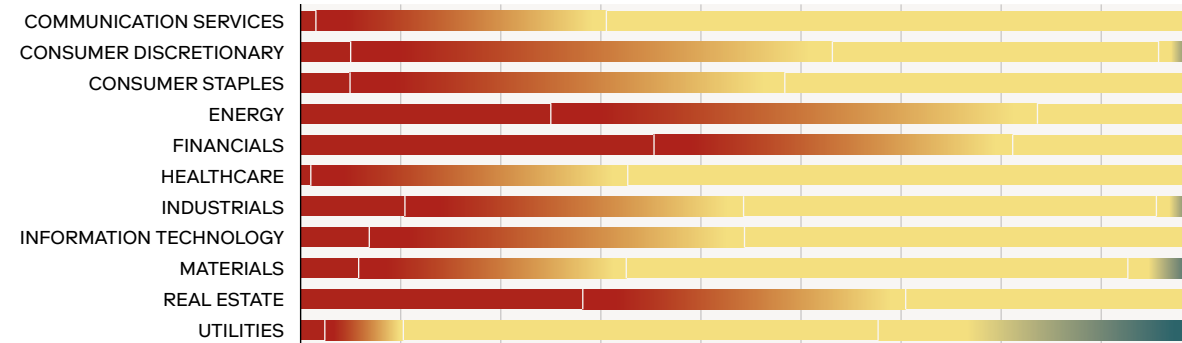
END OF YEAR 2023 (As of December 31, 2023)



END OF YEAR 2024 (As of December 31, 2024)



END OF YEAR 2025 (As of December 31, 2025)



Source: Neuberger

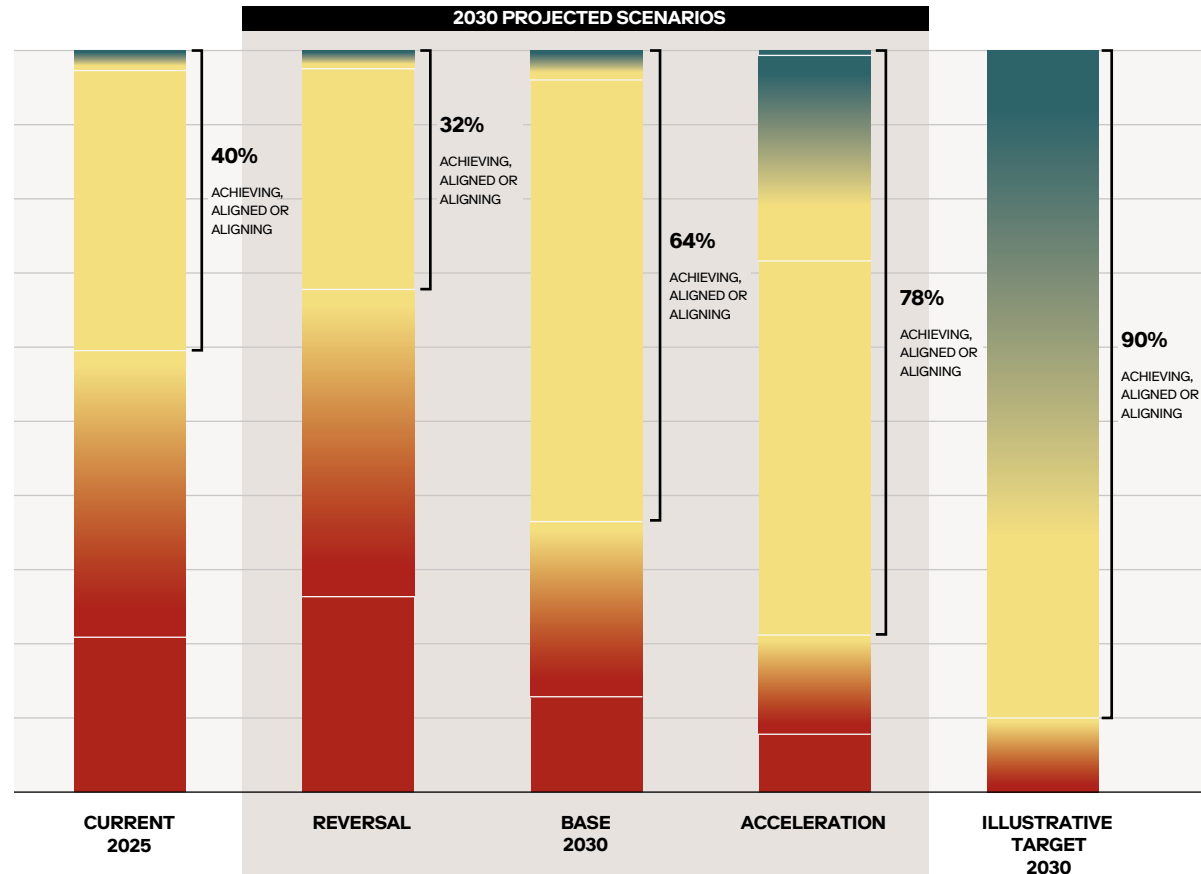
POTENTIAL ALIGNMENT PATHWAYS

Projected scenarios for global 2030 alignment

As asset owners and asset managers set alignment targets for their portfolios, understanding the evolution of alignment across the market is increasingly important. To help evaluate these potential pathways, we have constructed a variety of alignment scenarios to 2030. They are built on a structured set of forward-looking assumptions that link today’s disclosure quality, target setting, strategic planning, capital allocation, and future emissions performance over the next five years. Based on a company’s current sub-indicator scores, consistent rules are applied for how ambition translates into action. These relationships underpin the Reversal, Base, and Acceleration scenarios, anchoring each pathway in observable corporate behavior rather than speculative policy assumptions. Assessing these scenarios on an equal-weighted basis helps to showcase the range of companies in each alignment status, rather than the current alignment tilt based on market weighting.

Across these scenarios, even under optimistic assumptions, the MSCI World Index does not reach the illustrative target of 90% of issuers being Achieving, Aligned, or Aligning with net-zero pathways by 2030. Under the Acceleration and Base case, the improvement seen from today’s statuses is driven almost entirely by companies enhancing their decarbonization strategies and increasing capital allocation to support these efforts. Meanwhile, under the Reversal case, over 65% of companies lack either a decarbonization strategy or dedicated capital allocation for decarbonization efforts, resulting in difficulty achieving meaningful emissions reductions. Thus, even under an Acceleration scenario, the index is likely to retain meaningful transition risk.

MSCI WORLD EQUALLY WEIGHTED NET ZERO ALIGNMENT



Source: Neuberger

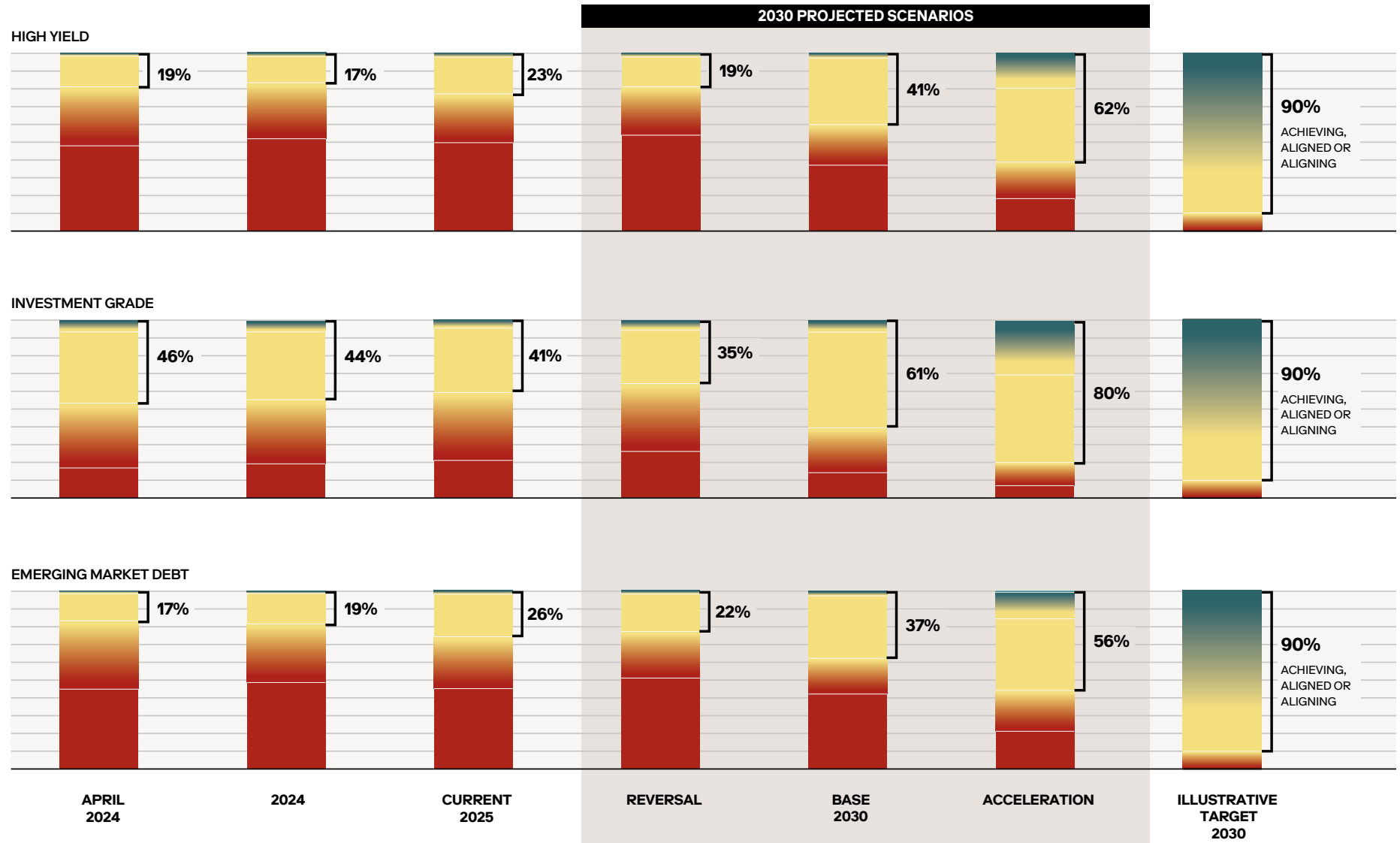
In our view, investors seeking to manage these exposures may therefore be better served by an active approach rather than passive. Understanding and identifying which companies are poised to support their targets with credible transition plans will be key in gaining exposure to transition opportunity, while mitigating the risk of companies who fail to advance beyond ambition.

Industrials, Materials, and Utilities are some of the primary contributors to improved alignment in the Acceleration case, reflecting progress in sector-specific decarbonization strategies and capital deployment. These companies’ robust disclosures and ambitions are currently helping to elevate their alignment. Indeed, cost-competitive renewable energy along with innovation in energy efficiency have allowed these sectors to make greater progress in their decarbonization efforts than others. In an Acceleration pathway, these sectors offer clearer visibility into transition execution, supporting longer-duration allocation where policy support and technology readiness are aligned.

However, under a Reversal scenario, Financials’ recent pullback could continue over the next five years, spurred by low levels of capital allocation. For investors, Financials are positioned less as direct transition drivers. Instead Financials reflect their existing lending portfolio, where alignment outcomes are shaped by client demand, regulatory frameworks, and risk-weighted asset considerations. As a result, investor exposure to Financials under a Reversal scenario is less about direct decarbonization execution and more about assessing second-order transition risk transmitted through credit demand, balance-sheet composition, and regulatory capital constraints.

Across sectors, capital allocation is likely to play a key role in the coming years, with many sectors requiring high levels of funding to finance decarbonization efforts. While this dynamic is important in equity markets, many companies will likely turn to debt financing to help fund these transition levers. When analyzing these scenarios across fixed-income benchmarks, a differentiation emerges across the sub-asset classes in potential future alignment. In our view, the divergence among sub-asset classes underscores the importance of active management, not only to meet client-directed net-zero objectives, but to navigate transition-driven risk, return dispersion, and financing dynamics across portfolios. Investment-grade credit is currently further along in its decarbonization journey, with more companies in this category having set long-term and near-term targets. The high-yield and emerging-market debt sectors by comparison are at the beginning of their decarbonization process and often have lower data availability. Starting from a lower baseline, even in the Acceleration case, high-yield and emerging-market debt sectors will be unlikely to close the current gap with Investment Grade by 2030. As a result, investors are likely to face widening divergence in transition-related risk and return across fixed-income portfolios, elevating the importance of issuer-level selection, maturity structure, and capital allocation credibility, particularly in high-yield and emerging-market exposures.

2030 NET-ZERO ALIGNMENT SCENARIOS ACROSS FIXED-INCOME ASSET CLASSES



Source: Neuberger
 Projections are based on benchmark data as of December 31, 2025.
 Benchmarks used in analysis:
 • Non-Investment Grade: ICE BofA Global HY Constrained Index HW0C.
 • Investment Grade: BBG Global Agg Corporate Index.
 • Emerging Market Debt: JP Morgan Corporate Emerging Markets Bond Index.

THE CONTINUED IMPLEMENTATION GAP

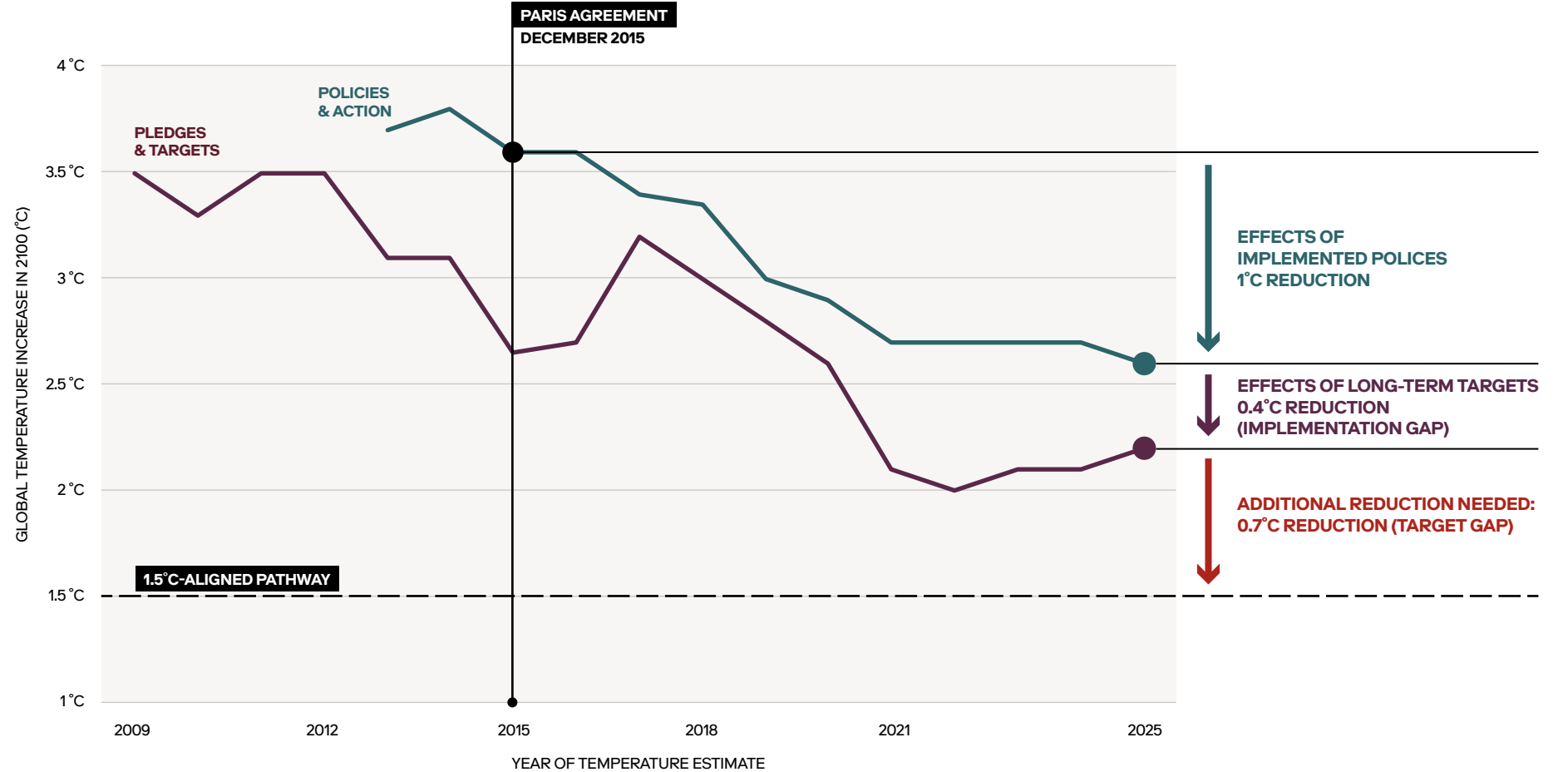
Where we could have been

While the importance of pairing action with ambition is clear, current government policies remain insufficient to limit the global temperature rise to 2°C in 2100, let alone 1.5°C, which represents the ‘stretch target’ under the Paris Agreement. This shortfall persists despite the release of a new round of 2035 national targets by many countries.

Current policies imply a global temperature increase of approximately 2.6°C by 2100. Full implementation of existing national targets could reduce this by around 0.4°C, underscoring the scale of the persistent implementation gap. As this gap continues at government level, delays in transition among companies facing significant transition costs are understandable.

However, even if the implementation gap can be closed in the coming years, global emissions remain off track for a net-zero pathway. While countries have announced new 2035 ambitions, the target gap in global emissions is still 26-31 GtCO₂e in 2035. To transition at the speed and scale required to meet these targets, advances in ambition, decarbonization strategy, and capital allocation are needed.

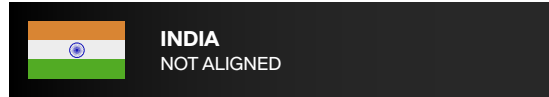
CHANGES TO ESTIMATED GLOBAL TEMPERATURE INCREASE IN 2100



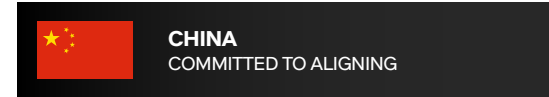
Source: Climate Action Tracker

SOVEREIGN ALIGNMENT

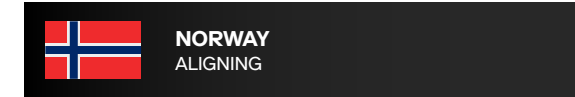
Sovereign alignment plays a critical role in shaping investment flows from both public and private sources, as well as influencing corporate action. Assessing a sovereign’s alignment provides insight into where progress in closing the target and implementation gap may occur, and goes beyond the ambition implied by national targets alone. Political shifts, as seen over the past year in the U.S., can have near- to mid-term implications on a sovereign’s ability to align with net zero. Countries with industrial-centric growth profiles face greater structural challenges in decarbonization. To capture real-time insights into various countries, we created a forward-looking Sovereign Net-Zero Alignment Indicator that seeks to capture a country’s current status and progress over time towards net zero. Understanding the strengths and weaknesses of these sovereigns’ alignment can paint a clearer picture of where public and private transition financing is likely to be directed.



- India currently aims to peak emissions in 2045 and achieve net-zero emissions by 2070. India also announced its new 2035 nationally defined contribution (NDC) in which it aims to reduce its emissions intensity of GDP by 47%. While the country receives partial credit for these ambitions, the delayed timeline and less-stringent reductions targets limits credit.
- Climate Action Tracker rates India’s current policies and action as “Insufficient” when compared with its fair-share contribution.
- India has outlined its ambition to increase its share of non-fossil-fuel electricity capacity to 60% by 2030 in its latest NDC. The IEA currently estimates the country is on track to achieve this increase in non-fossil-fuel capacity on the back of surging solar PV investment.
- However, the country remains heavily reliant on coal. Coal currently makes up nearly three-quarters of the country’s power generation, with the government recently considering proposals to continue building new coal plants through 2047. These plant additions could impact the country’s ability to achieve its 2070 targets.
- India will likely need as much as \$21 trillion to achieve its climate goals and lift its nation out of poverty. While India has announced a range of measures to support investment in power generation, this is not currently on pace with what is needed to decarbonize.



- Currently, China aims to peak CO₂ emissions before 2030 and achieve carbon neutrality by 2060. While we acknowledge the delayed timeline for carbon neutrality, we give credit for the emissions peak under Ambition (3), Targets (2), and Emissions Performance (2).
- As a Non-Annex I country, China is not required to submit regular emissions disclosures to the UNFCCC.
- China outlined its decarbonization strategy in the *Mid-Century Long-Term Low Greenhouse Gas Emission Development Strategy* published in 2021. The targets and plan are supported by its action plan for carbon dioxide peaking before 2030, as well as the 14th Five-Year Plan (FYP). One of the main targets is to reach over 1,200 GW of installed wind and solar power by 2030. However, coal production remains at high levels.
- Although China invested 6.8 trillion yuan (\$940 billion)⁵ in clean energy in 2024, fossil-fuel subsidies were 1.5% of GDP in 2022, the highest global contribution in absolute terms. The country has also made no commitment to phase out these fossil-fuel subsidies.

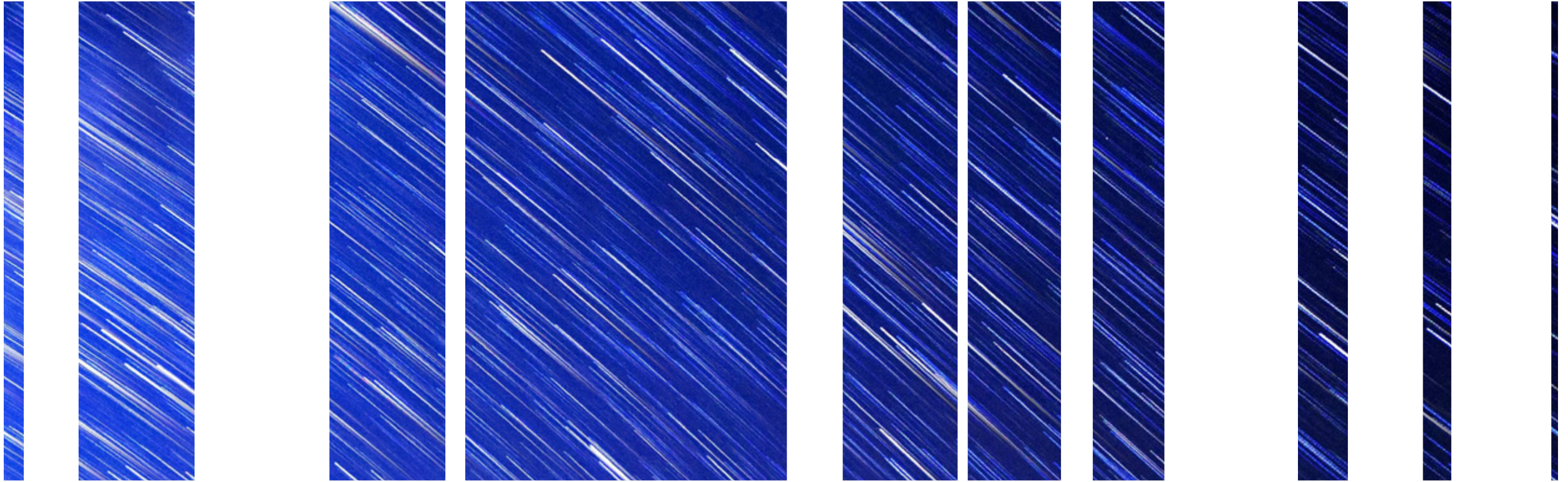


- Norway targets a 90 - 95% emissions reduction below 1990 levels by 2050, so it currently does not have a net-zero ambition. However, the country targets at least a 55% reduction below 1990 levels by 2030 in its updated NDC, giving it full credit under Targets.
- The Climate Action Tracker rates its policies and action-based emissions trajectory to be almost sufficient for a 2°C world. However, on a fair-share basis, the country’s trajectory is insufficient.
- Norway published its long-term low-emission strategy for 2050 in 2020, supported by carbon taxes and participation in the EU ETS. Furthermore, Norway generates almost all its electricity (99%) from renewable sources, primarily hydropower and wind power. However, acknowledging Norway’s high petroleum and gas production, we adjust its decarbonization score down from 4 to 3.
- The country has several green spending initiatives in place, including a NOK 3.6 billion green transition package to invest in sustainable power and infrastructure (2020), and subsidies for EVs. However, like its high-income country peers, its bilateral spending is insufficient.

5. Source: Carbon Brief (with the Centre for Research on Energy and Clean Air, CREA). The “clean energy” sectors include electric vehicles (EVs), renewable energy (manufacturing and power generation), rail transportation, electricity grids/transmission, energy storage, and energy efficiency.

Decarbonization Dashboard

Insights and Key Takeaways



OVERALL DECARBONIZATION STATUS

DECELERATING
DECARBONIZATION

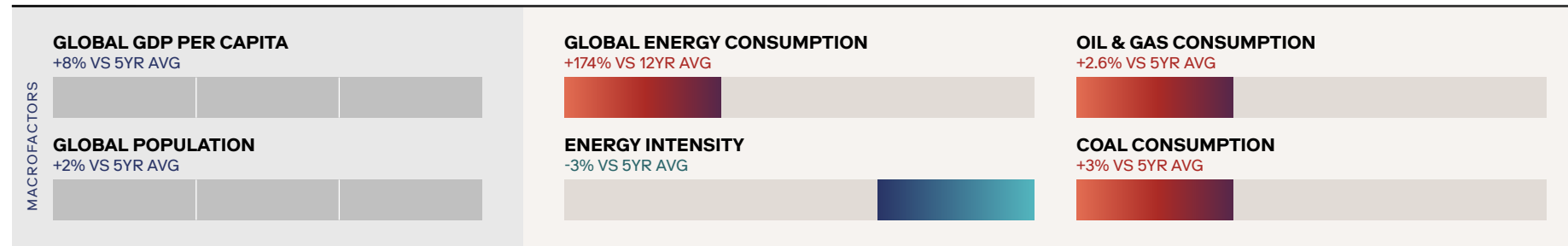
NEUTRAL

ACCELERATING
DECARBONIZATION

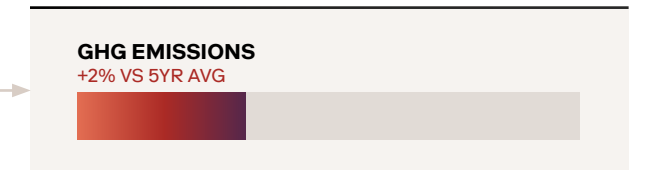


2025 INDICATORS⁶

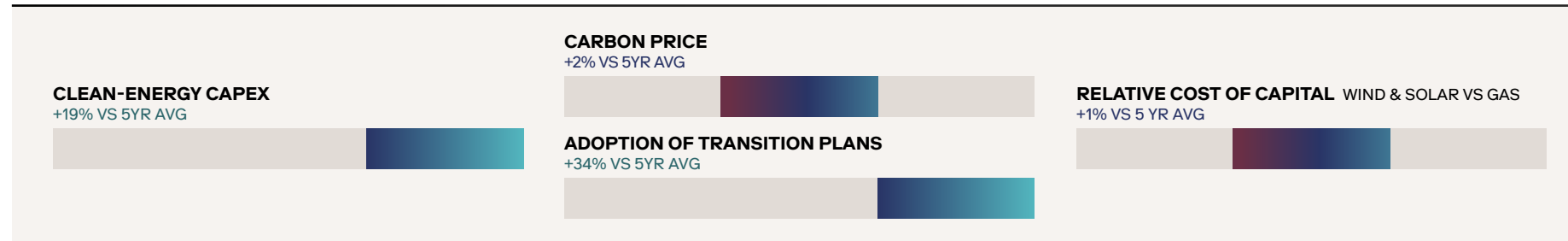
Structural Drivers



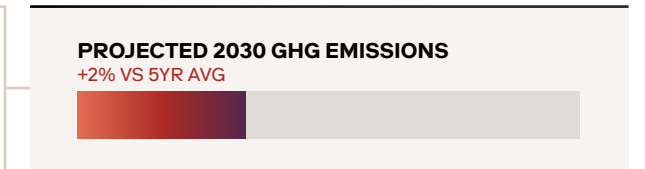
Emissions Outcome Current



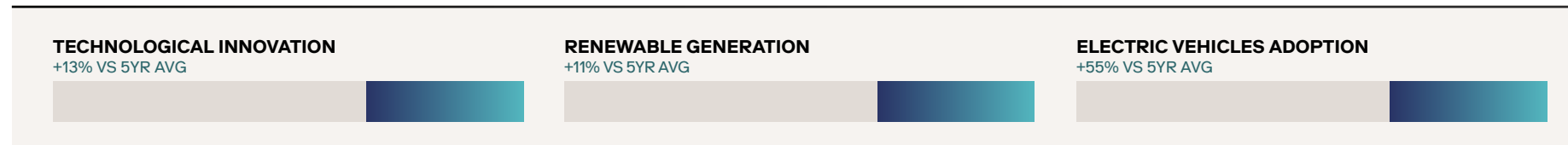
Enabling Conditions



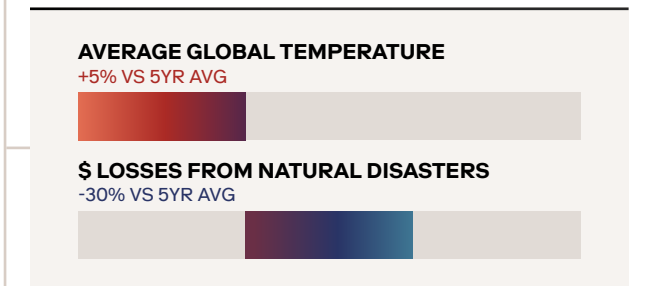
Emissions Outcome Projected



Deployment & Substitution



Climate Consequences



6. Indicators in the decarbonization dashboard are categorized as decelerating, neutral, or accelerating (left to right) based on their contribution to overall decarbonization. Indicators that are directly correlated with decarbonization (e.g., clean-energy capex) contribute to acceleration as they increase, while inversely correlated indicators (e.g., global energy demand) contribute to deceleration as they rise. Factors that influence emissions outcomes or climate impacts but do not directly impact decarbonization efforts are not categorized and are included for reference only. See the Appendix on pages 54 and 55 for the source data and additional indicators.

The Global Decarbonization Dashboard, which is in its third year of publication, distills the pace and direction of the transition by analyzing key indicators along with current and projected outcomes. Structural drivers capture the underlying forces shaping emissions trajectories, both direct and indirect, that define the scale and difficulty of decarbonization. Enabling conditions assess the factors that can help or hinder translating ambition into action, including regulation and investment. Deployment and substitution reflects progress in shifting the energy system through technology deployment. These inputs feed into emissions outcomes, both current and projected, which measure whether activity is translating into lower emissions today and over the medium term. Structural drivers primarily contribute to current emissions trends, while enabling conditions and deployment and substitutions prepare the globe for future emission reductions. Finally, climate consequences track the observable impacts of climate change—such as rising temperatures and economic losses from natural disasters—providing a real-world signal of whether the transition is occurring at sufficient speed and scale.

The 2025 findings reveal another challenging year for global decarbonization progress, with continued deceleration in key areas.

Key Highlights



THE OVERALL MOMENTUM OF THE TRANSITION STAGNATED IN 2025. WHILE PROGRESS WAS MADE ON CLEAN DEPLOYMENT, STRUCTURAL ENERGY-DEMAND GROWTH AND PERSISTENT FOSSIL-FUEL CONSUMPTION KEPT EMISSIONS OUTCOMES OFF TRACK.

STRUCTURAL DRIVERS

Rapid growth in global energy demand, led by artificial intelligence (AI) and data centers, is likely to constrain emissions reductions as an ‘all of the above’ energy strategy will be needed to meet rising load.

Predictions of ‘peak coal’ by the end of the decade remain uncertain because the majority of emerging economies continue to rely on coal for energy, as well as growing policy support in advanced economies like the U.S.

DEPLOYMENT & SUBSTITUTION

Despite a pullback in policy support in the U.S., EV adoption maintained positive momentum primarily driven by demand in Asia. Renewable generation also saw continued capacity additions to meet growing energy demand, although this remained slightly constrained by grid bottlenecks and permitting delays.

ENABLING CONDITIONS

Growth in the adoption of transition plans indicates some forward progress in the transition as well as continued growth in clean-energy capital expenditures.

EMISSIONS OUTCOMES

Emissions continued to rise in 2025, pushed up by structural drivers such as increased energy demands and economic growth.

While deployment of clean technology and innovation continued, global policy and corporate action has not been able to lower projected global emissions for 2030. Emissions are anticipated to be around 58 GtCO₂e, representing an approximate 17 GtCO₂e gap with a below 2° C scenario.

CLIMATE CONSEQUENCES

Global economic losses from natural disasters in 2025 were lower than in previous years but remain above the 21st century average with a persistent protection gap between economic and insured losses.

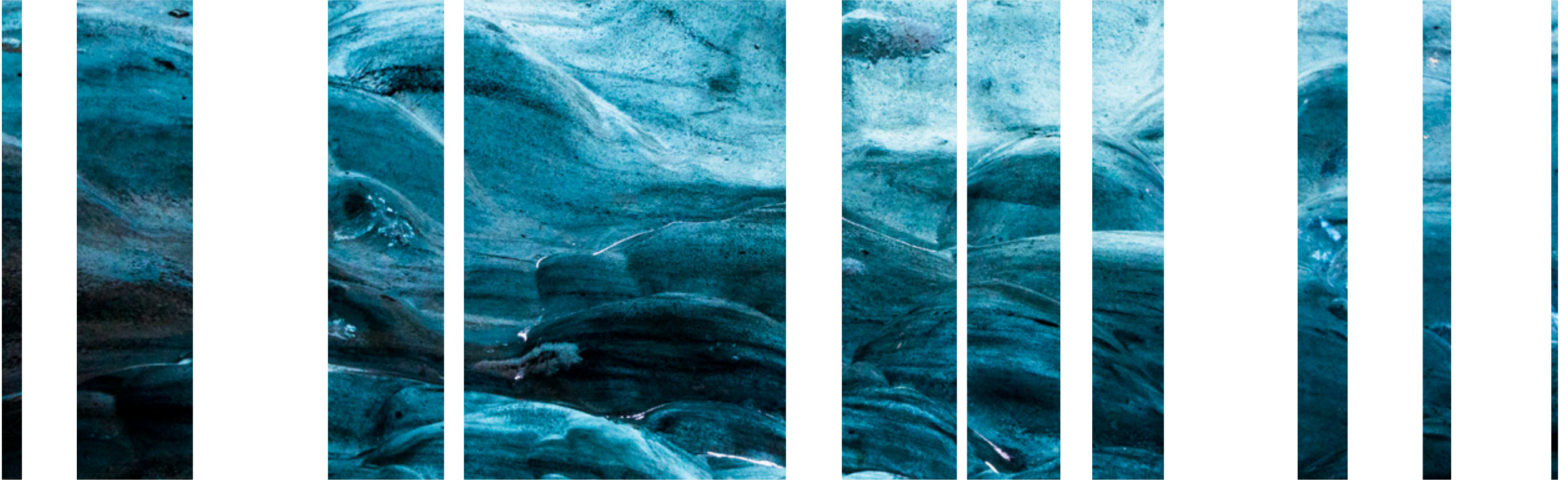


CONCLUSION

Despite continued progress in areas like renewables and clean-energy investment, little progress was made in global decarbonization efforts in 2025. The stalls seen in key enablers and deployment contribute to continued increases in emissions. While forward progress is delayed, investable opportunities remain that can help to advance the transition.

Financing the Transition

Who will be the key contributors to financing the global transition to net zero, and what implications does this have for investors?

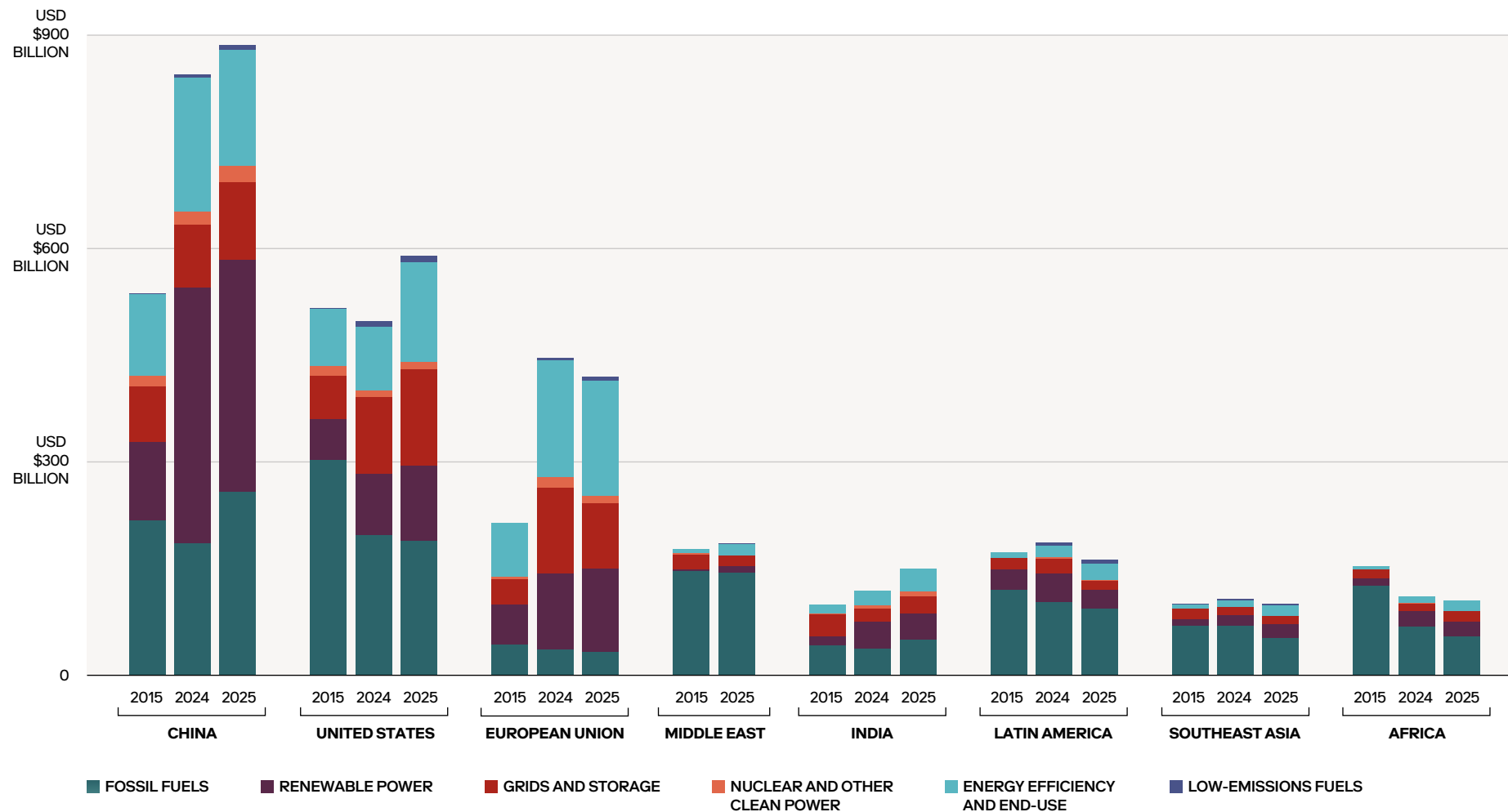


THE INVESTMENT LANDSCAPE

Despite mounting geopolitical uncertainty and tightening macroeconomic conditions, global energy investment continues to rise. According to the International Energy Agency (IEA), total energy spending was expected to reach \$3.3 trillion in 2025, with \$2.2 trillion directed toward clean-energy technologies, which is double the investment flowing into fossil fuels. The past decade has cemented China as the world’s dominant investor in clean energy. China now spends nearly as much on energy as the U.S. and E.U. combined, with its share of global clean-energy spending rising from a quarter to nearly a third in just 10 years. Despite persistent inflation and weakening industrial competitiveness in Europe, and political shifts and trade tensions in the U.S., growth in clean-energy investments remained intact. While 2025 marked a volatile year for political policy in the U.S., the known limitations are not expected to result in a reversal in investment, although they may result in a plateau.

This increase in spending across clean-energy sources is driven in large part by the ‘Age of Electricity’, with rising demand from industry, data centers, and artificial intelligence globally. A continuing decline in the cost of clean technologies is likely to underpin further investment. However, as stated earlier, geopolitical tensions and economic uncertainty may prompt some investors to adopt a wait-and-see approach to new project approvals.

REGIONAL ENERGY INVESTMENTS, 2015, 2024 & 2025



Source: IEA

PUBLIC CAPACITY, PRIVATE OPPORTUNITY, AND REGIONAL DIVERGENCE

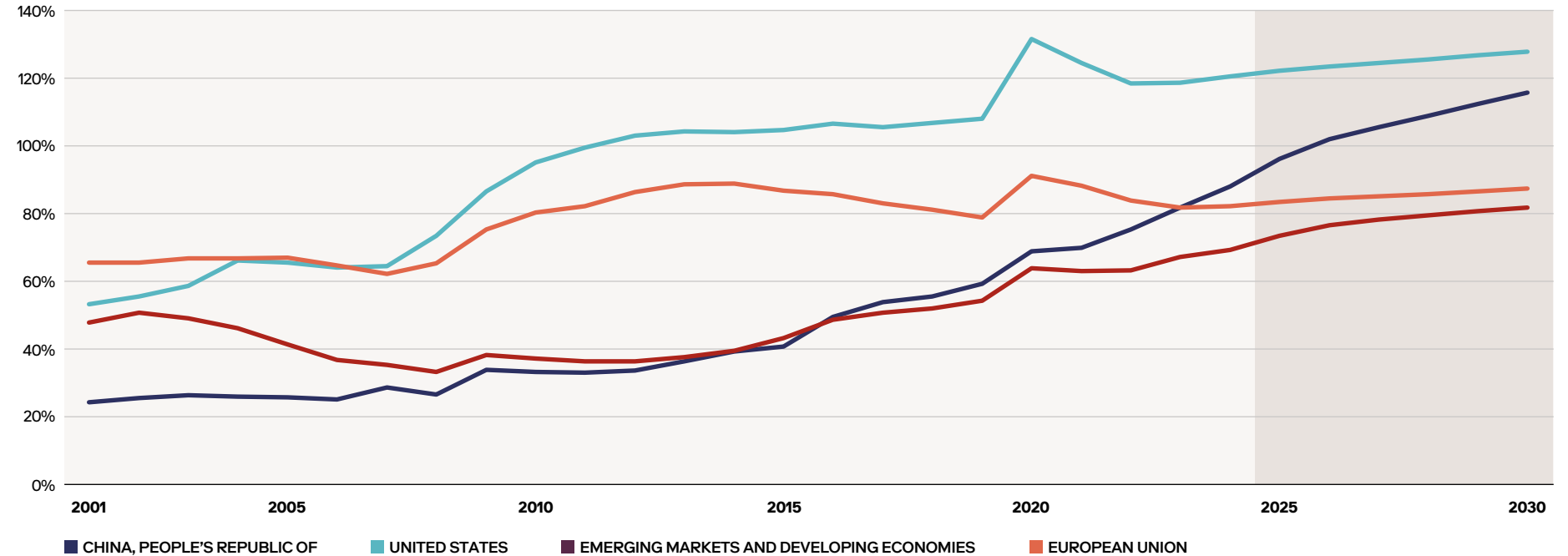
The sources of finance for the transition

To progress at the pace required to achieve net zero by 2050, the global energy transition requires sustained annual investment of ~\$4 trillion, yet public balance sheets across advanced economies are increasingly constrained. Government debt has risen sharply since 2020, and fiscal space is tightening as high interest rates have pushed up debt-servicing costs. As a result, transition financing is shifting further toward the private sector, an evolution already visible across developed markets, where roughly 85% of clean-energy investment now comes from non-government sources.

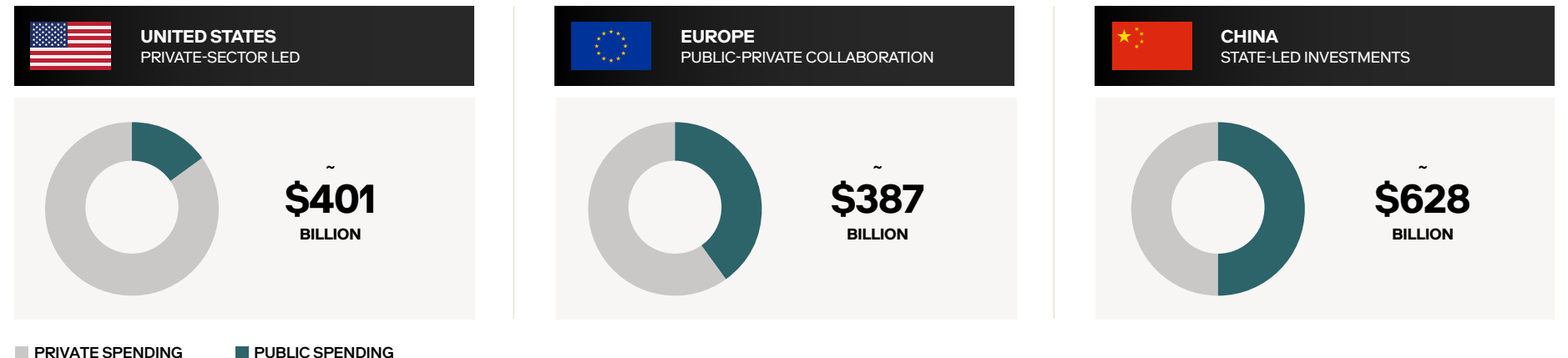
Public-sector contributions remain essential for enabling early-stage infrastructure but private actors are now responsible for the majority of incremental clean-energy spending. There are some regional divergences among major players like the U.S., Europe and China. While all still rely heavily on private financing, the U.S.'s support from the public sector is more driven by tax incentives, while Europe and China both show higher levels of government involvement.

Emerging markets (EMs) present a different picture. Although global clean-energy investments have grown from \$1.2 trillion in 2015 to over \$2 trillion in 2025, EMs (ex-China) have captured less than 10% of this growth. Private-investment flows in these regions have been hindered by increasing geopolitical tensions, currency risk, and macroeconomic factors. Without advances in these capital markets, public financing will be unlikely to meet energy-related financing requirements, representing a material financing gap.

GENERAL GOVERNMENT GROSS DEBT AS A PERCENTAGE OF GDP, 2001-2030



Source: IEA



Source: IEA (June 2025), Greening Europe (2022), State Council Information Office of the People's Republic of China (August 2025)

This geopolitical division has been further underscored by recent COPs, where developing countries, particularly those in Africa, feel proceedings have fallen short on funding. The ability to enact meaningful climate diplomacy was further hindered in 2025 by the pullback of certain countries from collective climate action and heightened political tension. While recent COPs have fallen short of industry expectations, prior COPs and the Paris Agreement have helped to mobilize \$10 trillion in clean-technology investments since 2015. A future-fit COP could bridge this financing gap by focusing on orchestrating sectoral coalitions and practical financing support rather than high-level pronouncements.

Over the past year, the rapid expansion of low-cost solar PV, batteries, and electric vehicles manufactured in China has materially lowered the cost of decarbonization in many low- and middle-income countries. This has enabled parts of the emerging world to leapfrog directly to clean-energy systems. That said, persistent constraints, particularly around grid infrastructure, financing conditions, and industrial decarbonization, mean that while clean-energy deployment is accelerating, broader economy-wide transitions remain uneven.

DEBT AND DECARBONIZATION

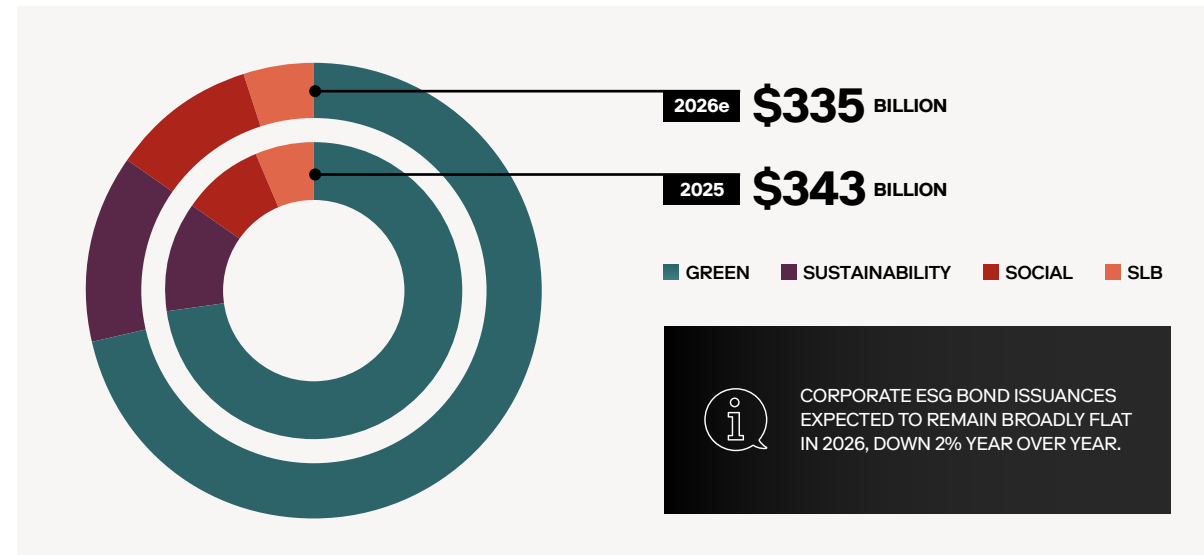
Debt financing remains a critical capital structure for the clean-energy transition. This is particularly true for EMs as debt typically offers a lower cost of capital needed by these countries. While inflationary pressure and high interest rates can act as potential impediments, clean-energy debt financing has remained resilient in recent years. In 2024, 80% of total investments in utility-scale solar was met through debt financing.

The market has remained concentrated in recent years, with Europe and China acting as standouts for green-bond issuances. However, the growth in global ESG-bond issuances seen since 2020 is expected to plateau or fall in the coming years. This will be driven in part by low greeniums and a maturity wall in 2026. While the ESG-bond market is expected to reach a record \$240 billion in redemptions in 2026, there is unlikely to be a wave of new corporate issuances of green-labeled bonds. This is due to changes in taxonomies and investor expectations that would likely result in additional costs. These barriers may have issuers looking to traditional bond markets to refinance maturing ESG bonds. For the U.S. in particular, ESG-labeled issuances are expected to be unfavorable in light of political backlash and heightened regulatory scrutiny.

One bright spot in the ESG-bond market may be the APAC region. Thirteen local taxonomies have recently been announced, with some of the most notable including Australia (June 2025), China (expanded October 2025), and India (upcoming). The release of new taxonomies typically precedes a surge in new labeled issuance, which could present continued financing opportunities in these regions.

Overall, debt financing will continue to remain an important factor in financing the green transition. However, thematics are also likely to come into focus, prioritizing the financing of single project types rather than multiple sustainability categories.

2026 BOND SUPPLY OUTLOOK



Source: Barclays

The Technology-Readiness Gap

How would you assess the current technology readiness of key decarbonization solutions, and what are the primary barriers that must be overcome for each to achieve scalable deployment?



INNOVATION AND ECONOMICS

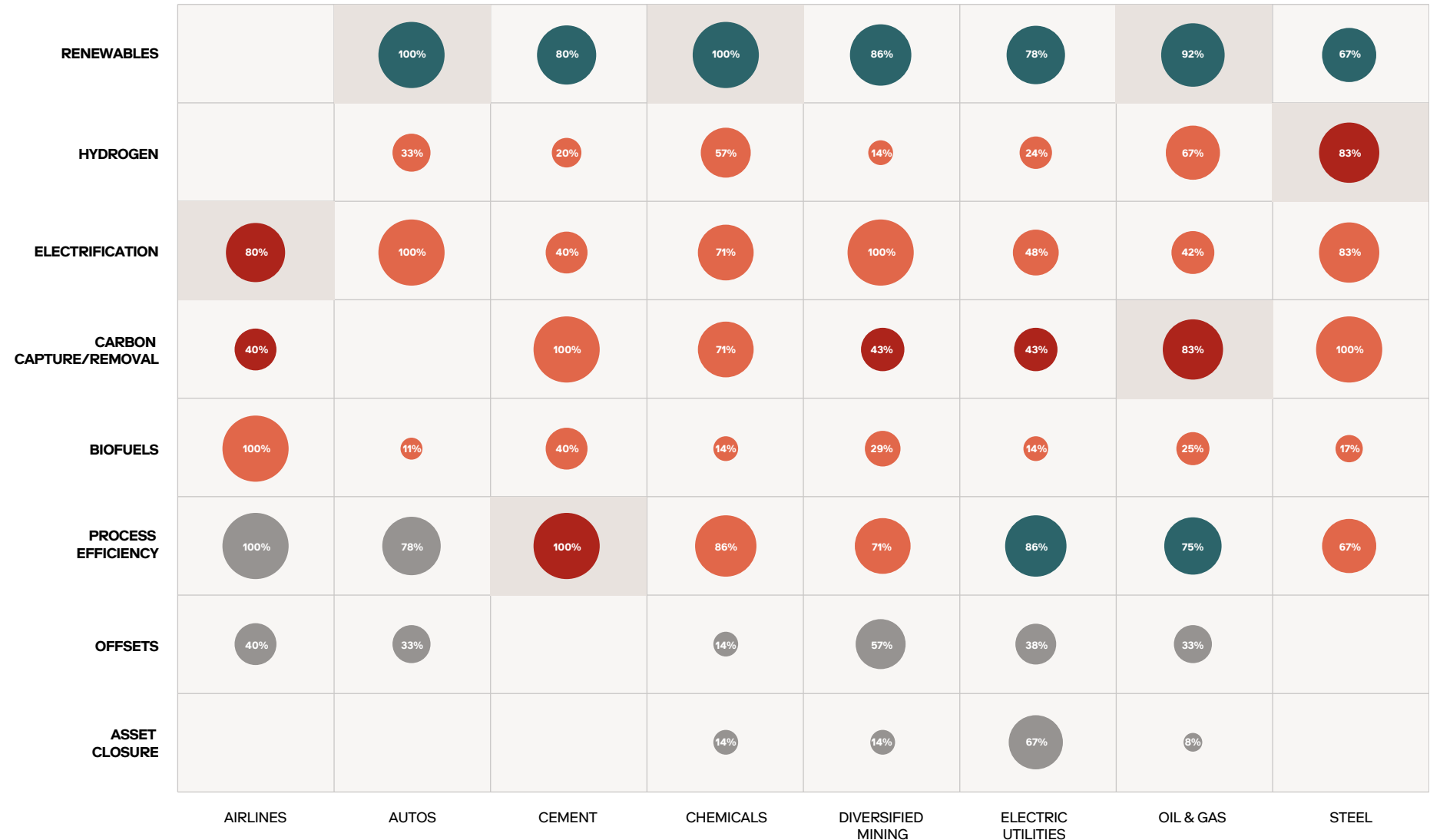
The importance of technological readiness and cost-competitiveness

One of the key factors in funding the green transition is technological innovation. Even with a willingness for companies and sovereigns to decarbonize, the readiness of these technologies is a critical factor in deployment. Analysis from the Transition Pathway Initiative underscores the uneven nature of technological readiness across sectors. While many companies reference a broad suite of decarbonization levers, the maturity of those levers varies significantly, shaping both execution risk and the credibility of transition plans. Renewables stand out as the most mature and widely deployed solution, particularly across power, utilities, and diversified mining, where technology readiness and commercial viability are less of a constraint. In contrast, heavy industrial sectors such as steel, cement, and chemicals remain more reliant on technologies that are still at the demonstration or early commercial stage, including hydrogen, carbon capture, and certain bio-based solutions.

This dispersion in technology readiness complicates comparisons across sectors but also sharpens the investment signal. Companies leaning heavily on low technology-readiness-level (TRL) technologies face a longer and more uncertain pathway to delivery, with progress contingent on policy support, infrastructure build-out, and cost declines that remain outside management control. Conversely, firms prioritizing mature technologies such as electrification, renewable-power procurement, and process efficiency are better positioned to translate ambition into near-term emissions reductions.

While technological readiness is one bottleneck for deployment, economic feasibility ultimately determines whether solutions scale. Today, utility-scale solar and onshore wind remain among the lowest-cost sources of new power and as such have seen significant capacity

THE DECARBONIZATION LEVERS DISCLOSED ACROSS SECTORS SHOWCASE RELIANCE ON A VARIETY OF TECHNOLOGIES AT VARYING LEVELS OF READINESS, WITH RENEWABLES STANDING OUT AS THE MOST MATURE AND MOST UTILIZED.



TECHNOLOGY READINESS LEVEL (TRL) KEY:
■ 9-10 MARKET UPTAKE ■ 7-8 DEMONSTRATION ■ 5-6 LARGE PROTOTYPE COMPANIES WITH HIGH RELIANCE ON TECHNOLOGIES WITH LOW OR HIGH TRL VALUES **BUBBLE SIZE** % OF COMPANIES REFERENCING LEVER BY SECTOR

Source: Transition Pathway Initiative (Data as of June 23, 2025)

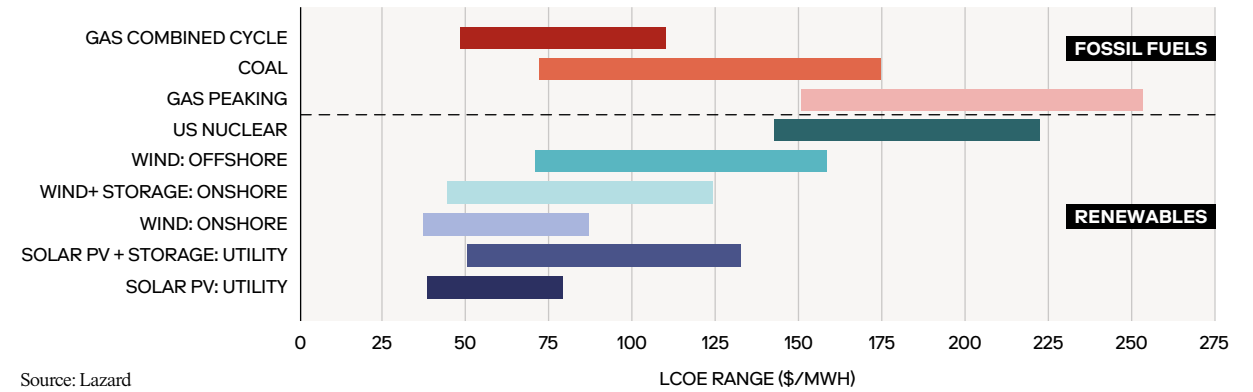
additions in recent years. The range of the levelized cost of energy (LCOE) for renewables varies by region and can be affected by permitting and grid curtailments, but it remains cost competitive even as financing conditions have tightened. BNEF estimates that global clean energy LCOEs could fall by another 22 - 49% by 2035, with some variation based on technology and region. However, other decarbonization technologies still face substantial green premiums. Carbon capture in cement and steel, sustainable aviation fuel, and hydrogen-based industrial processes all remain meaningfully more expensive than conventional alternatives, limiting uptake without policy support or long-term offtake commitments.

The concept of the green premium—the additional cost of low-carbon alternatives relative to incumbent technologies—provides a useful lens through which to assess adoption risk. As noted in Bill Gates’s letter, *Three Tough Truths About Climate*, the green premium represents a yardstick on affordable net-zero innovation. Reducing the green premium to zero or near zero, whether through policy support or innovation, can help technologies be adopted more readily. Renewables are a prime example of innovation that has achieved this greenium reduction: once levelized costs converged with fossil-based generation, capacity additions accelerated rapidly. Gates argues that identifying high-impact clean technologies with the potential to reduce their green premium presents a great opportunity for investors. For those technologies that have not yet reduced their greenium, Gates advocates for policymakers to help bring these costs down further. This could be through subsidies to promote the use of hydrogen-based fuels in the shipping industry, or enacting carbon prices on products using traditional instead of low-carbon aluminum. However, during 2025 we observed some policy action that resulted in an increase in green premiums. Tariffs instituted in the U.S. caused imported solar equipment and battery costs to increase despite global prices declining. This impacted

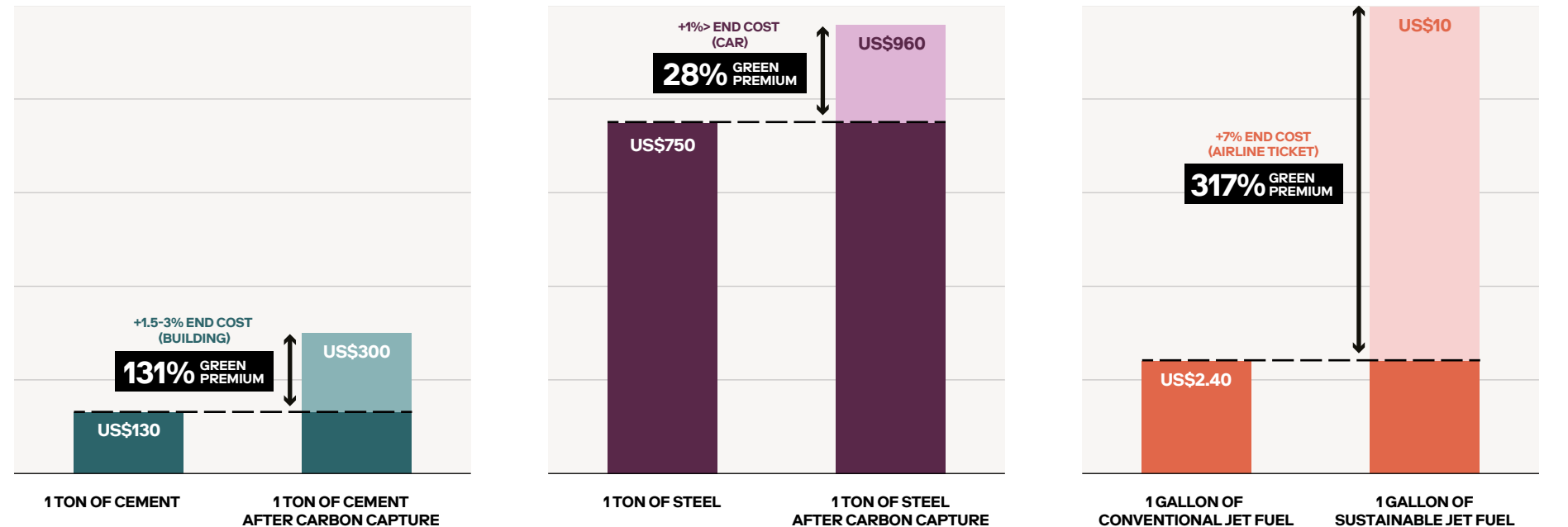
Chinese exports, including the renewal of a 100% tariff on Chinese EVs. The wind industry also faced increasing greeniums due to regulatory interventions that resulted in construction delays. In December 2025, the U.S. Department of the Interior paused construction for five wind farms, representing approximately \$25 billion in investment. These instances highlight how government policy can help or hinder adoption of clean technologies.

Understanding which technologies are on a credible path toward cost convergence and which remain structurally challenged is critical for assessing both transition risk and opportunity. Below we outline the status and projected progress across key technologies.

RENEWABLES REMAIN COST-COMPETITIVE COMPARED WITH TRADITIONAL ENERGY SOURCES



THE GREEN PREMIUM CAN HELP ACT AS AN INDICATOR FOR TECHNOLOGIES THAT ARE READY TO BE ADOPTED BUT MAY REQUIRE GOVERNMENT SUPPORT OR ADDITIONAL INNOVATION TO MAKE THEM ECONOMICALLY FEASIBLE.

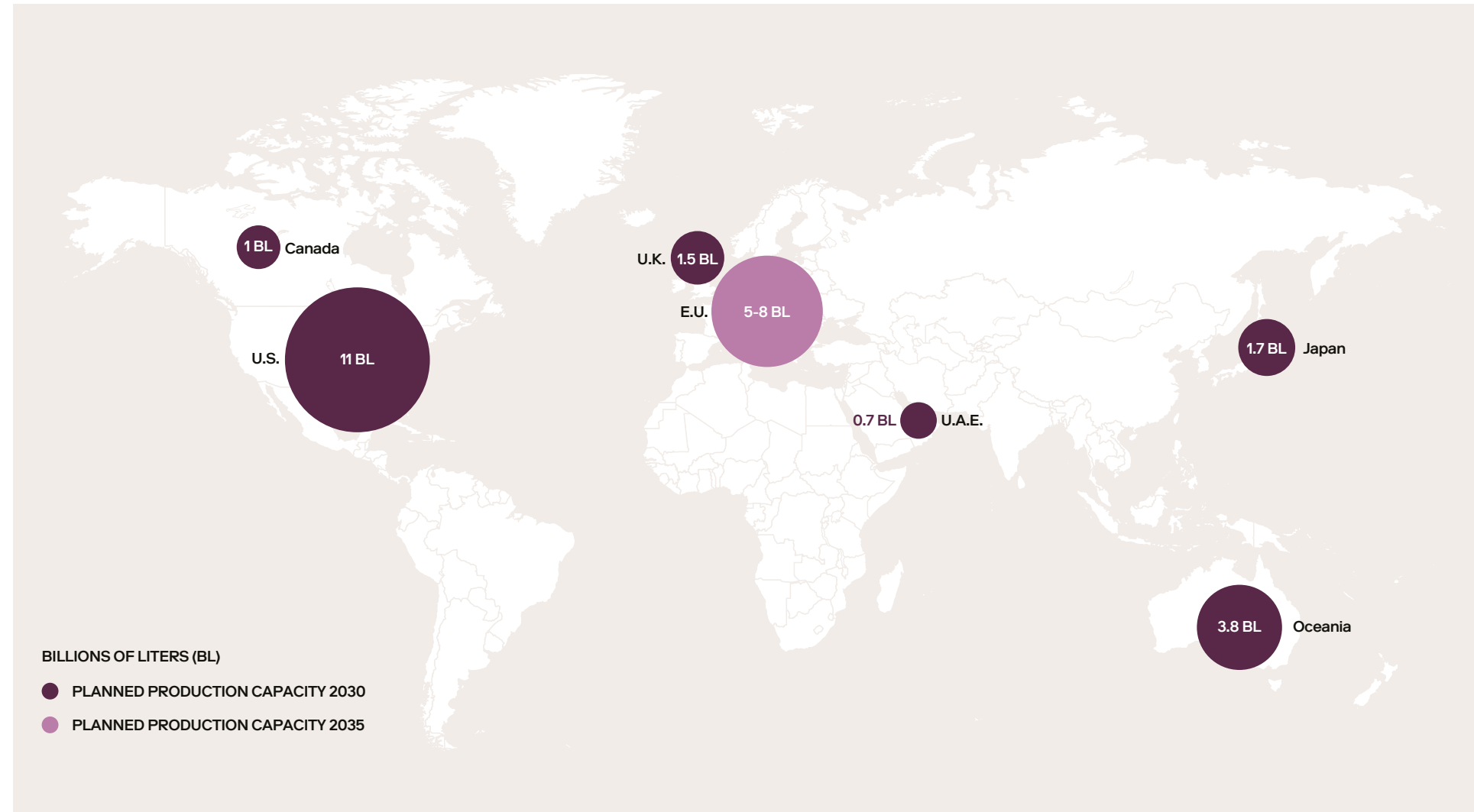


Source: Breakthrough Energy

SUSTAINABLE AVIATION FUEL: SHORTFALL

Sustainable aviation fuel (SAF) is essential to decarbonizing the aviation industry. The International Air Transport Association (IATA) expects 65% of the emissions reductions needed for aviation to achieve net zero to come from sustainable fuels. Key bottlenecks to SAF adoption include limited production capacity, higher fuel costs, and the additional infrastructure investment required to scale supply and distribution. While production capacity has expanded in recent years, rising from one million tons (Mt) in 2024 to 1.9 Mt in 2025 (a 90% increase), growth is expected to slow in 2026 to 26%. Even with a more ambitious increase in SAF production, supply would still fall about 100 Mt short of the required capacity for air transport to achieve net zero by 2050. Many airlines assessed by our Net-Zero Alignment Indicator remain 'Not Aligned' or 'Committed to Aligning' as a result of these constraints. These companies do have decarbonization goals: American Airlines, for example, is looking to replace 10% of its jet fuel with SAF by 2030 and entered into numerous offtake and purchase agreements in 2024 to secure supply. However, the limitations around price and availability hinder their progression toward net-zero alignment. Until greater advances are made in SAF, airline exposure within portfolios will likely be subject to elevated transition risk. Active management and engagement with these companies will remain critical in navigating these risks.

REGIONAL POTENTIAL PRODUCTION CAPACITY OF SAF BY 2030-2035 VARIES BUT FALLS SHORT OF THE 25 BL REQUIRED GLOBALLY UNDER IATA'S NET-ZERO PATHWAY FOR 2030.

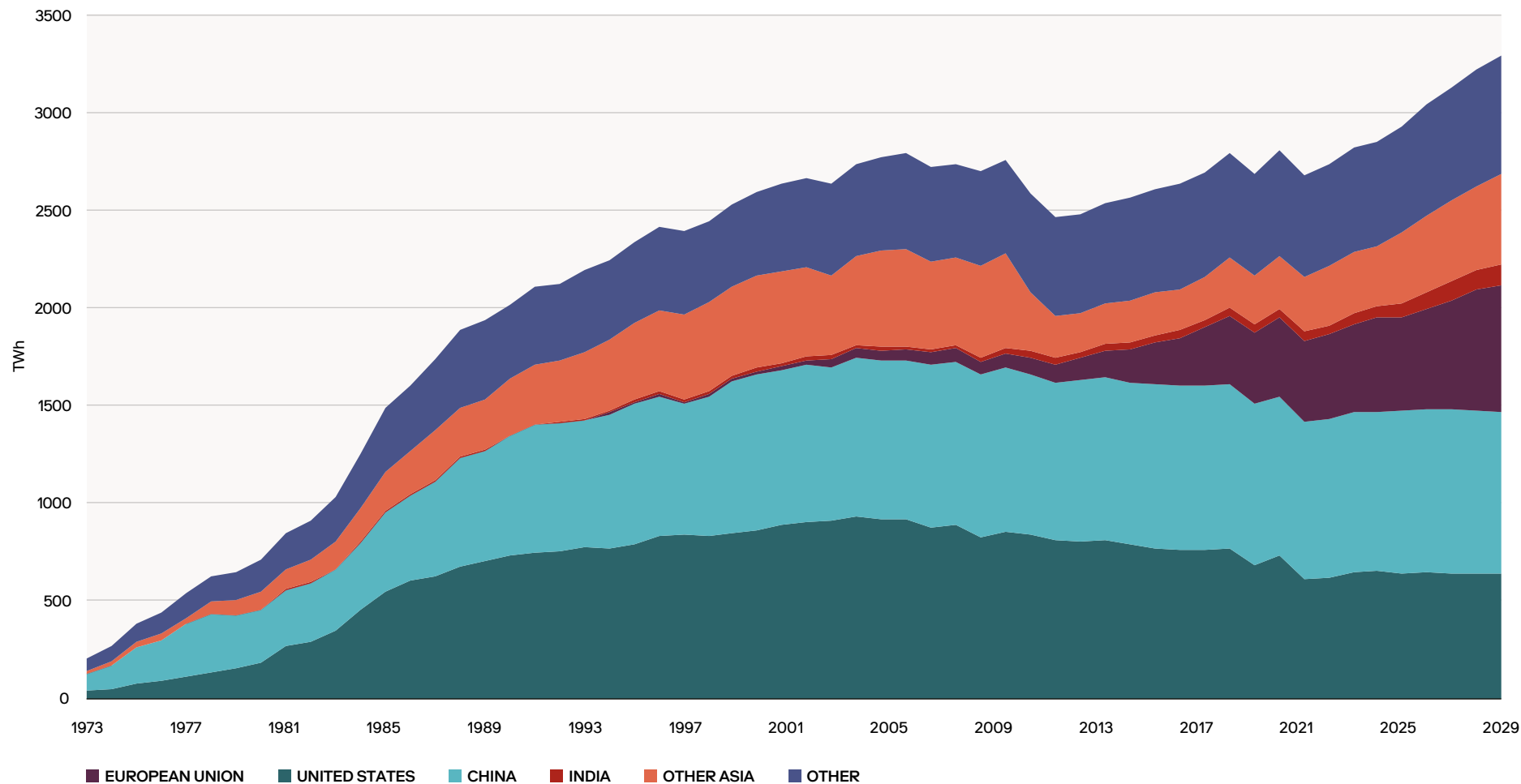


Source: KAPSARC (December 2025)

NEW NUCLEAR: EXPANSION AND THE HOPES FOR SMRs

The nuclear renaissance continued in 2025, with nuclear generation at record levels. This trend is expected to persist through 2030, growing by an average of 2.9%, more than double the growth rate seen in the past five years. Much of this growth is driven by China, which makes up approximately half the projects under construction. New nuclear is also being commissioned in India and Korea, as well as plant restarts in Japan. The United States and European Union’s nuclear-electricity output is expected to remain relatively stable. This is in part driven by the aging fleet of existing plants in advanced economies, which have an average age of 36 years, with new construction offsetting plants entering retirement. However, supportive policy and planned small modular reactors (SMRs) additions in the U.S. should result in additional capacity coming online after 2030. Much of this demand growth is being driven by the increasing energy demand from AI and data centers searching for low-emissions power sources that can provide continuous supply. Traditional nuclear plants currently require government support for financing due to their scale, capital intensity, and construction lead times. SMRs may attract more private funding due to their shorter construction times and payback period, which can be half that of traditional plants. While SMRs have gained a lot of attention from the public and private sector in recent years, effective deployment will depend on supportive policies, the easing of regulatory bottlenecks, and financing. Under current plans, up to 25 GW of SMR capacity could be added through 2050. With the streamlining of designs and licensing bringing construction costs down over the next 15 years, uptake of SMRs could increase by 60%.

NUCLEAR GENERATION IS EXPECTED TO CONTINUE RISING STEADILY THROUGH THE END OF THE DECADE.



Source: IEA

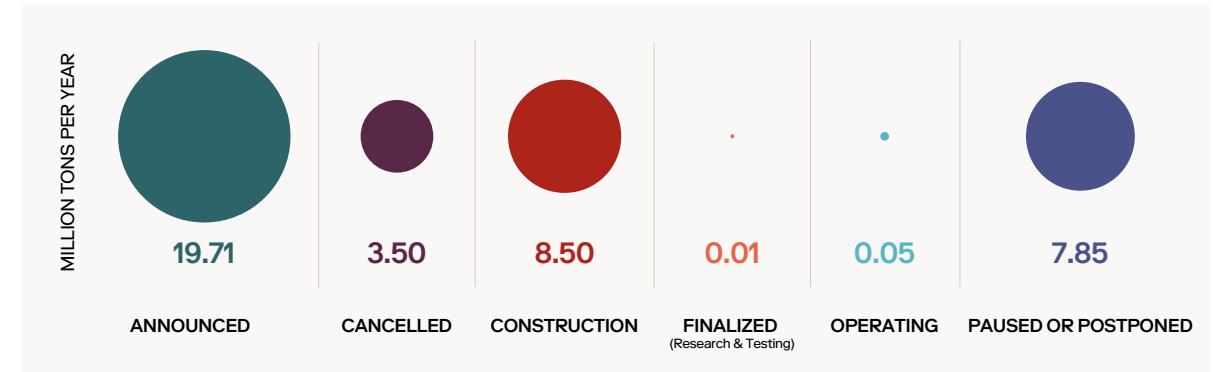
GREEN STEEL: SLOW SCALING

2025 represented a mixed year for advancing green steel production. Steel production accounts for approximately 7 - 9% of global GHG emissions, so it is one of the highest industrial contributors. Yet new projects in green steel and iron have slowed since their peak, and a number of projects have been canceled or delayed. As of today, only 60,000 tons per year of green steel production is operational, while current planned capacity by 2050 is expected to reach 28 Mt per year. Even if we achieve this by 2050, it only represents a fraction of today's overall steel production of 1,800 Mt per year.

For steel manufacturers that have made net-zero commitments, technologies will need to scale to enable more green steel production. While hydrogen-direct reduced iron (H-DRI) and electric arc furnaces (EAF) are emerging as the preferred technological option, blast furnace-basic oxygen furnaces (BF-BOF) still make up 70% of steel production today. Current barriers include the higher costs of these low-emission alternatives, with H-DRI costing 50 - 140% more than BF-BOF. Steel producers have cited the inability to source green hydrogen at cost as hindering their ability to progress with planned projects. ArcelorMittal announced the cancellation of two major green steel projects in 2025, citing high electricity costs and green hydrogen not yet being a "viable fuel source". As a result, along with limited deployment of capital earmarked for decarbonization, ArcelorMittal's alignment status was downgraded from 'Aligning' to 'Committed to Aligning' to reflect these barriers to their emissions trajectory. Additional macro factors, including weak steel demand in European markets and a decline in global steel prices, further constrained growth across steel manufacturers.

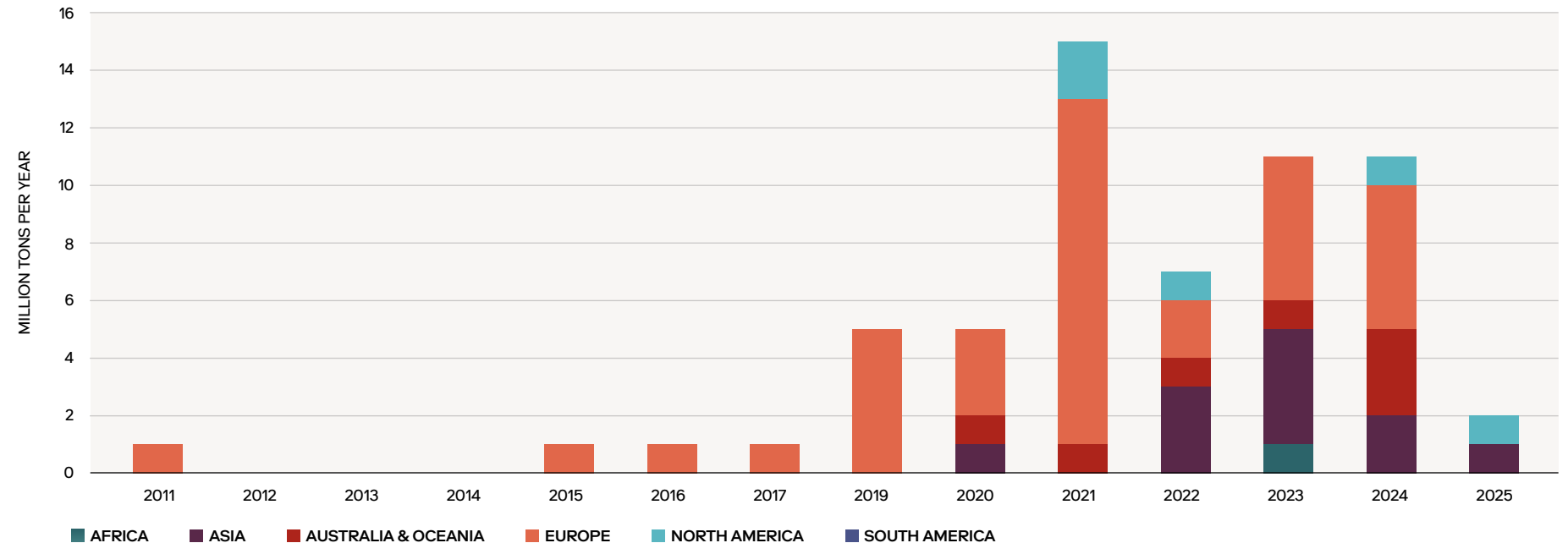
One key policy that may help reignite the green steel industry is the implementation of the E.U.'s Carbon Border Adjustment Mechanism (CBAM). January 2026 saw the phasing in of CBAM certificates priced in line with the E.U. Emissions Trading System (EU ETS), which affects covered goods such as steel. However, reducing the green premium will likely require further policy support across regions, as well as advances in critical inputs such as low-emissions hydrogen.

OPERATIONAL GREEN STEEL CAPACITY REMAINED LOW IN 2025, WITH SOME HIGH-PROFILE PROJECTS DELAYED OR PAUSED.



Source: GreenSteel Tracker

ANNOUNCED GREEN STEEL AND GREEN IRON PROJECTS HAVE SLOWED IN 2025 FROM THE PEAK IN 2021.



Source: GreenSteel Tracker

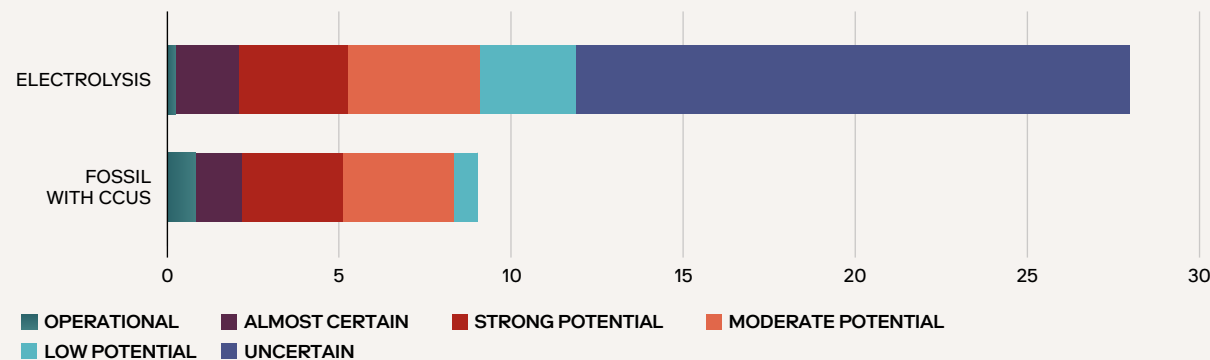
HYDROGEN: CONTINUED HURDLES

Green hydrogen is a key input for decarbonization across multiple industrial sectors. Global hydrogen production was about 100 Mt in 2024 and is expected to exceed 100 Mt for the first time in 2025. However, most supply remains conventional, with low-emissions hydrogen accounting for less than 1% of global production. Key barriers to scaling low-emissions supply include high costs, uncertain demand, and slow infrastructure and technology development. The cost gap is likely to persist in regions where natural-gas prices are expected to remain low, such as the U.S. and the Middle East, while costs may fall faster in China due to abundant renewables and lower technology costs.

Outside China, emerging markets continue to lag behind advanced economies in hydrogen production. Still, Africa, Latin America, and Southeast Asia are aiming to account for 25% of low-emissions hydrogen production by 2030. To meet these ambitions, these regions will likely need to leverage strong renewable resources and competitive labor costs.

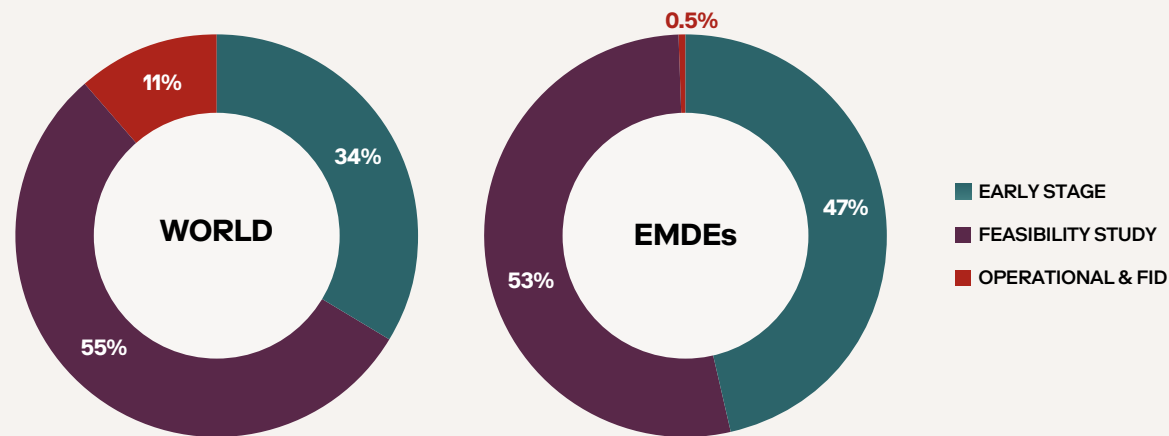
Despite progress, the pipeline of announced green hydrogen projects continues to face significant delays and cancellations. While policy momentum has enabled some projects to reach a final investment decision, in the absence of additional grants or sustained subsidy support there will likely be further delays or cancellations. In response, many oil and gas companies have shifted their focus toward blue hydrogen, given its ability to leverage existing infrastructure and deliver a more cost-competitive pathway relative to green hydrogen. These persistent implementation challenges across low-emissions hydrogen production are expected to slow deployment materially versus prior expectations, creating a growing gap between projected supply and the volumes required under a net-zero pathway.

DELAYS IN PROJECT DELIVERY CREATE UNCERTAINTY ON ABILITY TO DELIVER ON LOW-EMISSIONS HYDROGEN PRODUCTION CURRENTLY ANNOUNCED BY 2030.



Source: IEA

EMERGING-MARKETS HYDROGEN PROJECTS ARE LAGGING BEHIND COMPARED WITH GLOBAL PROGRESS.



Source: IEA (data as of July 2025)



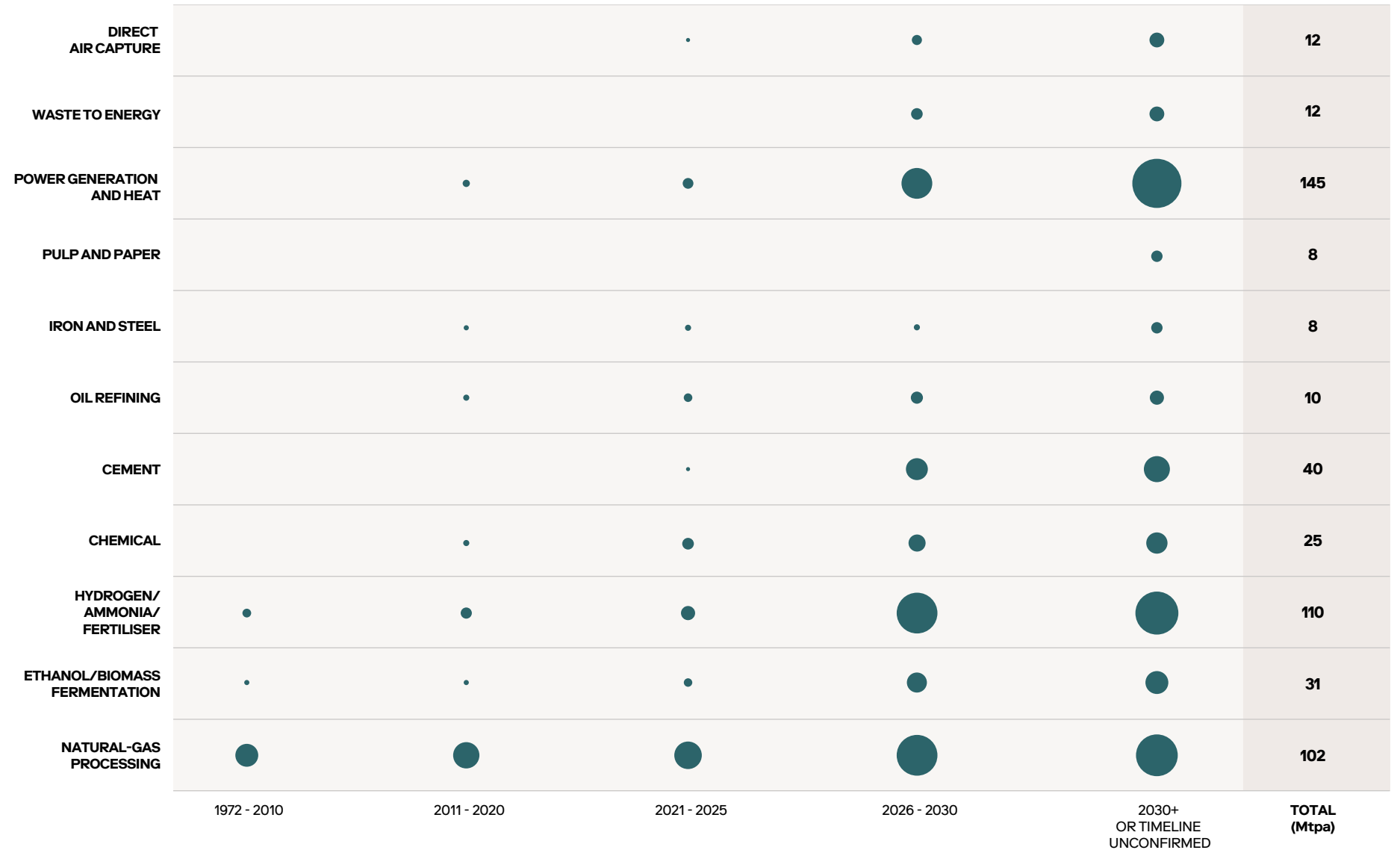
CARBON CAPTURE AND STORAGE (CCS): GROWTH AND INDUSTRY DIVERSIFICATION

Carbon capture and storage (CCS) has seen meaningful growth in recent years, with 64 Mtpa of commercial CCS in operation by July 2025. This is still primarily concentrated in natural-gas processing facilities, representing more than 60% of capacity.

Global governmental policy and the proliferation of data centers are expected to support continued growth in CCS projects at CAGR of about 40% through 2030, although the U.S. has shown mixed signals that may curtail CCS deployment in the region. Several climate policies and projects have been rolled back but the 45Q tax credit has continued to receive bi-partisan support. North America and Europe currently represent 60% of operational CCS capacity and could represent up to 80% by 2030. China and the Middle East are also making strides to increase capacity and currently account for 25% (either operational or under construction).

Overall total CCS operating capacity could reach 337 Mtpa over the next five years. However, this growth is still not aligned with the trajectory of a net-zero pathway.

OPERATING CCS CAPACITY IS SET TO GROW ACROSS SECTORS



Source: Global CCS Institute

COMPANY SPOTLIGHTS

To illustrate how execution and strategy can be accelerated or hindered by the deployment of critical green technologies, we highlight two contrasting company case studies. One demonstrates how leadership in innovation and commercialization can enable the transition, while the other shows how slower adoption can lead to weaker net-zero alignment and greater risk potential.



CASE STUDY: LEADER

COMPANY: GE VERNOVA

CURRENT STATUS: ALIGNING

GE Vernova is an energy-technology company that supplies equipment and solutions across power generation and grid electrification, helping utilities and industrial customers produce, move, and manage electricity as energy systems shift toward lower-carbon sources. Its decarbonization approach emphasizes innovation in both its installed base and next-generation technologies, including hydrogen blending in combined-cycle power plants, expanded renewable generation, and longer-dated options such as small modular reactors (SMRs), carbon capture and storage (CCS), and ammonia as a fuel. The company pledged to invest \$100 million in 2025 toward electrification and carbon-reduction technologies. This focus on next-generation technologies, as well as R&D focused on long-term technical innovation, has helped bring GE Vernova's status to 'Aligning' with a net-zero pathway. Implementing these levers into their roadmap and looking to advance areas with key gaps can help the company remain ahead of the curve.

INDICATOR	ANALYST-ADJUSTED SCORE (1 - 5)	SCORE BREAKDOWN
1. Long-term ambition	5	Ambition to reach net zero for use of products sold (Scope 3) by 2050; third-party validated.
2. Short- and medium-term targets	2	Self-declared ambition to achieve carbon neutrality in operations by 2030.
3. Emissions performance	2	Scope 1 and Scope 2 emissions declined from 2023 compared with a 2019 baseline.
4. Disclosures	4	Discloses Scope 1 and Scope 2 emissions, and use of products sold Scope 3.
5. Decarbonization strategy	3	Prioritizing increased revenue and market share through renewable generation.
6. Capital allocation	3	Planned \$5bn investment in R&D focused on long-term technical innovation through 2028.
TOTAL SCORE	19	ALIGNING

CASE STUDY: LAGGARD

COMPANY: ARCELORMITTAL

CURRENT STATUS: COMMITTED TO ALIGNING

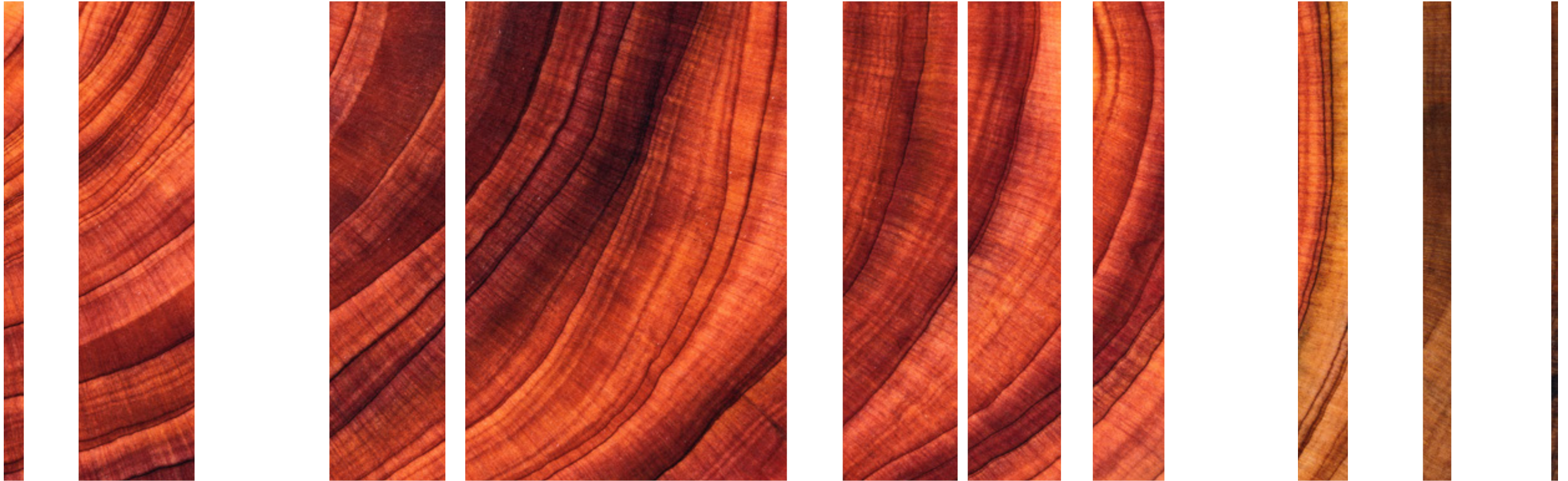
ArcelorMittal is one of the world’s largest steel producers, supplying steel products to end markets such as construction, automotive, and industrial manufacturing. While the company has articulated a decarbonization strategy that includes steelmaking transformation levers such as DRI/EAF and hydrogen, its progress is viewed as lagging. Arcelor does not yet plan to fully transition to EAF production and continues to rely on blast-furnace-based routes, pairing them with carbon-capture solutions rather than prioritizing a faster shift to lower-emissions primary production. This slower adoption of key technologies is compounded by execution delays and limited near-term spend, contributing to a sense that the pace of change remains below what is needed. This has resulted in Arcelor’s status being downgraded from ‘Aligning’ to ‘Committed to Aligning’ as their delays may result in an inability to meet emissions-reductions targets and could further expose the company to climate risk. With additional policy support, the company may be able to execute the levers outlined in its decarbonization strategy.

INDICATOR	ANALYST-ADJUSTED SCORE (1 - 5)	SCORE BREAKDOWN
1. Long-term ambition	3	Self-declared net-zero target for Scope 1 and Scope 2 emissions by 2050. Excludes Scope 3 and major JVs (notably AM/NS India). Company withdrew from SBTi in 2024.
2. Short- and medium-term targets	2	2030 target of 25% CO ₂ intensity reduction (Scope 1+2, global), 35% (Europe) vs. 2018 baseline. No quantitative Scope 3 target. Company has signaled it is unlikely to meet the 2030 goal under current regulatory conditions.
3. Emissions performance	2	Slow Scope 1 and Scope 2 emissions reduction trend (-5.4% global and -5% Europe in 2024 vs. 2018), behind expectations, and mostly due to lower steel output and asset sales.
4. Disclosures	4	Externally assured disclosure of Scope 1, 2, and 3 emissions, but emissions from major JVs missing.
5. Decarbonization strategy	3	Five-pillar strategy: steelmaking transformation (DRI/EAF, hydrogen), energy transformation (renewables, CCUS), increased scrap use, clean-electricity sourcing, minimal offsets. Major projects delayed or contingent on policy support. Continued investment in coal-based capacity (notably India JV).
6. Capital allocation	2	\$10bn planned for decarbonization (2020-2030), but only ~\$1bn spent by 2024, less than 7% of total capex spent. Execution lags, with much dependent on public funding and policy clarity.
TOTAL SCORE	16	COMMITTED TO ALIGNING



Risk and Resilience

Is the value of climate-resilient assets being fully recognized by investors, and are physical climate risks being reflected in asset prices?



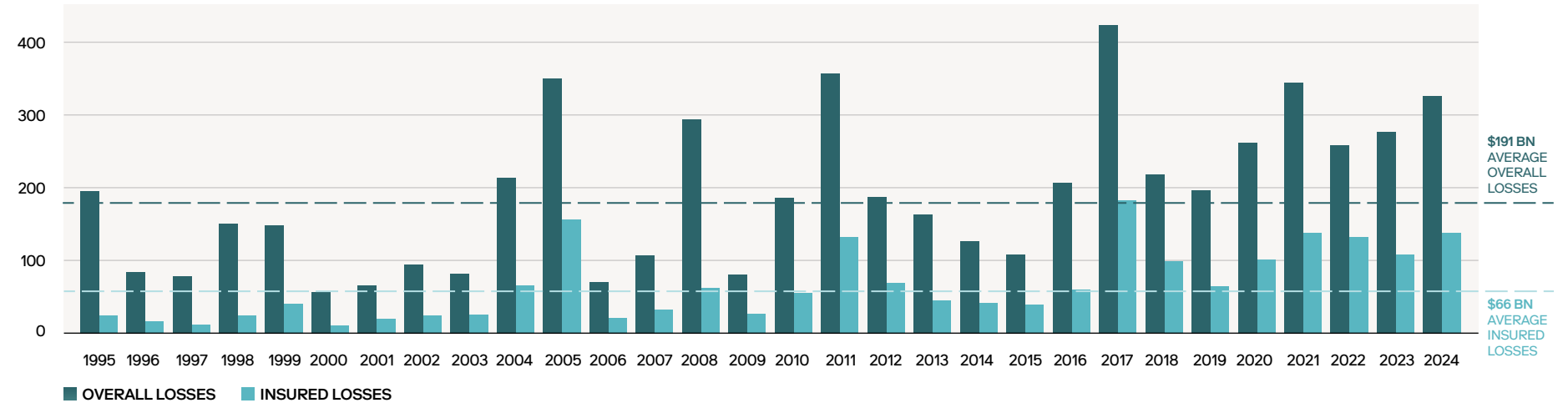
RISING NATURAL CATASTROPHE INCIDENCE AND ECONOMIC LOSSES

The physical impacts of climate risk are increasingly visible in the rising frequency and severity of natural catastrophes, with economic losses now consistently exceeding historical norms. Global economic losses from natural disasters reached \$224 billion in 2025, with insured losses accounting for about \$108 billion. While total economic losses have declined slightly since 2024, they remain above the 30-year historical average. 2025 also marked the fifth consecutive year where insured natural catastrophe losses exceeded \$100 billion.

These losses are overwhelmingly driven by weather-related events—including floods, storms, wildfires, and heatwaves—while geophysical risks such as earthquakes have contributed a comparatively small share of total damages. The geographic concentration of these losses remains pronounced, with nearly 80% of global insured losses occurring in the United States, reflecting both high asset values and elevated exposure to climate-driven hazards such as hurricanes, severe convective storms, and wildfires.

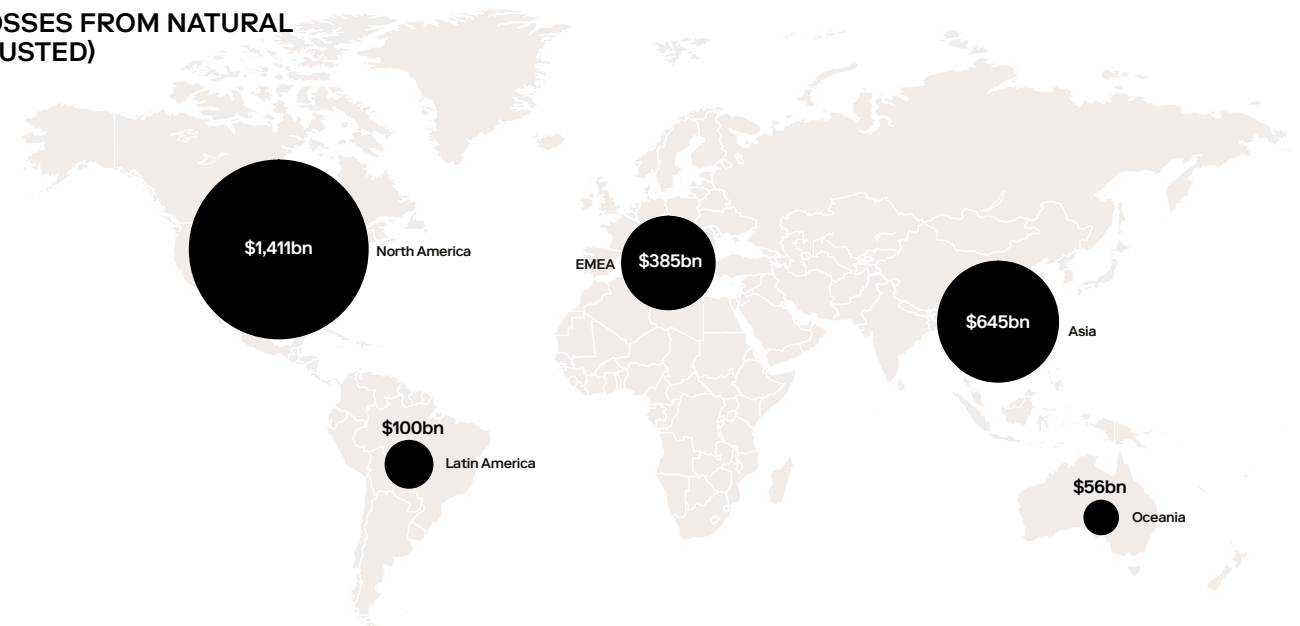
From an investor perspective, these trends highlight that physical climate risk is no longer a tail risk but a recurring macroeconomic shock. Rising catastrophe losses are increasingly influencing sovereign balance sheets, insurance affordability, infrastructure resilience, and corporate-earnings volatility. As extreme weather events become more frequent, the financial system is being forced to internalize risks that were historically treated as episodic or idiosyncratic.

GLOBAL NATURAL-DISASTER LOSSES OVER THE PAST 30 YEARS (IN \$US BN, INFLATION-ADJUSTED)



Source: MunichRe

CUMULATIVE REGIONAL ECONOMIC LOSSES FROM NATURAL DISASTERS (2015-2024, INFLATION ADJUSTED)



Source: MunichRe

UNDERSTANDING THE PROTECTION GAP

Persistent uninsured losses and structural vulnerabilities

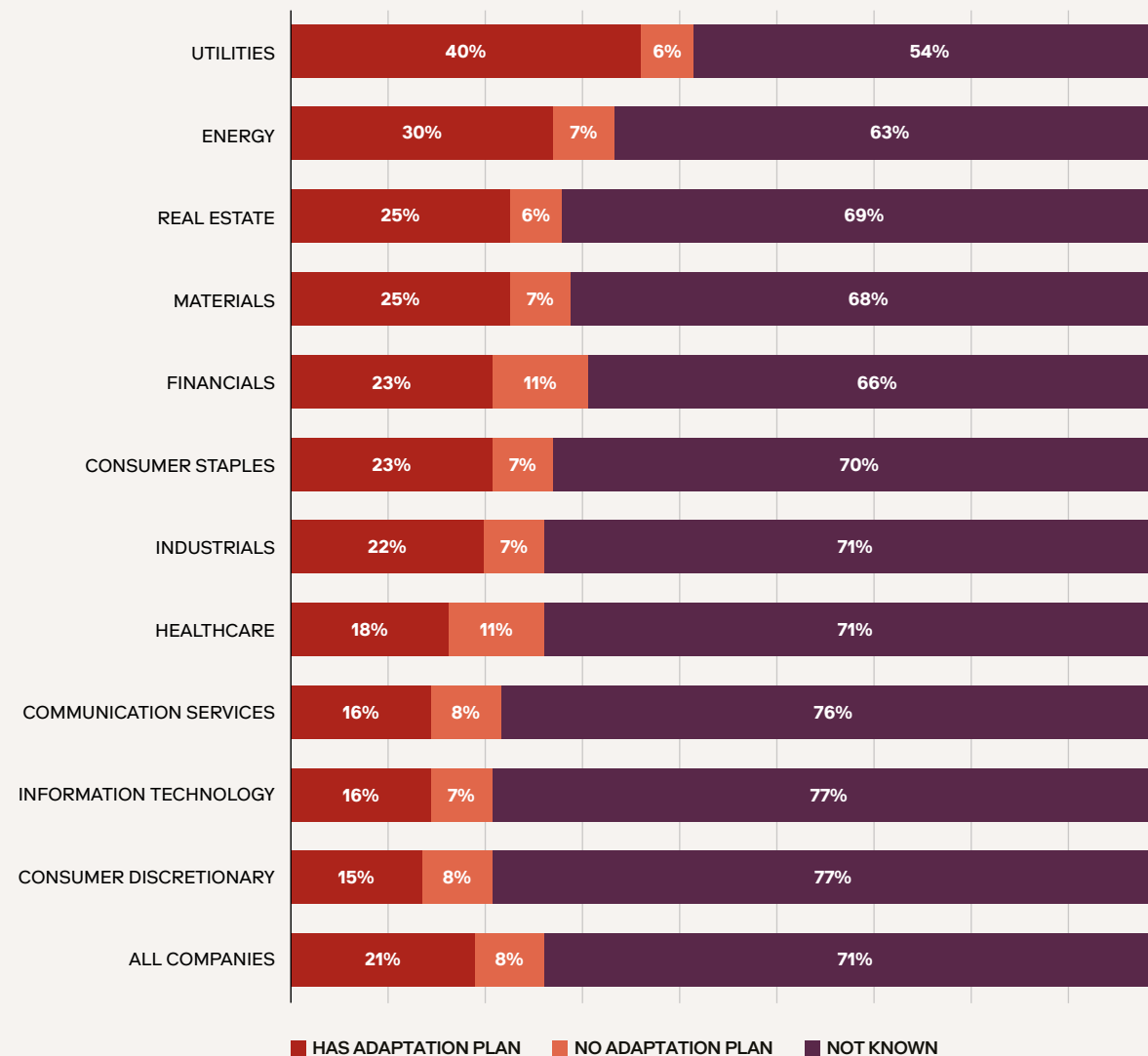
Despite rising insured losses, a significant portion of economic damage from natural catastrophes remains uninsured, resulting in a persistent global protection gap. In 2025, approximately 52% of global economic losses from natural disasters were not covered by insurance. This gap continues to place a disproportionate burden on governments, households, and businesses, particularly in emerging and climate-vulnerable regions. Importantly, the persistence of the protection gap reflects both affordability constraints and structural limitations in traditional insurance markets. As climate risks intensify, insurers have begun to reassess risk pricing, coverage limits, and geographic exposure, in some cases withdrawing from high-risk regions altogether. This new dynamic risks creating a feedback loop in which rising physical risks reduce insurance availability, further increasing the share of losses borne by the real economy.

SwissRe estimates that a 3.2°C rise in global temperature by 2050 could reduce global GDP by 17%. Even if warming is limited to 2.7°C, which is considered very likely, S&P Global projects that large companies could face about \$1.2 trillion in annual physical-risk costs in the 2050s. Climate risks are especially acute for businesses with long-lived fixed assets and offices in regions that are becoming more exposed to extreme heat, drought, and flooding; those with a high dependence on natural resources such as water; and those with value chains vulnerable to these hazards. With the rise of AI, data centers are a prime example of businesses with assets that face heightened exposure to climate hazards. This exposure could result in elevated risk for these and other businesses if appropriate resilience measures are not put in place. Despite recent policy action at COP30 to triple adaptation funding by 2035 (non-binding), a sizable gap remains: adaptation finance needs are estimated at \$284 - \$339 billion per year until 2035, roughly 12 - 14 times current flows. While the public sector will likely provide most of the financing for adaptation, this gap presents a meaningful opportunity for private-sector investment.



ONLY 1 IN 5 COMPANIES HAVE AN ADAPTATION PLAN TO ADDRESS PHYSICAL RISK

Results based on responses from 6,871 companies in Jefferies CSA survey



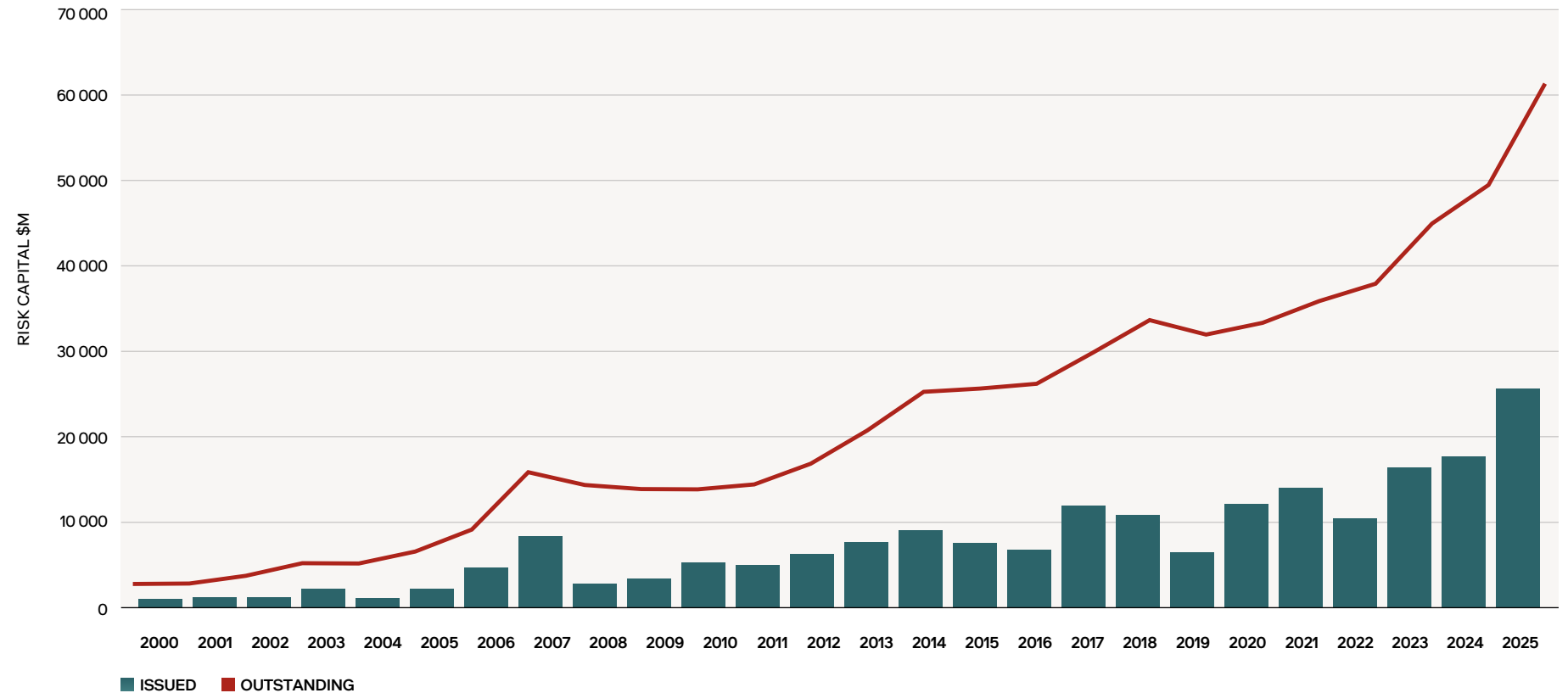
Source: Jefferies

CATASTROPHE BONDS AND INSURANCE-LINKED SECURITIES

Bridging the gap

Against this backdrop, catastrophe bonds (CAT bonds) and the broader market for insurance-linked securities (ILS) have emerged as an increasingly important mechanism for transferring climate risk from insurers and sovereigns to capital markets. Neuberger’s Insurance-Linked Strategies (NB ILS) approach to the asset class includes quantification of acute physical climate risks and works to develop products that contribute to growing an innovative risk-transfer market. NB ILS has participated in multiple catastrophe-bond issuances that facilitate natural-catastrophe risk transfer, including approximately \$4 billion of protection obtained by The World Bank due to worldwide earthquakes. Globally, we have seen continued growth in CAT-bond issuance as sponsors seek to diversify risk transfer beyond traditional reinsurance and secure multi-year protection against extreme events. In 2020, the amount of outstanding catastrophe-bond risk capital was nearly double what it was a decade earlier, and new issuance reached a record \$25.6 billion. CAT bonds have also broadened in scope: historically concentrated in hurricane and earthquake risk, they are now being structured to cover additional perils, including wildfire. Against the backdrop of a widening protection gap, the insurance-linked securities market appears to have substantial runway for growth beyond traditional re/insurers. Sovereign entities, such as Jamaica, are also using catastrophe bonds to help cover damages from natural disasters like Hurricane Melissa.

CATASTROPHE BOND & ILS CAPITAL ISSUANCES AND OUTSTANDING CAPITAL HAVE SEEN STRONG GROWTH IN RECENT YEARS (2000 - 2025).



Source: Artemis

Looking forward, CAT bonds are likely to play a growing role in narrowing the global protection gap. While they are not a substitute for comprehensive adaptation and risk-reduction measures, they represent a scalable financial tool that can mobilize private capital in support of climate resilience. As physical climate risks continue to rise, the integration of CAT bonds into broader adaptation and resilience strategies may become an increasingly important theme for both insurers and long-term investors.

ASSESSING PHYSICAL RISK

Data centers in focus

Outside of CAT bonds, physical-risk assessments are increasingly likely to be incorporated into investment decision-making as investors seek a clearer understanding of underlying risk exposures. Industries with high incremental capital expenditure and large long-lived assets with limited alternative use are particularly exposed to physical risks. These include mines, airports, data centers, and other infrastructure projects.

Among these, data centers stand out due to the scale and speed of capital deployment. Global data-center capital expenditure is expected to reach approximately \$1.7 trillion by 2030, with the six largest U.S. hyperscalers alone projected to spend around \$700 billion in 2026. As capital requirements have increased, AI-related companies have increasingly turned to debt financing, with AI-exposed sectors now representing approximately 18% of the aggregate corporate bond index. Bond issuance within the technology sector has also risen sharply, nearly quadrupling since 2023. Equity markets are similarly concentrated, with AI-related stocks accounting for roughly 50% of the S&P 500's market capitalization, further amplifying investor exposure to physical risks associated with data-center infrastructure.

At the project level, data-center siting decisions often prioritize access to energy supply—such as natural-gas availability or existing grid infrastructure—over physical-resilience considerations. In parallel, community opposition and regulatory pushback have increasingly shaped location choices, with developers gravitating toward regions with lighter regulatory regimes.

Taken together, these dynamics suggest that physical-risk exposure associated with data centers is becoming increasingly material to portfolio construction. To illustrate these risks, the following section outlines physical-risk assessments for two major U.S. data center development sites.

CASE STUDY

OPEN AI STARGATE (ABILENE, TX)

Data Center Campus

GW capacity	~1.2 GW
Site investment	~\$15 billion
Target initial build-out date	Mid-2026
Financing	Stargate JV, Blue Owl, Crusoe

Open AI's Stargate partnership plans to invest \$100 billion in an initial roll-out across multiple data-center sites within the U.S., with \$500 billion in total investment expected over the next four years. One of these sites in Abilene, TX, faces heightened exposure to wildfire risk. This risk could result in business interruptions or potential loss of capital-intensive assets. Further engagement to better understand any adaptation measures would be important for investors to assess how this impacts the overall risk exposure of their investment and portfolio.

CLIMATE RISK ASSESSMENT

HAZARD	RISK FACTOR	30-YEAR CHANGE IN EXPOSURE										
Flood	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="background-color: #008080; color: white; padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">10</td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	No change
1	2	3	4	5	6	7	8	9	10			
Wind	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="background-color: #008080; color: white; padding: 2px 5px;">1</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">2</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">3</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">10</td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	+4 mph 3s gusts
1	2	3	4	5	6	7	8	9	10			
Wildfire	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="background-color: #008080; color: white; padding: 2px 5px;">1</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">2</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">3</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">4</td> <td style="background-color: #ff8c00; padding: 2px 5px;">5</td> <td style="background-color: #ff4500; padding: 2px 5px;">6</td> <td style="background-color: #ff0000; padding: 2px 5px;">7</td> <td style="background-color: #ff0000; padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">10</td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	+31% cumulative risk
1	2	3	4	5	6	7	8	9	10			
Heat	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="background-color: #008080; color: white; padding: 2px 5px;">1</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">2</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">3</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">4</td> <td style="background-color: #ff8c00; padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">10</td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	+13 days over 90°F
1	2	3	4	5	6	7	8	9	10			
Cold	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="background-color: #008080; color: white; padding: 2px 5px;">1</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">2</td> <td style="background-color: #008080; color: white; padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">10</td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	-3 days under 30°F
1	2	3	4	5	6	7	8	9	10			
Drought	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="background-color: #008080; color: white; padding: 2px 5px;">1</td> <td style="padding: 2px 5px;">2</td> <td style="padding: 2px 5px;">3</td> <td style="padding: 2px 5px;">4</td> <td style="padding: 2px 5px;">5</td> <td style="padding: 2px 5px;">6</td> <td style="padding: 2px 5px;">7</td> <td style="padding: 2px 5px;">8</td> <td style="padding: 2px 5px;">9</td> <td style="padding: 2px 5px;">10</td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	-4 consecutive weeks
1	2	3	4	5	6	7	8	9	10			

1	Minimal	2	Minor	3	4	Moderate	5	6	Major	7	8	Severe	9	10	Extreme
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Climate risk assessment source: First Street

CASE STUDY

META HYPERION (RAYVILLE, LOUISIANA)

Data Center Campus

GW capacity	~>2 GW
Site investment	~\$10 billion
Target initial build-out date	2028-2029
Financing	Blue Owl Joint Venture

Meta’s Hyperion project is focused on building out data-center capacity to support their AI and cloud-computing capabilities. The project will be funded in conjunction with Blue Owl via a ~\$30-billion joint venture. The primary hazards for the Rayville data-center location include extreme heat and wind. While extreme heat may involve increased operating expenses to cool the data center, this hazard does not expose the location to the same potential replacement cost or business interruptions as hazards like floods. If more advanced cooling technologies are utilized to combat these temperature rises, the data centers may be able to cool the servers more efficiently and avoid these expenses. Understanding which adaptation solutions can reduce risk most effectively can help mitigate future costs for both corporates and investors.

CLIMATE RISK ASSESSMENT

HAZARD	RISK FACTOR	30-YEAR CHANGE IN EXPOSURE
Flood	1 2 3 4 5 6 7 8 9 10	No change
Wind	1 2 3 4 5 6 7 8 9 10	+2 mph 3s gusts
Wildfire	1 2 3 4 5 6 7 8 9 10	+0.02% cumulative risk
Heat	1 2 3 4 5 6 7 8 9 10	+15 days over 90°F
Cold	1 2 3 4 5 6 7 8 9 10	-1 days under 30°F
Drought	1 2 3 4 5 6 7 8 9 10	-7 consecutive weeks

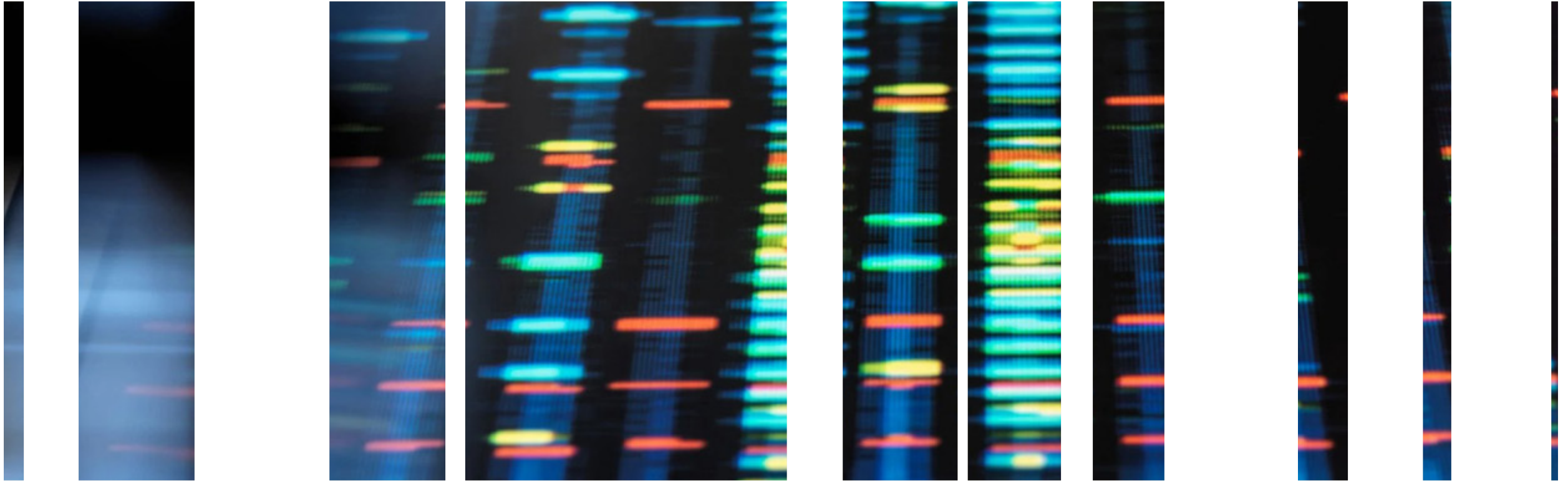
1 Minimal 2 Minor 3 Moderate 4 Moderate 5 Major 6 Major 7 Severe 8 Severe 9 Extreme 10 Extreme



Climate risk assessment source: First Street

AI: Energy in a Digitized World

As AI technologies evolve, how should investors evaluate their impact on the net-zero transition, both as potential investment opportunities and as tools for managing climate risk?



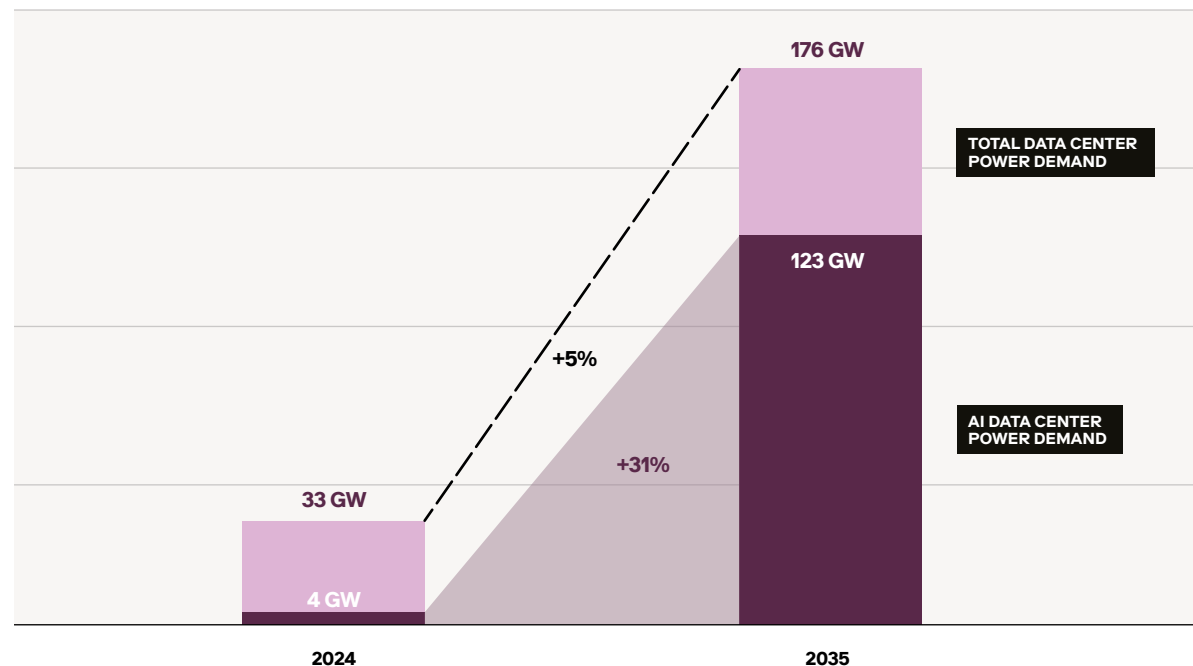
DATA-CENTER DEMAND

Data centers have moved from a peripheral source of electricity demand to a structurally material driver of power-system growth. Today, data centers account for approximately 1 - 2% of global electricity demand, but this share is projected to increase rapidly as AI deployment scales across cloud computing, enterprise applications, and industrial use cases. Data-center power demand is expected to grow by roughly 165% through 2030 relative to 2023 levels, making it one of the fastest-growing sources of incremental load globally. A typical data center consumes about the same amount of energy as 100,000 households.

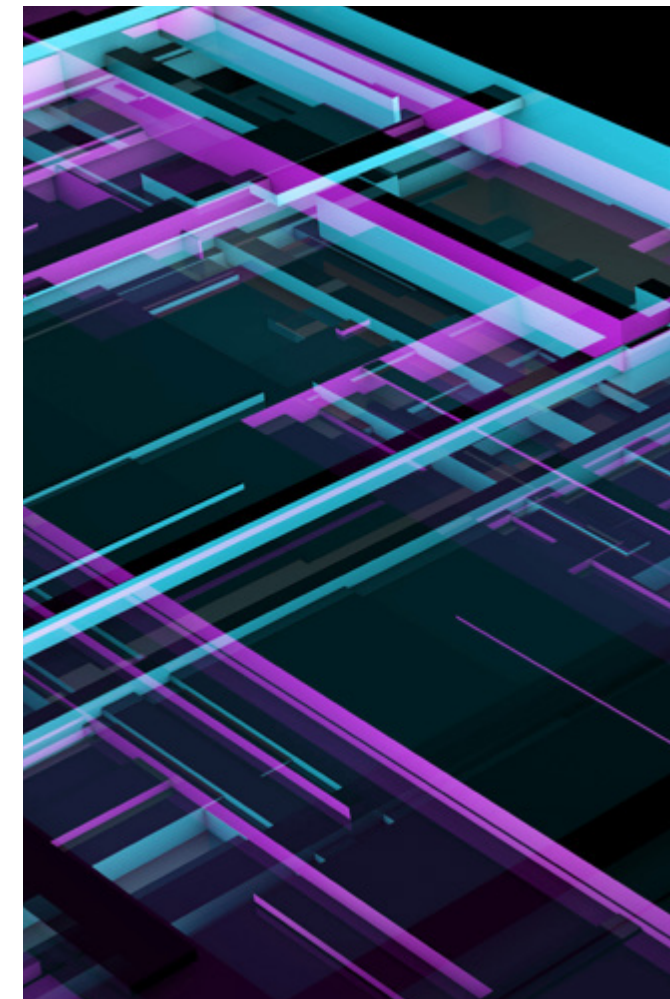
This growth is highly concentrated in specific regions, particularly the United States where hyperscalers are accelerating capital deployment to secure near-term capacity. There are more than 50 new data-center construction projects being planned across the U.S. alone, some with capacities double or quadruple those of existing projects. The SPEED Act, which was recently advanced by the House of Representatives, could help to expedite permits for projects related to AI infrastructure, further advancing the U.S.'s position in the AI race. U.S. data-center capacity currently represents approximately 40% of the global total. While China and Europe lag behind the U.S. in terms of capacity, China is projected to add roughly 2.5 times its current capacity and Europe is expected to add an extra 75% of its current capacity through 2030. This global acceleration has prompted questions around how data centers will source energy to meet this rising demand.

Unlike historical sources of load growth, data centers require continuous high-load high-reliability power, limiting flexibility in how and when demand can be met. As a result, hyperscalers are increasingly committing to long-dated power contracts and, in some cases, directly catalyzing new generation capacity. The speed and scale of this build-out has compressed planning timelines across the power value chain and raised questions around grid capacity and energy sourcing.

U.S. POWER DEMAND FROM DATA CENTERS IS EXPECTED TO BOOM IN THE COMING YEARS.



Source: Deloitte



GRID-LOCK

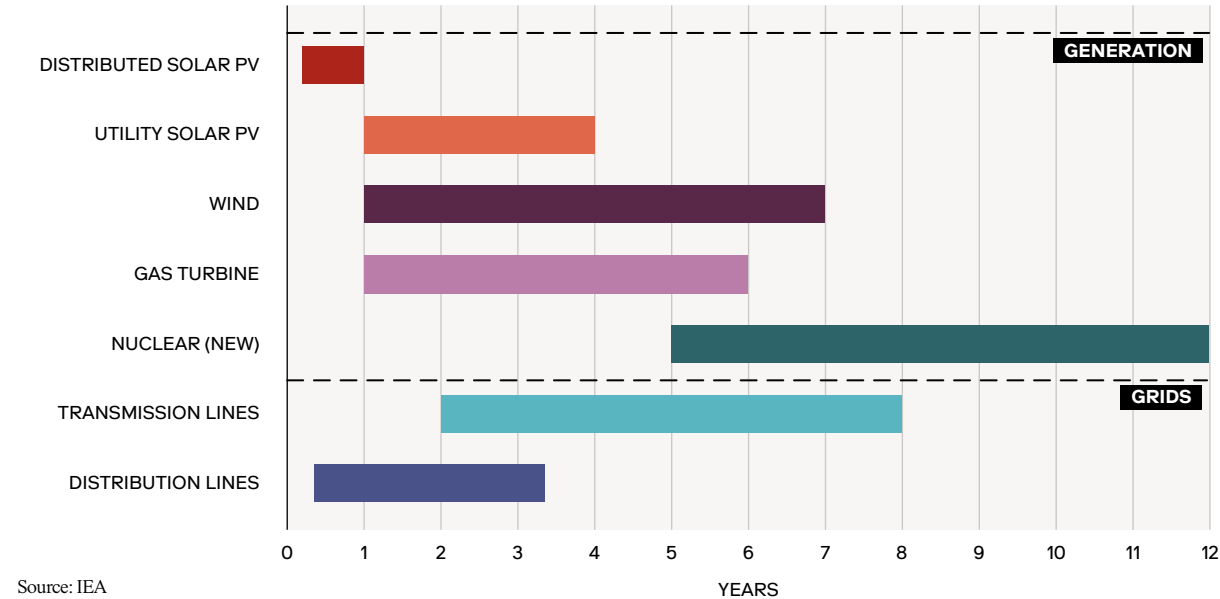
Grids' critical role in the roll-out of data centers

While generation-capacity additions continue across multiple technologies, grid infrastructure has emerged as a major constraint on the ability to meet rising data-center demand. Global electricity networks currently span more than 82 million kilometers but they will need to increase by 30% over the next decade. Global grid investment requirements are substantial, with estimates suggesting \$22.5 trillion will be required by 2050 to remain aligned with net-zero pathways. While we have seen grid investments accelerating, rising by 16% year on year in 2025, grid expansion has lagged behind generation build-out.

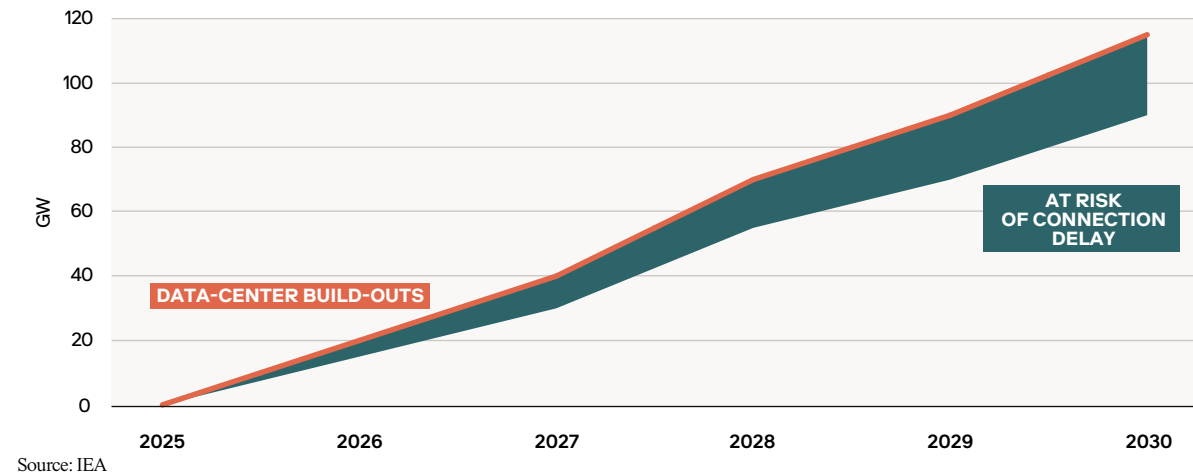
While implementation times can vary for new generation, the majority of construction occurs much quicker than building new transmission and distribution lines. For the chart opposite, with the exception of distributed solar PV, which does not require grid connections, these energy sources could require an additional two to eight years before becoming operational if they do not have easy access to the grid. Lengthening interconnection queues, transformer shortages, and multi-year permitting delays are preventing projects from coming online fast enough. The IEA warns that grid delays could result in the loss of up to 58 Gt of potential CO₂ emissions savings by 2050. This has led some hyperscalers, such as Alphabet, to consider co-location arrangements, building data centers adjacent to power stations to limit the need for long-distance transition.

Without accelerated grid investment and further permitting reform, grid congestion risks locking in higher carbon generation in the near-term. In this context, grid infrastructure has become not just an enabler of decarbonization but a determinant of whether decarbonization pathways remain feasible.

TYPICAL DEVELOPMENT TIME FOR ELECTRICITY GENERATION AND GRIDS



UNDER A BASE-CASE SCENARIO, CONNECTION ISSUES COULD CAUSE DELAYS IN GLOBAL DATA-CENTER BUILD-OUTS



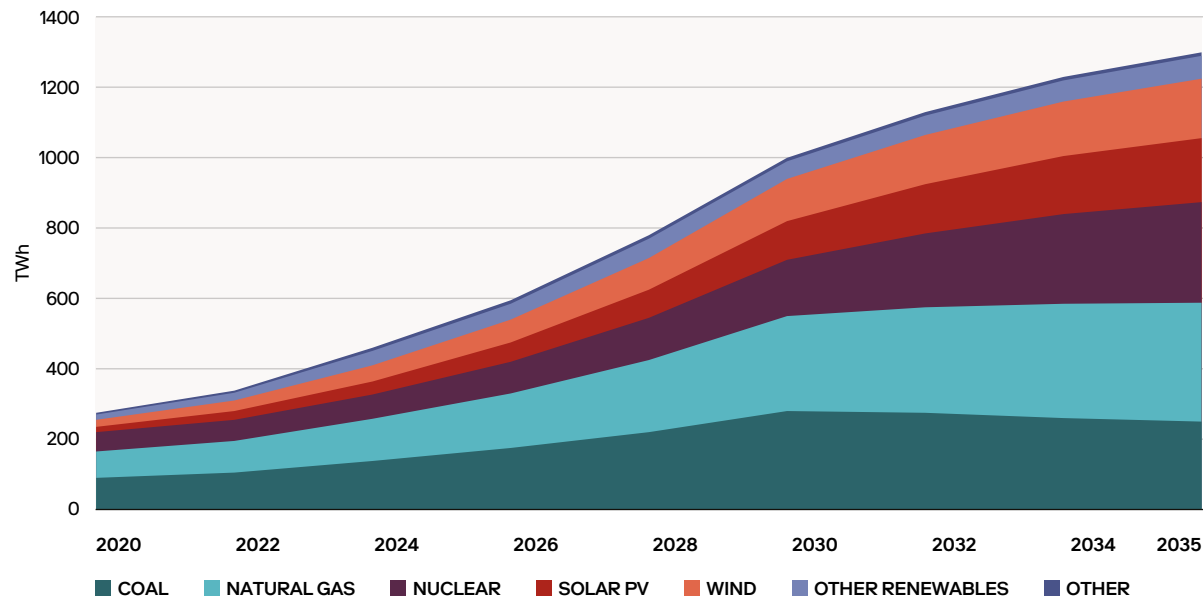
POWERING DATA CENTERS: ALL HANDS ON DECK

Given these constraints, dispatchable energy sources are playing an outsized role in meeting incremental data-center demand. The source of energy generation for data centers is likely to vary over regions and time. Globally, natural gas and coal are expected to meet over 40% of additional data-center power demands through 2030. Coal currently accounts for a majority (nearly 70%) of China's electricity supply for data centers, while natural gas is the largest source of energy generation in the U.S. Gas's role reflects its relative speed to deployment, operational flexibility, and compatibility with existing grid infrastructure. However, this reliance introduces tension with net-zero objectives, particularly given concerns around methane leakage and lifecycle emissions. As such, hyperscalers are seeking out low-carbon sources of energy to help maintain their sustainability commitments.

Renewables are likely to contribute more to data-center energy generation in the coming years, with an expected annual increase of 22% through 2030. Wind and solar will likely make up most of the renewable generation in the near-term, with nuclear playing a larger role after the 2030s. Nuclear's role is expected to increase as SMRs begin to come online, with technology companies planning to finance more than 20 GW of SMRs to date. The increasing portion of renewable power is expected to lead to a plateau of CO₂ emissions from data centers in 2030.

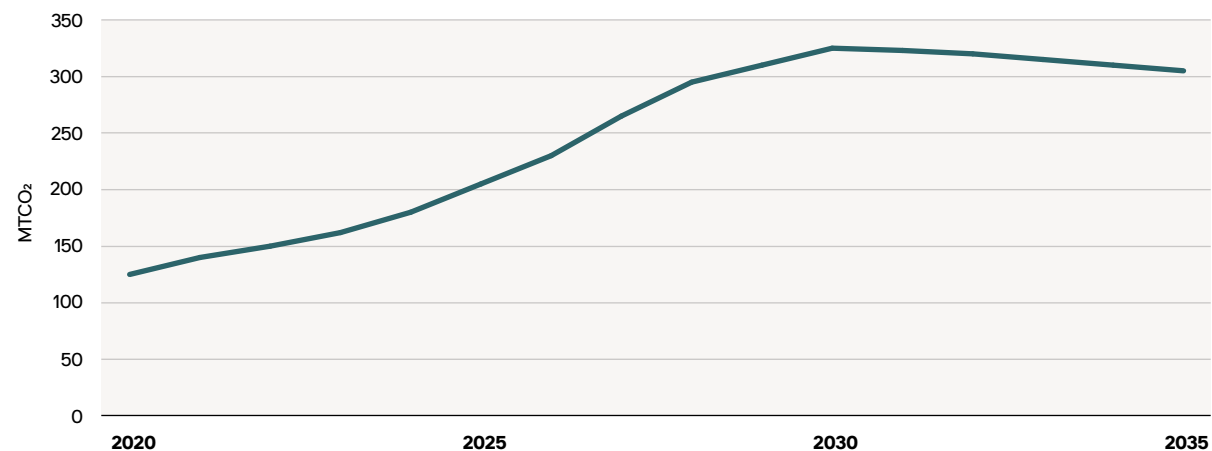
While renewables are expected to play a pivotal role in powering data centers, fossil fuels will likely remain a significant part of their energy supply, particularly given the availability of merchant gas and nuclear power. While there is some uncertainty, particularly regarding potential policy changes, hyperscalers, utilities, and independent power producers will likely remain focused on an all-of-the-above approach that balances emissions, costs, and reliability, with renewables and storage likely to be the key winners.

SOURCES OF GLOBAL ELECTRICITY GENERATION FOR DATA CENTERS (BASE CASE)



Source: IEA

CO₂ EMISSIONS FROM DATA CENTERS ARE EXPECTED TO LEVEL OFF AFTER 2030



Source: IEA



THE HYPERSCALER DECARBONIZATION SCORECARD

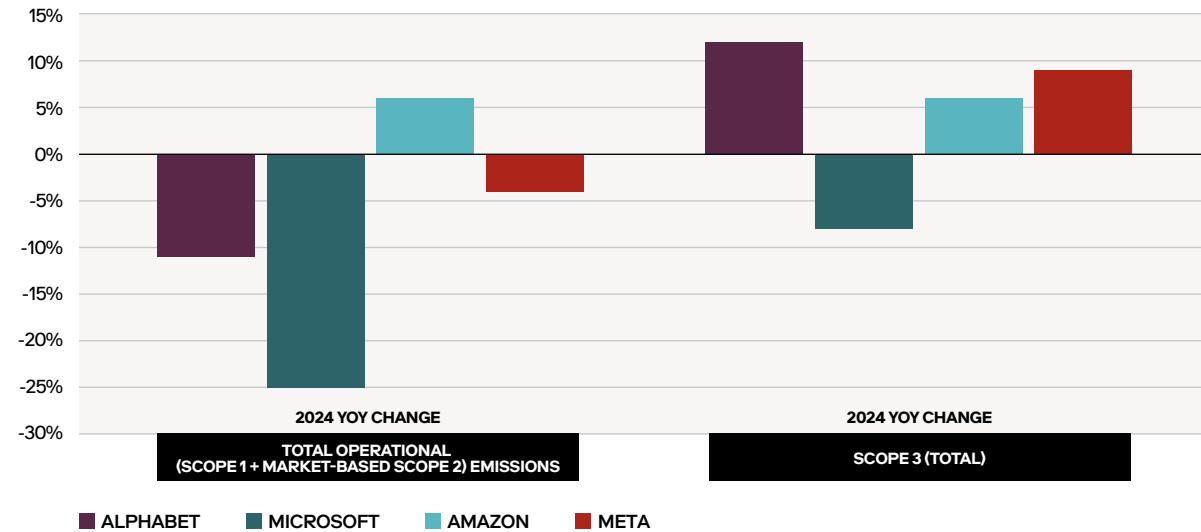
The growing divergence in how hyperscalers manage energy sourcing is becoming increasingly relevant for investors assessing real-world decarbonization outcomes. While many hyperscalers maintain ambitious net-zero commitments, rising data-center demand has complicated execution. Higher absolute emissions, increased reliance on fossil-backed power, and growing capital allocation toward energy infrastructure are testing the credibility and comparability of corporate climate strategies. As hyperscalers contend with these factors, we see varied success in reducing or limiting emissions across scopes.

This divergence underscores the importance of moving beyond headline targets toward more granular

assessments of capital allocation, grid engagement, and energy-procurement strategies. Hyperscalers that proactively invest in grid solutions, long-term clean firm power, and system-wide decarbonization enablers are better positioned to reconcile growth with climate alignment. We have therefore developed a Hyperscaler Decarbonization Scorecard to better understand these companies' performance across key metrics in regards to decarbonization as it relates to data centers. These metrics include carbon targets, energy sourcing, and innovative power solutions.

While Meta still enacts sustainability efforts, they are lagging behind those of their peers, particularly when compared with Alphabet. To the right, we dive into each of these companies' broader net-zero alignment and the factors enabling and hindering their transition.

HYPERSCALERS' 2024 EMISSIONS YEAR-OVER-YEAR CHANGE



Source: Amazon 2024 Sustainability Report, Alphabet 2025 Environmental Report, 2025 Microsoft Environmental Data Fact Sheet, Meta 2025 Environmental Data Index

VERTICALS	ALPHABET	MICROSOFT	AMAZON	META
Carbon targets	<ul style="list-style-type: none"> Overall goal: Net-zero across operations by 2030 24/7 CFE⁷ goal: 24/7 carbon-free energy (CFE) by 2030 	<ul style="list-style-type: none"> Overall goal: Carbon negative by 2030 24/7CFE goal: 100% carbon-free electricity, 100% of the time by 2030 	<ul style="list-style-type: none"> Overall goal: Net-zero across operations by 2040 24/7 CFE goal: No 24/7 CFE commitment 	<ul style="list-style-type: none"> Overall goal: Net-zero across value chains by 2030 24/7 CFE goal: No 24/7 CFE commitment
Energy sourcing	<ul style="list-style-type: none"> CFE matching progress: 66% of data centers source 24/7 CFE Renewables: Purchased 8 GW of additional clean-energy generation in 2024 	<ul style="list-style-type: none"> CFE matching progress: Matched 100% of 2025 global annual electricity with renewables (not hourly) Renewables: Contracted 19 GW of new renewables in 2024 	<ul style="list-style-type: none"> CFE matching progress: Matched 100% of 2025 global annual electricity with renewables (not hourly) Renewables: 124 new renewable projects announced in 2024 	<ul style="list-style-type: none"> CFE matching progress: Matched 100% of annual electricity consumption with renewables since 2020 (not hourly) Renewables: Over last decade 15 GW of new renewable energy
Innovative solutions	<ul style="list-style-type: none"> Variable compute: Program that shifts power request to most clean available grid PUE⁸: PUE is down from 1.1 to 1.09 Nuclear/SMRs: Investing in SMRs and storage 2025 nuclear restart of Duane Arnold (~500 MWs) 	<ul style="list-style-type: none"> Variable compute: Pilot program to enable energy-efficient decision-making PUE: Increase from 1.16 to 1.17 Nuclear: 2024 restart of Constellation nuclear facility 	<ul style="list-style-type: none"> Variable compute: No carbon-aware/flexible compute program PUE: Approximately 1.15 in 2024 Nuclear: 2025 "Behind-the-meter" nuclear deal, contracting existing nuclear capacity 	<ul style="list-style-type: none"> Variable compute: No carbon-aware/flexible compute program PUE: Maintained 1.8 in 2024 Nuclear: Aiming to add 1 to 4 GW of nuclear by 2030, contracting existing nuclear capacity
Status	Leader	Leader	In Line	Lagging

7. CFE: Carbon-free energy

8. PUE: Power-usage effectiveness

Source: Alphabet Sustainability Report, Microsoft 2025 Environmental Sustainability Report, Energy Digital, Amazon 2024 Sustainability Report, Meta 2025 Sustainability Report

COMPANY SPOTLIGHT

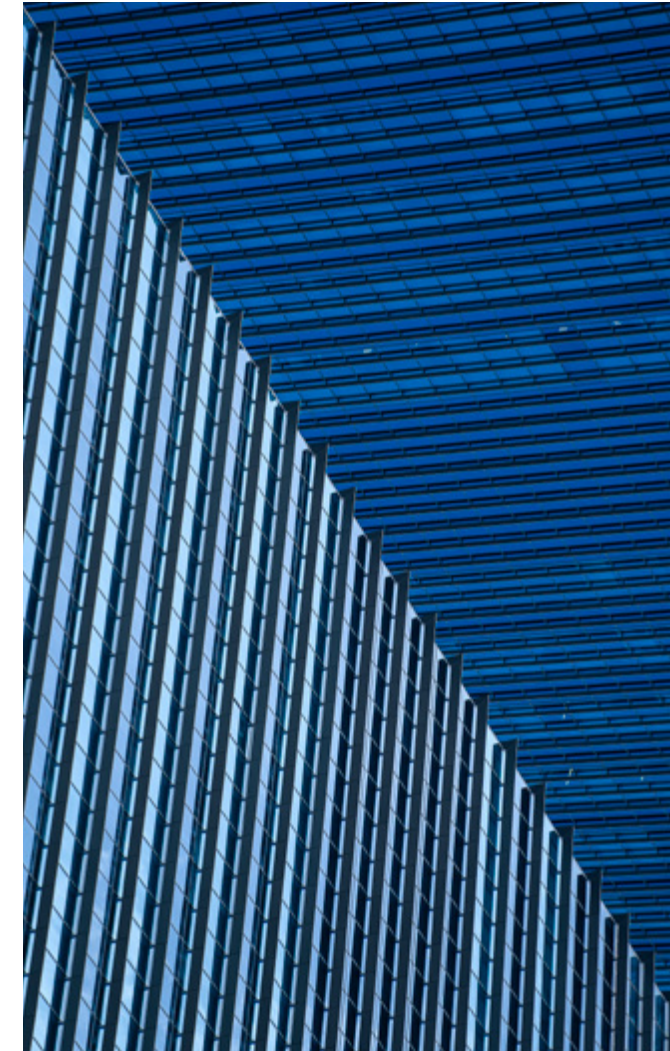
CASE STUDY: LEADER

COMPANY: ALPHABET INC

CURRENT STATUS: ALIGNING

INDICATOR	ANALYST-ADJUSTED SCORE (1 - 5)	SCORE BREAKDOWN
1. Long-term ambition	5	Ambition to reach net zero across operations by 2030 & 24/7 carbon-free energy by 2030.
2. Short- and medium-term targets	4	SBTi-validated target to reduce Scope 1,2 and 3 emissions by 2030.
3. Emissions performance	3	Scope 1 and Scope 2 emissions declined by 11% in 2024, while Scope 3 (ambitions-based) continued to increase by 22% compared with 2023.
4. Disclosures	5	Discloses Scope 1, Scope 2 and Scope 3 emissions.
5. Decarbonization strategy	3	Prioritizing hourly clean-energy matching in data centers in addition to low-carbon data-center construction and increased efficiency.
6. Capital allocation	3	Between 2010 and 2024, entered into agreements to produce ~6 GW in clean-energy projects and partnerships.
TOTAL SCORE	23	ALIGNING

Alphabet continues to stand out as a relative leader among hyperscalers, reflecting the benefits of early and sustained investment in clean-power procurement and grid-aware decarbonization strategies. The company’s historic use of long-term power-purchase agreements, growing focus on 24/7 carbon-free energy matching, and willingness to contract across technologies—including renewables and nuclear power—have supported stronger net-zero alignment outcomes despite rapid growth in data-center demand. While absolute emissions have risen alongside expanding computing needs, Alphabet’s capital allocation and energy-sourcing decisions demonstrate a clearer linkage between ambition and execution, positioning it more favorably than peers navigating similar demand pressures.



COMPANY SPOTLIGHT

CASE STUDY: LAGGARD

COMPANY: META PLATFORMS

CURRENT STATUS: COMMITTED TO ALIGNING

INDICATOR	ANALYST-ADJUSTED SCORE (1 - 5)	SCORE BREAKDOWN
1. Long-term ambition	3	Ambition to reach net zero across operations by 2030, SBTi-validation removed.
2. Short- and medium-term targets	4	SBTi-validated target to reduce Scope 1,2 and 3 emissions by 2030.
3. Emissions performance	3	Scope 1 and Scope 2 emissions declined by 4% in 2024, while Scope 3 increased by ~9% compared with 2023.
4. Disclosures	5	Discloses Scope 1, Scope 2 and Scope 3 emissions.
5. Decarbonization strategy	1	Lacks quantified decarbonization strategy.
6. Capital allocation	2	High-level outline of investments in low-carbon solutions.
TOTAL SCORE	17	COMMITTED TO ALIGNING

Meta continues to lag relative to its peers, its decarbonization trajectory increasingly constrained by the pace and concentration of its data-center expansion. While Meta maintains high-level climate commitments, gaps remain between stated ambition and the scalability of its energy-procurement strategy. It also lacks a quantified roadmap for its decarbonization strategy and green capital allocation in the coming years. While still able to maintain 100% clean matching for its global annual electricity consumption, shifting to hourly matching and enhancing its investment in innovative solutions like variable compute power could help improve Meta's net-zero alignment.



China

To what extent does the success of global decarbonization hinge on China's policy choices and technology deployment?



PROGRESS AND POLICY

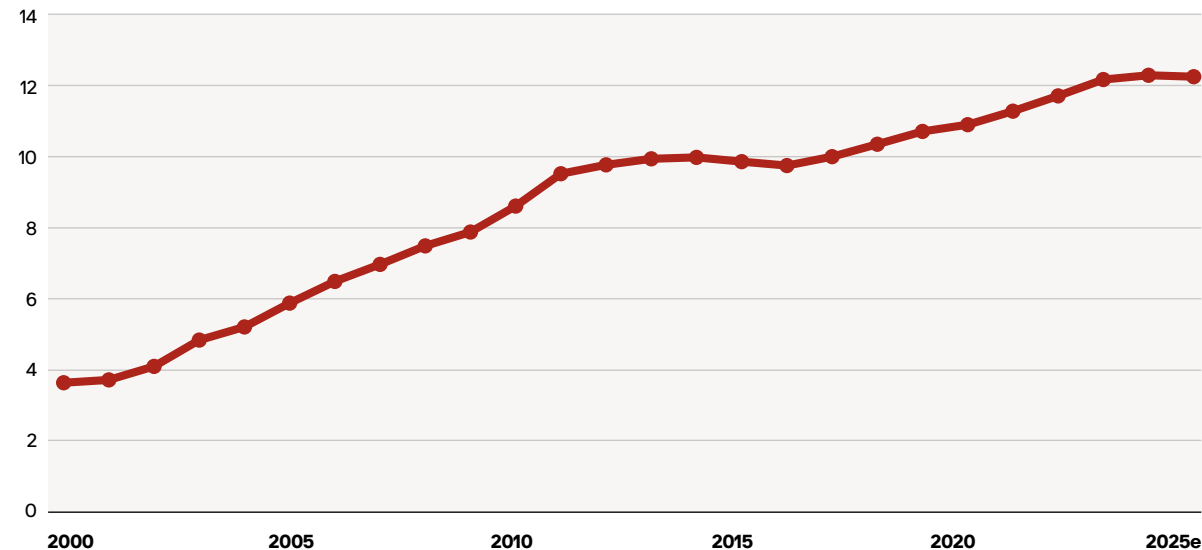
China has emerged as a central player in the global AI and data-center race, underpinned by the recent launch of its AI+ policy, which targets 90% penetration of AI-enabled devices and applications by 2030. A key advantage in this effort is China's emphasis on scalable low-cost renewable generation, which provides a structural energy cost advantage as compute demand accelerates. This dynamic is partly driven by policies such as China's East-West Computing Resources Transmission Project, which aims to build a national computing network with more data centers in western regions (e.g., Gansu, Inner Mongolia) that benefit from close proximity to renewable-energy sources and storage capacity, as well as lower mean temperatures. In parallel, China's support for open-source large-language models (LLMs) reflects a less compute-intensive AI strategy, potentially delivering further gains in energy efficiency and system-level cost competitiveness. Together, these dynamics position China to expand its AI infrastructure while moderating some of the energy-intensity challenges seen in other markets.

That said, AI and data centers represent only one facet of China's broader climate and energy transition. Data centers accounted for only around 1 - 1.5% of China's total electricity consumption in 2024, a relatively modest share of the overall energy system, although this figure is expected to double by 2027. Much larger sources of incremental demand remain elsewhere in the economy: manufacturing alone added approximately 300 TWh of electricity consumption in 2024 (~2 - 3 times larger than the entire data sector's electricity footprint), highlighting the scale of China's industrial energy requirements and the importance of economy-wide decarbonization rather than a narrow focus on digital infrastructure.

Against this backdrop of rising energy demand across sectors, China's role in the global decarbonization trajectory remains pivotal. Notably, China's CO₂ emissions are estimated to have declined by approximately 0.3% in 2025, which would mark the first post-COVID emissions decline despite continued economic expansion. This inflection was supported by the rapid deployment of renewable energy, with China reaching its 1,200 GW wind and solar capacity target in 2024, six years ahead of schedule.

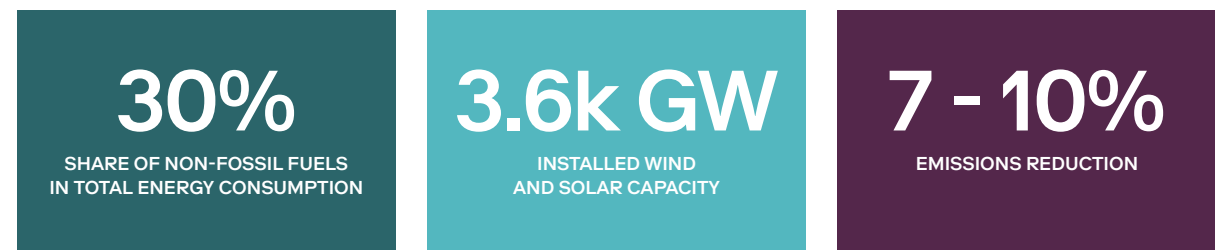
Under its current climate framework, China has committed to peaking CO₂ emissions before 2030 and achieving carbon neutrality by 2060, a timeline that lags developed-market targets but reflects the country's industrial structure and development priorities. In 2025, China introduced its 2035 NDC to achieve a 7 - 10% reduction in greenhouse-gas emissions from peak levels, although this is far below the estimated 30% reduction needed to align with the Paris Agreement. While this target was under market consensus, China announced that it would strive to do better, indicating that this was actually a conservative baseline. China's most recent five-year plan, which was published in March 2026, generally aligns with their 2030 and 2035 targets, but there is some debate regarding a methodological adjustment to include industrial emissions in the calculation. Overall, the focus of the latest plan and recent policy action suggest they are prioritizing developing green manufacturing and zero-carbon industrial parks. At the same time, continued coal capacity build-out underscores the dual objectives embedded in China's policy approach: accelerating decarbonization while maintaining energy security and economic stability.

ANNUAL CO₂ EMISSIONS, 2000 - 2025 (BILLION TONS)



Source: Global Carbon Budget (2025)

CHINA'S 2035 NATIONALLY DETERMINED CONTRIBUTION (NDC)



Source: Climate Action Tracker

ADVANCING RENEWABLES AT SCALE

Deployment, cost and system impact

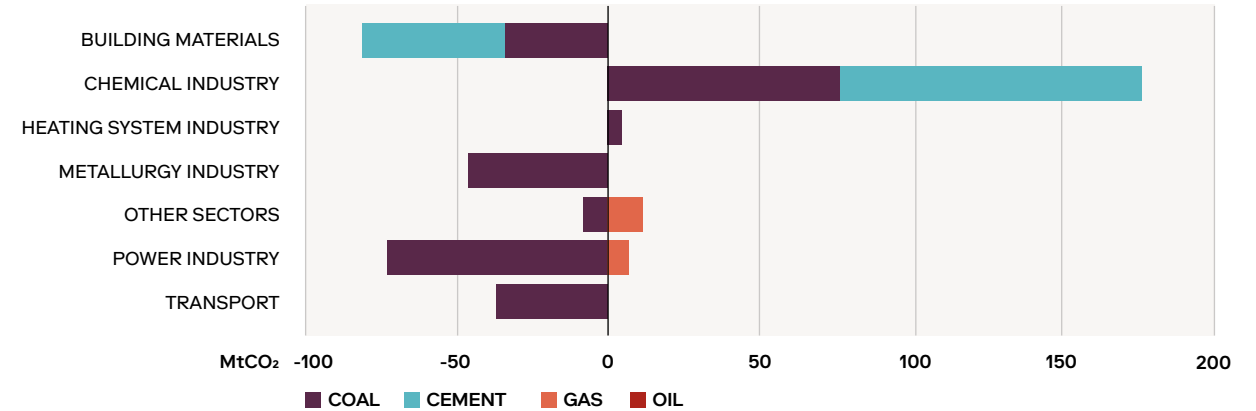
China's renewable-energy deployment remains unmatched in both scale and speed. The country is expected to account for more than half of global renewable capacity additions in the coming years, with solar photovoltaic installations leading growth. This growth is expected to continue as China targets expanding wind and solar capacities 2.5-fold by 2035. The proliferation of renewables and fall in coal use has seen a decline in emissions year on year across a number of sectors, with the exception of chemicals which remains hard to abate. This build-out has been driven by a combination of falling technology costs, centralized planning, and strong state-backed financing mechanisms.

While non-fossil-fuel capacity continues to outpace consumption, China would be able to bridge this gap with continued investment in grid infrastructure, distributed generation, and energy storage. Renewable consumption is further impacted by a recent policy change that has shifted away from fixed tariffs for solar and wind towards market-based renewable-price reform. While this policy may lead to a temporary slow-down in new renewable-project development, it should help to enhance long-term integration and sector efficiency. Coal will continue to play a role in balancing the system but the trajectory of China's power sector is tilted towards less-carbon-intensive energy sources.

From an investor perspective, China's renewables story illustrates opportunity in the region supported by clear policy commitment. Under its latest NDC, China also targets an increase in non-fossil energy's share of primary energy consumption from below 20% in 2024 to over 30% by 2035, alongside the six-fold expansion in combined

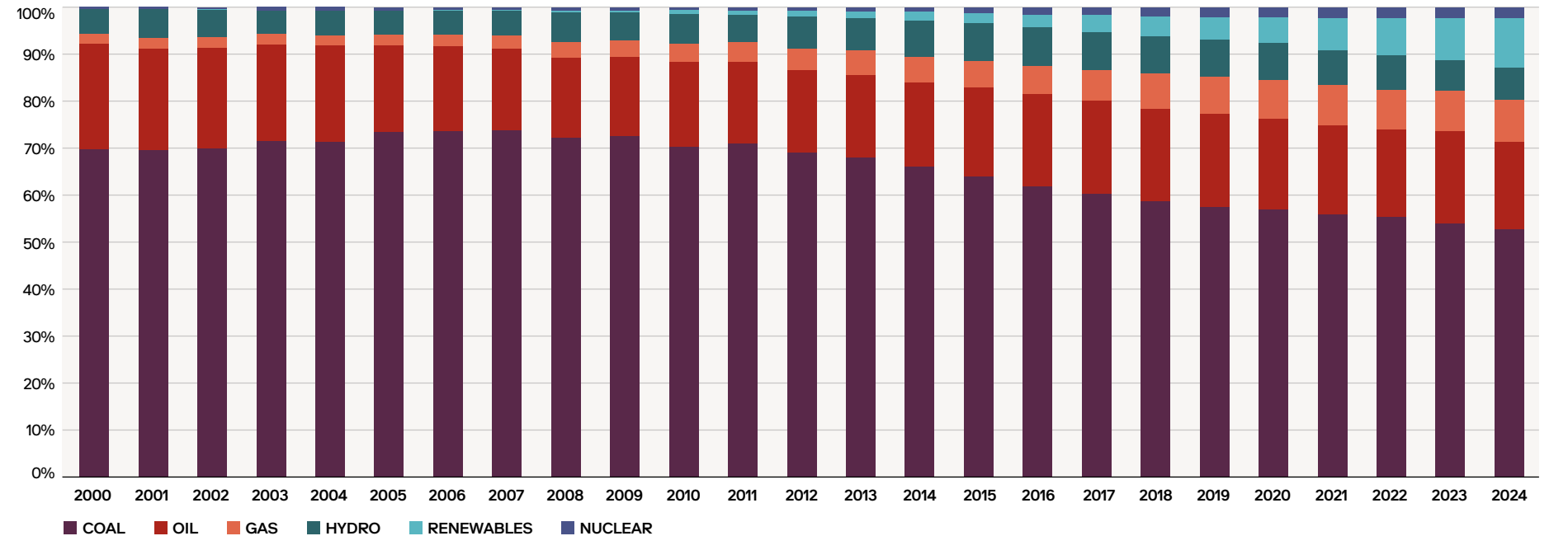
wind and installed solar capacity. Translating these ambitions into implementation, the 15th Five Year Plan—China's economic and industrial blueprint for 2026 - 2030—outlines a comprehensive build-out of a new energy system, with quantitative targets spanning hydropower, wind, nuclear, and grid infrastructure. While China's near-term pathway may not yet be fully aligned with 2050 net-zero trajectories, the sheer scale of clean-energy deployment—both domestically and through equipment exports—has already positioned China as one of the most consequential actors in the global energy transition. As a result, assessing China's role in decarbonization requires looking beyond national targets to real-economy outcomes at home and abroad.

CHINA'S YEAR-ON-YEAR CHANGES IN EMISSIONS IN 2025 VARIED ACROSS INDUSTRIES



Source: CarbonBrief

COAL'S SHARE OF CHINA'S ENERGY CONSUMPTION HAS DECLINED IN RECENT YEARS WHILE RENEWABLES AND NUCLEAR ARE ON THE RISE.



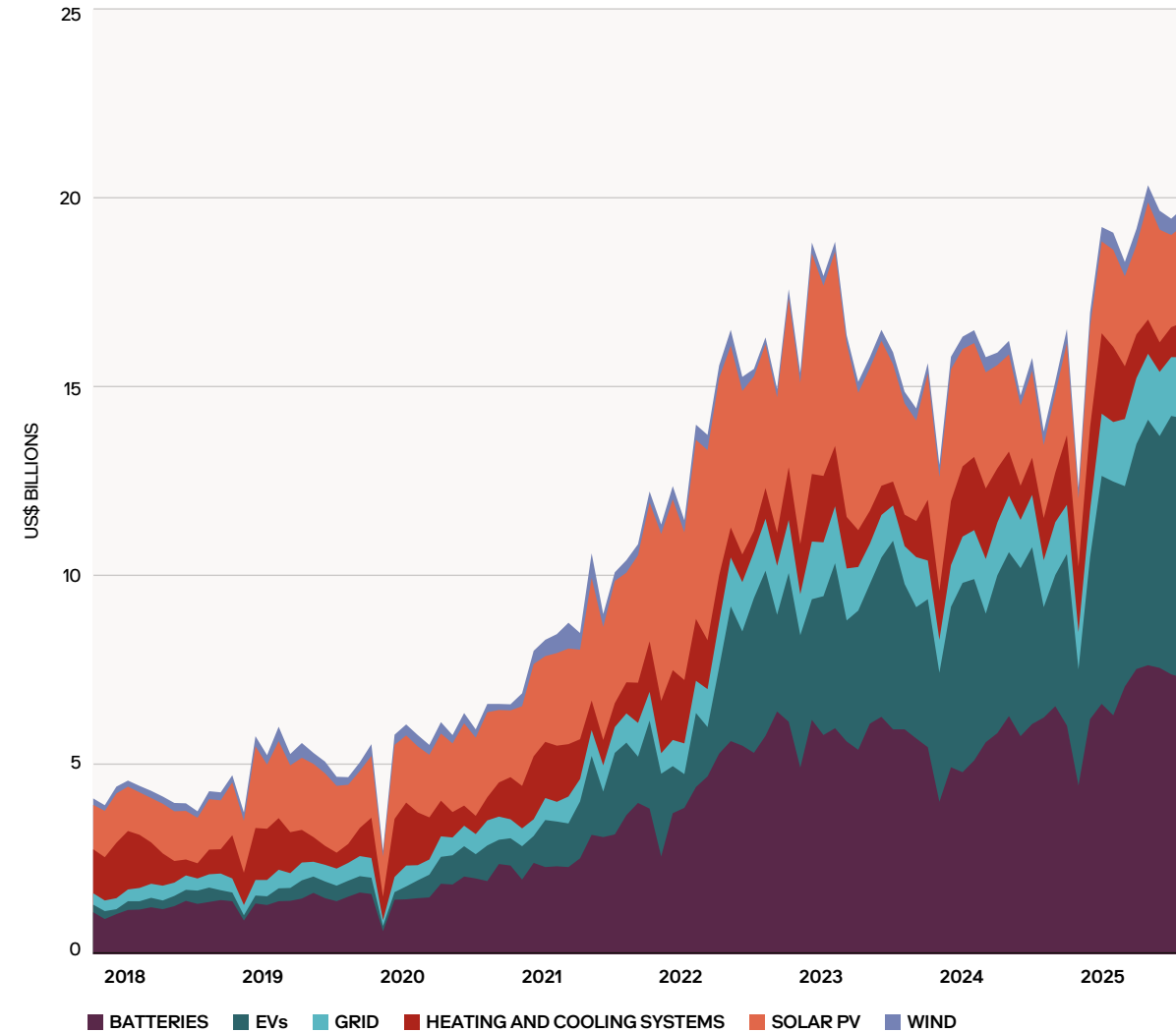
Source: Energy Institute- Statistical Review of World Energy (2025)

EXPANDING EXPORTS

China is also contributing to the energy transition abroad. It produces over 80% of the world’s wind turbines, solar panels, and batteries. In 2025, clean-technology exports surpassed \$20 billion, with batteries and electric vehicles leading the way and solar exports contributing a growing portion. These clean-energy exports were estimated to have avoided around 4 billion tons of CO₂ globally in 2024, which equated to approximately a third of China’s total emissions in 2025, primarily driven by solar exports and projects.

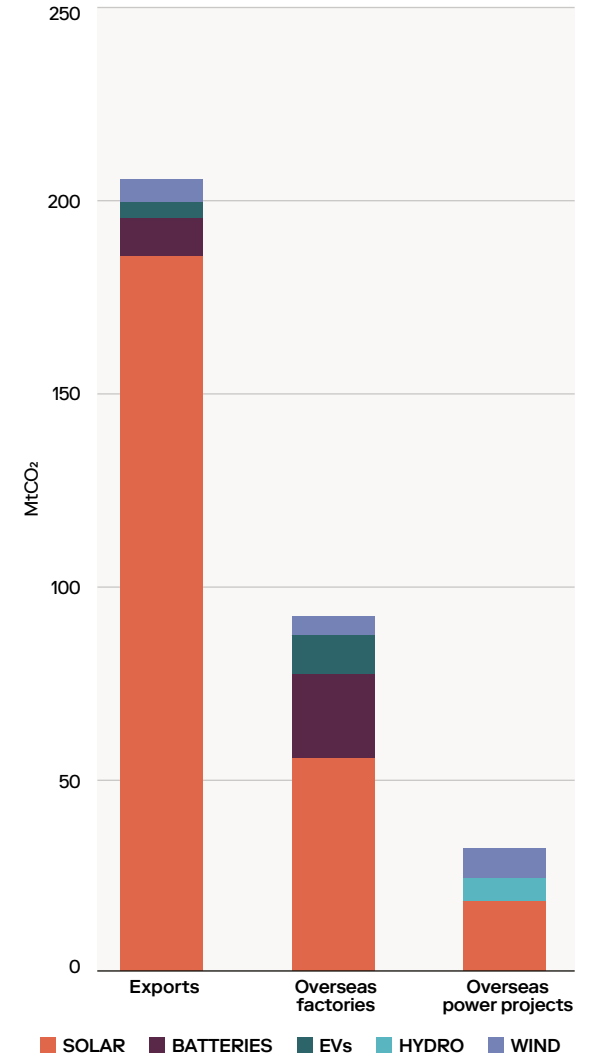
As the price of clean technologies continues to fall, demand is picking up in new markets. More than half of the growth in China’s EV exports in 2025 came from outside the OECD. For emerging and developing economies, these Chinese exports have helped to expedite the transition, with clean-energy technology exports in 2024 leading to a 1% reduction in global emissions outside China. With continued supportive policy, China is likely to maintain its competitive advantage as the top clean-tech producer and exporter.

CHINA'S CLEAN TECH EXPORTS SURPASSED \$20 BILLION IN 2025, DRIVEN BY EVs AND BATTERIES



Source: Ember

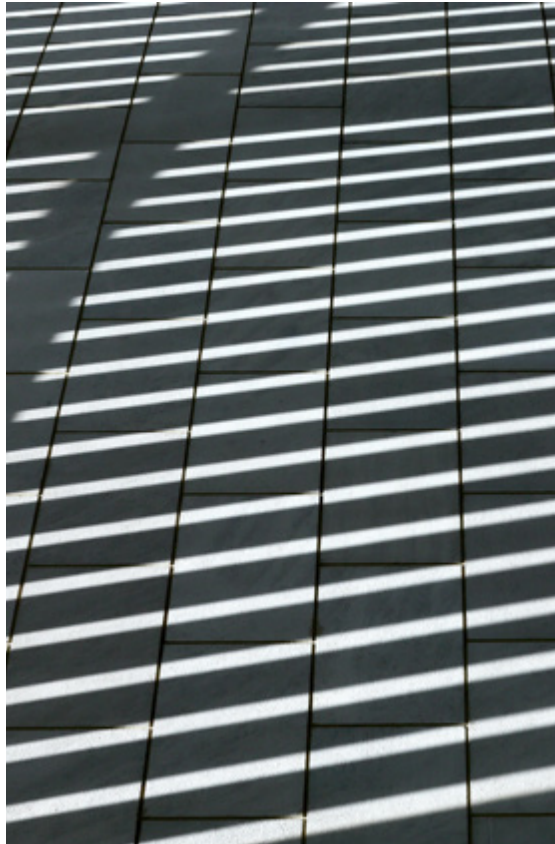
OVERSEAS AVOIDED EMISSIONS FROM CHINA'S CLEAN-ENERGY EXPORTS



Source: CarbonBrief: MtCO₂ emissions avoided overseas as a result of China's clean-technology exports in 2024 and investments in 2023 - 2024 broken down by technology and type of activity.

COMPANY SPOTLIGHT

With the acceleration of climate frameworks and policy, investable decarbonization opportunities exist through climate technology. Opposite are a few case studies showcasing different companies contributing to China's transition. SICC and Envicool lower the carbon-emissions intensity of data centers, while industry consolidation in China's solar industry may begin to clear excess capacity over time.

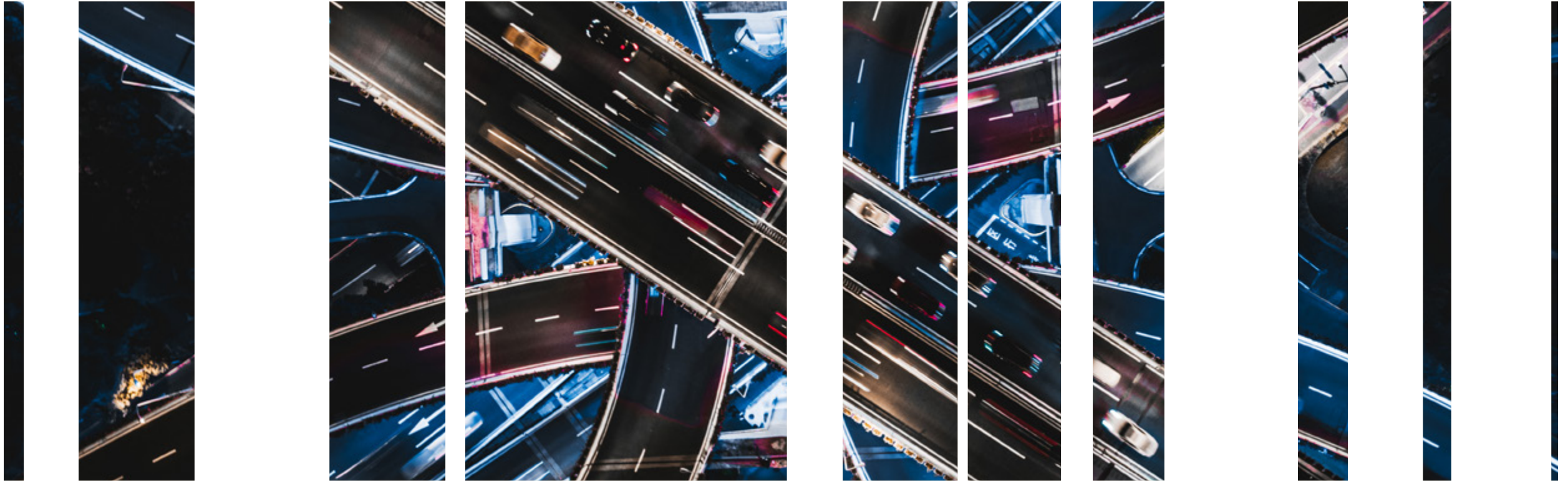


CASE STUDIES

	SICC	ENVICOOL	TONGWEI
Company profile	SICC is a top-three global silicon carbide (SiC) substrate manufacturer with ~17% global market share and recognized technology leadership. Overseas markets account for ~50% of revenue, with the company joining SBTi in 2024 to meet European customer climate requirements.	Envicool is a leading provider of precision cooling and thermal management solutions for data centers, telecom networks, and energy-storage systems. The company is a validated NVIDIA MGX ecosystem partner and serves hyperscale customers including ByteDance, Tencent, and Alibaba.	Tongwei is a global leader in the photovoltaic value chain, ranking No.1 in high-purity crystalline silicon supply and solar-cell shipments. Its vertically integrated manufacturing model spans upstream polysilicon through downstream cell production.
Decarbonization product offering	SiC enables higher energy efficiency and thermal performance in power electronics, particularly for EVs and data centers, compared with traditional silicon. Applications include motor-drive energy-loss reductions of 70 - 90% and data-center SiC-based PSUs delivering higher power density with lower energy loss and cooling demand.	Liquid cooling solutions provide superior heat transfer compared with air cooling, improving energy efficiency by an order of magnitude. These systems enable stable operation at high power densities while reducing PUE and total cost of ownership.	The company's scale and integration support cost-competitive solar module production, enabling large-scale renewable deployment. Tongwei's manufacturing capacity exceeded 80 GW in 2024, significantly above annual PV installations in the U.S. (~36 GW) and India (~25 GW).
Recent trend/ catalyst	AI-driven data-center infrastructure is accelerating demand for SiC, supported by NVIDIA's shift toward higher-voltage architectures. As rack power density rises, SiC adoption enables higher efficiency, lower heat, and improved system reliability.	Rising AI workloads are driving megawatt-scale rack power densities, accelerating the shift toward liquid-cooling architectures. As AI data centers move beyond air-cooling limits, Envicool is well positioned to capture growing adoption across hyperscale and telecom applications.	Industry consolidation continues, highlighted by Tongwei's acquisition of Lihao Qingneng, a top-10 polysilicon producer. This acquisition is expected to accelerate capacity exits, increase upstream concentration, and support a more disciplined pricing environment.

Policy: Setting the Pace

How are specific governmental initiatives shaping both the direction and pace of the climate transition, and how do differences in policy design and implementation across regions influence technology deployment and sectoral decarbonization outcomes?

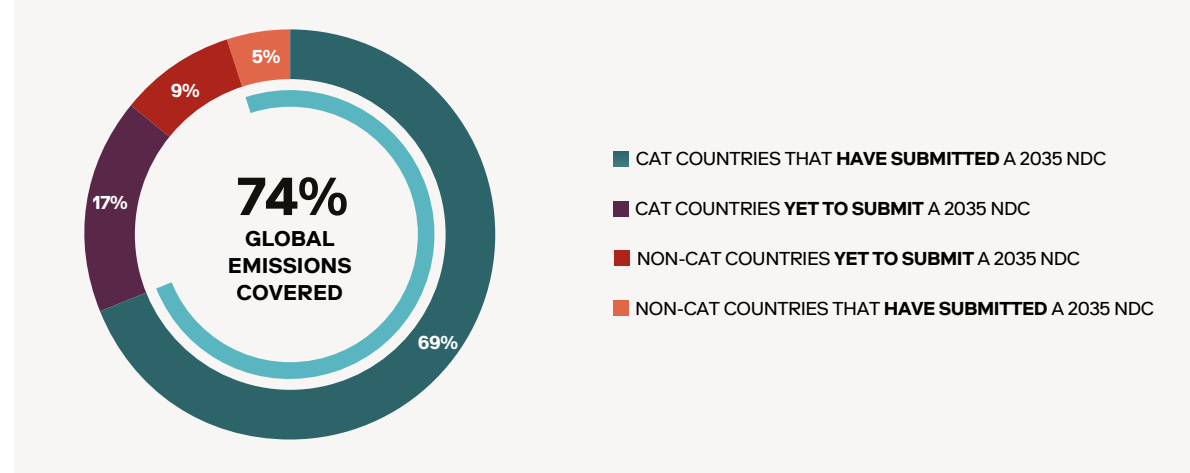


2035 NDC TARGETS: PROGRESS BUT NOT PERFECTION

Like China, other countries are also updating their climate policies and have submitted their latest rounds of Nationally Determined Contributions (NDCs). Under the Paris Agreement’s NDC 3.0 cycle, countries were required to submit updated climate plans in 2025, extending mitigation targets through 2035 and reflecting the outcomes of the first Global Stocktake. These 2035 NDCs cover approximately 74% of global emissions but this represents only 53 of the countries Climate Action Tracker (CAT) assesses out of 105 countries worldwide.

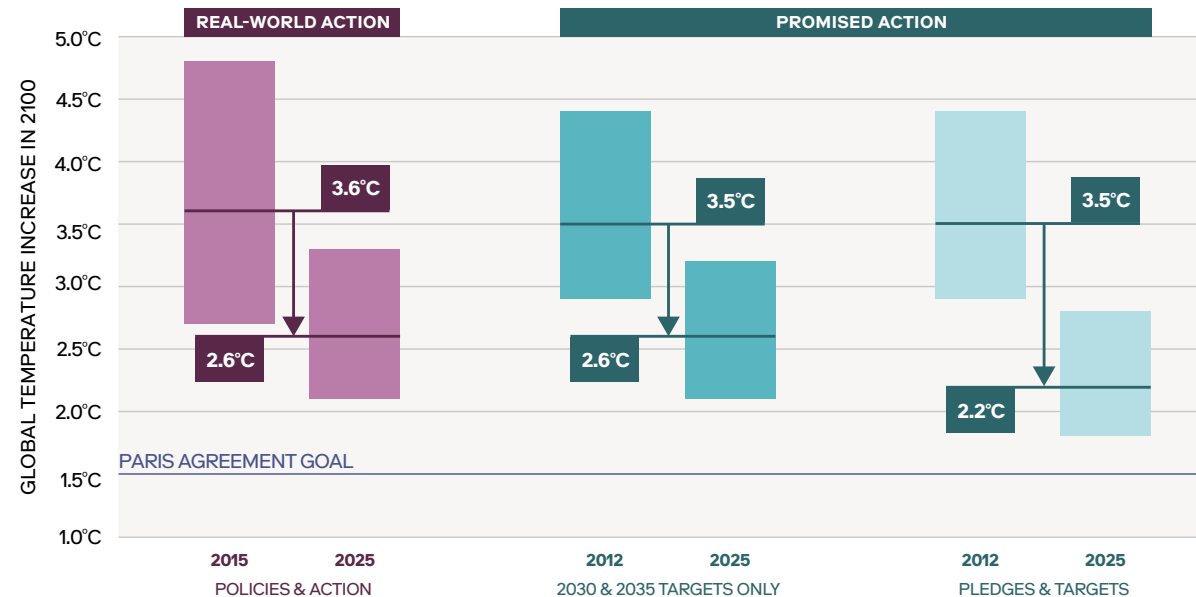
Where NDCs have been submitted, several common features are emerging. First, many governments have reaffirmed long-term net-zero ambitions while deferring more stringent policy action to the post-2030 period, reflecting domestic political and fiscal constraints. Second, few submissions meaningfully strengthen 2030 targets relative to prior commitments, despite Global Stocktake findings that current policies imply a warming trajectory above 2°C by the end of the century. While there has been a decline in the estimated temperature rise in 2100 since the Paris Agreement, the 2030 and 2035 targets scenario remained the same as last year, which suggests that the 2035 NDCs have not moved the needle much.

While NDCs remain a critical reference point for long-term transition alignment, their limited near-term ambition reduces their effectiveness as a driver of capital reallocation in the 2025 - 2030 window. As investors, seeking countries with credible near or long-term ambitions supported by policy action helps to indicate areas of transition opportunity. Countries with a wider implementation and target gap between their NDCs and climate policy may indicate higher risk for transition investments.



Source: Climate Action Tracker

ACROSS SCENARIOS, CAT ESTIMATES ARE SHOWING IMPROVEMENT IN OVERALL PROGRESS SINCE THE PARIS AGREEMENT



Source: Climate Action Tracker

COP30: AMBITIONS VS. RESULTS

This gap between ambition and results is also observed across collective climate action, including the 2025 COP30 summit hosted in Brazil. Progress was made on adaptation, nature, and inclusion, including political commitments to scale adaptation finance, advances on forest conservation, and the launch of a Just Transition Mechanism. These outcomes, while largely non binding, point to areas where policy frameworks may increasingly support capital deployment, particularly in resilience, adaptation, and nature-linked assets. However, COP30 fell short on emissions reduction, with no fossil-fuel phase-out roadmap, limited mitigation ambition in updated national targets, and continued misalignment with 1.5°C pathways, leaving global temperature trajectories broadly unchanged.

For investors, the key takeaway is that COP outcomes are becoming less determinative than real-economy execution. The summit underscored widening dispersion across regions and sectors, driven by infrastructure readiness, technology deployment, and policy credibility rather than global consensus. As diplomacy struggles to close the ambition-implementation gap, transition outcomes will increasingly be shaped by sector-level delivery—across grids, industry, transport, and resilience—heightening the importance of selective capital allocation, active stewardship, and a focus on where policy, infrastructure, and scalable technologies converge.

POLICY IN ACTION: THE EU CARBON BORDER ADJUSTMENT MECHANISM (CBAM)

The European Union's Carbon Border Adjustment Mechanism represents one of the most concrete attempts to translate climate ambition into enforceable policy. This policy serves two main objectives: to help mitigate the competitive disadvantage currently faced by European producers and to ensure that a carbon price is paid on all carbon imports. Initially this adjustment will apply to the cement, aluminum, fertilizers, iron and steel, chemicals, and electricity sectors. CBAM became effective on January 1, 2026, and is expected to have an impact on reductions and trade.

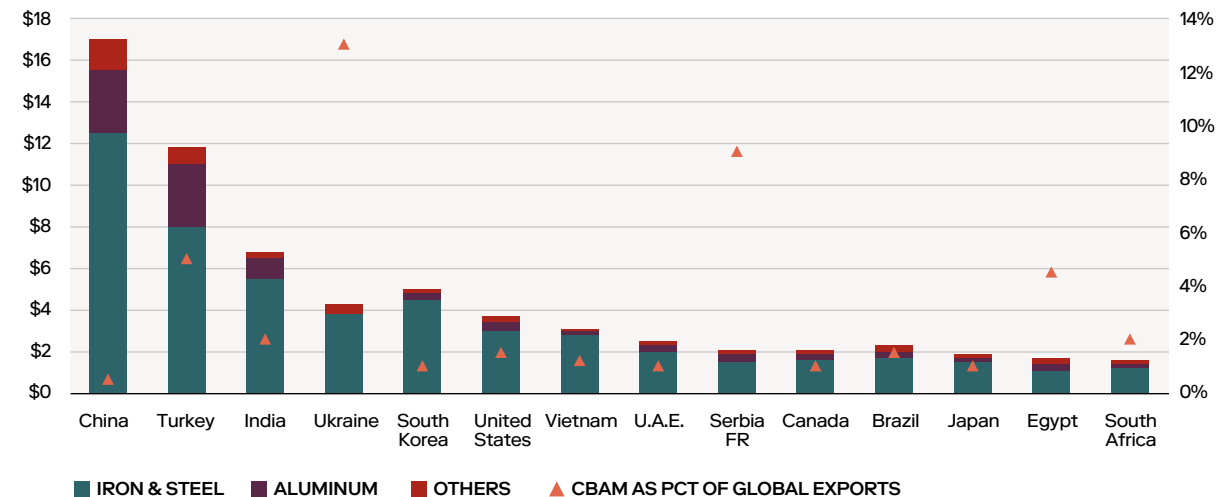
China, India and Turkey are among the countries expected to be most heavily impacted by this carbon pricing. While CBAM has received some push-back from its trade partners, this is part of a growing regulatory trend in global compliance carbon-pricing markets being proposed or adopted. Approximately 28% of global carbon emissions are now covered under carbon-pricing schemes. Some industry experts expect this trend to continue as countries use it both as a tool for addressing climate change as well as their economic and security objectives.

Sectoral impacts vary significantly: fertilizers are projected to see the steepest decline in imports (up to 26%) due to high embedded emissions and limited decarbonization options, while aluminum faces a more modest contraction (~4%) as cleaner production methods offer a competitive edge. The steel sector, which is the most exposed in trade volume and emissions, is expected to undergo a major transformation, with cost increases of up to 50% for high-carbon exporters like India and China by 2034. To mitigate this cost, trade flows may be re-routed with lower-emissions steel prioritized to Europe and more

carbon-intensive steel generated using blast furnaces routed to the rest of the world. CBAM is thus catalyzing a global reorientation of supply chains toward lower-carbon production, with significant implications for competitiveness, trade flows, and climate diplomacy.

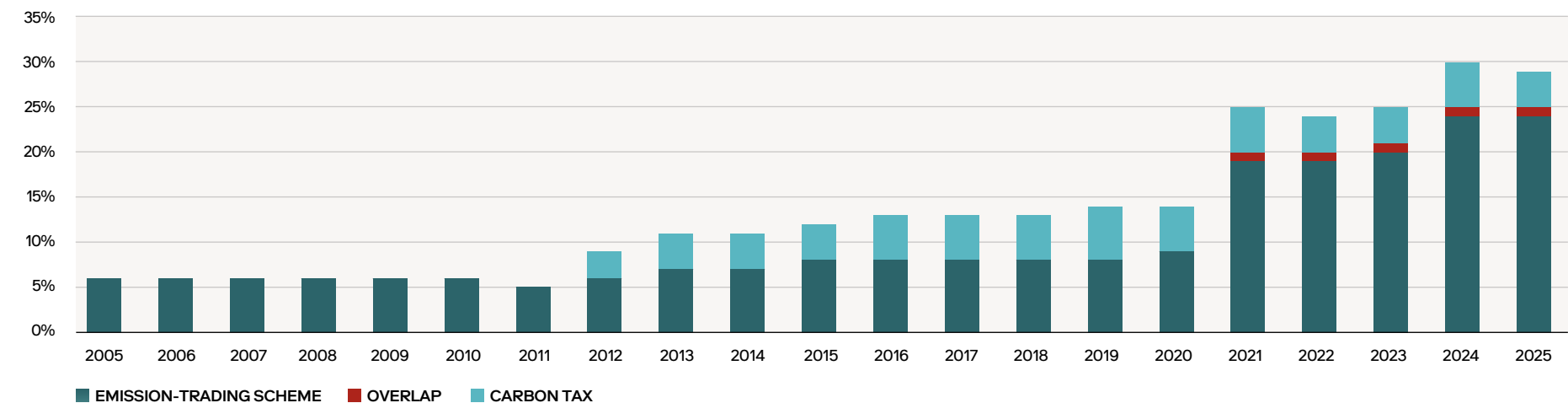
That said, the mechanism also introduces new sources of uncertainty for investors. Compliance costs, data-quality requirements, and the potential expansion of CBAM to additional sectors beyond 2026 create both transition risks and relative value opportunities, particularly for producers with lower embedded emissions or access to cleaner energy inputs.

U.S.\$BN OF E.U. CBAM-COVERED EXPORTS TO E.U., 2024



Source: GoldmanSachs

GLOBAL COMPLIANCE CARBON-PRICING SCHEMES COVER 28% OF GLOBAL EMISSIONS AS OF 2025



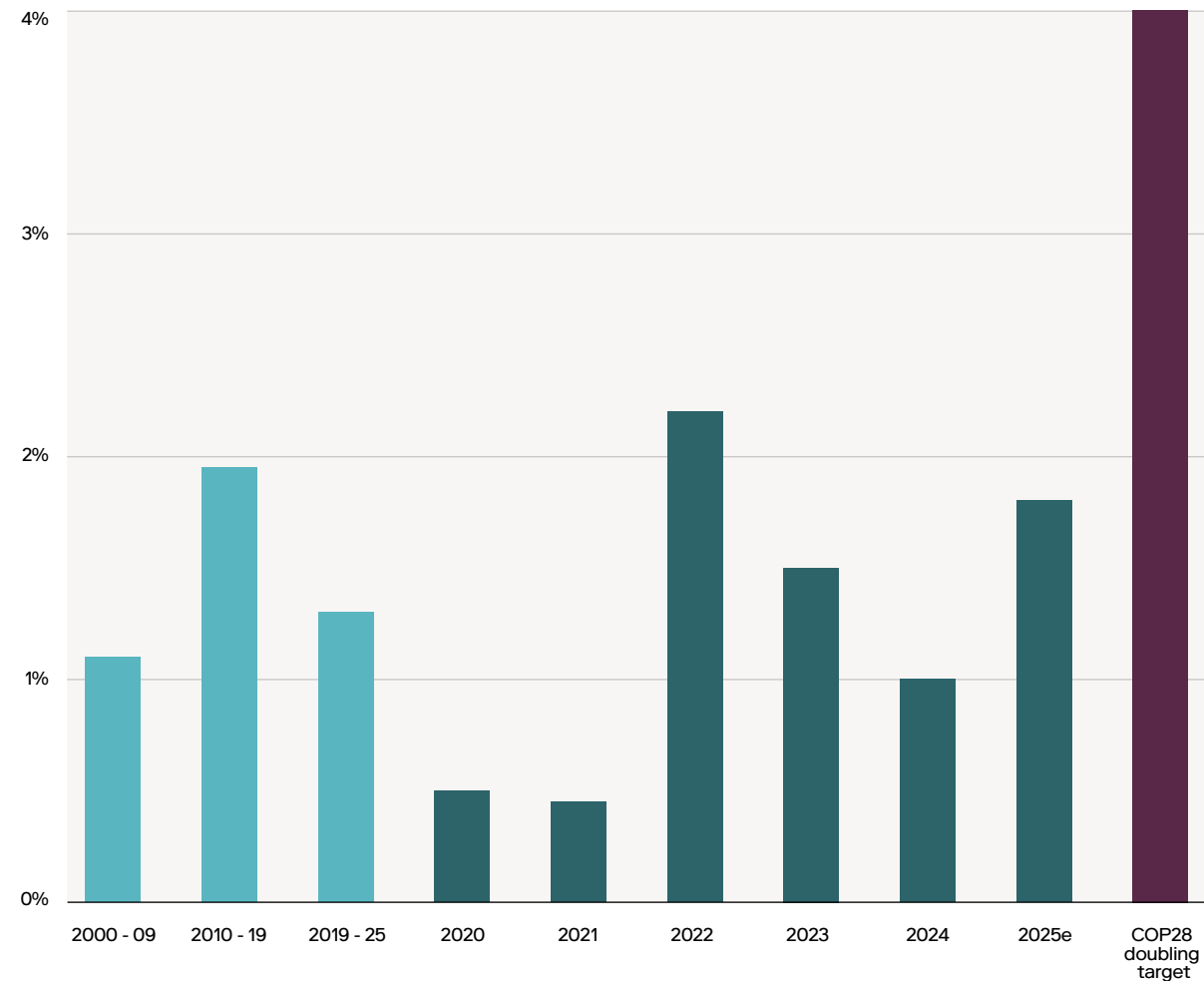
Source: GoldmanSachs

INDUSTRIAL EFFICIENCY AND PROCESS OPTIMIZATION

While policies like CBAM remain more difficult from a regulatory perspective, policies across the globe remain supportive and have highlighted the importance and potential tailwinds for companies implementing efficiency solutions, particularly for the industrials sector. Industrial efficiency remains one of the most scalable and economically attractive levers for near-term emissions reduction. A recent IEA study has found that energy-management systems within both light and heavy industry can on average result in 11% energy savings in the first few years. Regional policies—including those enacted by the E.U., China, India, and the U.S.—have helped to encourage the uptake of formal energy-efficiency certification. According to the International Energy Agency, global energy-efficiency improvements are projected to reach around 1.8% in 2025, up from roughly 1% in 2024. While still behind the COP28 doubling target, this represents notable progress.

Global investment in energy efficiency reached approximately \$660 billion in 2024, with modest growth expected in 2025, although nearly 90% of spending is concentrated in China and advanced economies. Some industrial sectors—particularly, steel, cement, and chemicals—continue to face constraints related to capital intensity and long asset lifetimes, slowing the deployment of the best-available efficiency technologies. However, battery storage, heat pumps, and HVAC technology represent key efficiency measures across advanced and emerging economies. The continued interest and feasibility in this area of the transition presents an opportunity for investors as other areas see a pullback in the decarbonization progress.

GLOBAL PRIMARY ENERGY INTENSITY IMPROVEMENT, 2000 - 2025e



Source: IEA



COMPANY SPOTLIGHT

CASE STUDY: LEADER

COMPANY: TRANE TECHNOLOGIES

CURRENT STATUS: ALIGNED

INDICATOR	ANALYST-ADJUSTED SCORE (1 - 5)	SCORE BREAKDOWN
1. Long-term ambition	5	SBTi-validated target to reach net-zero GHG emissions across value chain by 2050.
2. Short- and medium-term targets	5	SBTi-validated target to reduce 50% Scope 1 and 2 goal by 2030, as well as gigaton challenge focused on Scope 3.
3. Emissions performance	3	Reduction across Scope 1, Scope 2 and disclosed Scope 3 emissions over the past three years.
4. Disclosures	4	Disclose Scope 1 and Scope 2 emissions, and Scope 3 Category 1 and 11.
5. Decarbonization strategy	3	Outlines 2050 Net-Zero Roadmap across Scope 1, 2 and 3, highlighting primary levers for emissions reduction.
6. Capital allocation	4	Material sustainable capex, investing in sustainable solutions including electrification of heat and refrigerated transport.
TOTAL SCORE	24	ALIGNED

Trane Technologies continues to demonstrate comparatively strong net-zero momentum, supported by clear medium-term targets, improving emissions performance, and capital allocation that is closely aligned with its core business strategy. The company’s focus on electrification, energy efficiency, and low-global-warming-potential HVAC solutions positions it well within a transition pathway that emphasizes commercially viable decarbonization levers. From an alignment perspective, progress is underpinned less by reliance on nascent technologies and more by scaling proven solutions, giving investors greater visibility into near-term delivery amid tightening policy and customer efficiency requirements. Trane’s technologies and solutions help to reduce the energy consumption of its buildings and transport, both of which are significant contributors to global emissions. Thus far, these solutions have avoided 237 million metric tons of CO₂e cumulatively since 2019. The decarbonization efforts from its own operations—as well as its innovation to help reduce value-chain emissions—mark Trane Technologies as a leader in the net-zero transition.



COMPANY SPOTLIGHT

CASE STUDY: LAGGARD

COMPANY: COMMERZBANK | CURRENT STATUS: COMMITTED TO ALIGNING

INDICATOR	ANALYST-ADJUSTED SCORE (1 - 5)	SCORE BREAKDOWN
1. Long-term ambition	3	Aim to reduce emissions to net zero for banking operations by 2040 and loan investment portfolio by 2050.
2. Short- and medium-term targets	4	SBTi-validated 2030 emissions-reduction target across high-emitting sectors.
3. Emissions performance	2	Material high-emitting sectors projected to align with a 1.5°C-scenario by 2030.
4. Disclosures	5	Disclose Scope 1, 2 and 3 emissions including category 15.
5. Decarbonization strategy	1	Target lending towards sustainable solutions not material to the company's operations.
6. Capital allocation	2	Expected coal phase-out by 2038, and does not support new construction of coal mines.
TOTAL SCORE	17	COMMITTED TO ALIGNING

Commerzbank's net-zero alignment reflects the broader dynamics facing the financial sector, particularly the influence regulation and policy can have on a corporate's ability to decarbonize. While the bank has articulated climate commitments, forward alignment remains closely tied to client transition pathways and lending decisions, introducing greater sensitivity to macroeconomic conditions. To align with German policy that has moved toward greater reliance on fossil fuels, Commerzbank has extended its coal phase-out to 2038 and no longer requires its clients to have transition plans for coal by 2025. While the company does not anticipate their coal exposure to increase, this change in strategy highlights how policy can play a key role in helping or hindering a company's transition.



Conclusion: Using Investor Leverage to Navigate an Uneven Transition

2025 underscores that the low-carbon transition is no longer a uniform policy-led pathway but an uneven investment landscape shaped by execution risk, capital intensity, and growing dispersion across sectors and regions. For investors, the central challenge is how to navigate transition uncertainty, identify where progress is likely to materialize, and manage downside risks where momentum stalls.

Capital Allocation

Capital allocation remains the most immediate way investors can express conviction about where the transition is likely to succeed or struggle. Tilting new capital toward transition-enabling assets and issuers allows portfolios to increase exposure to areas where deployment, policy support, and economics are converging, while reducing reliance on assumptions of broader system-wide decarbonization. This includes assets linked to clean power, grids, electrification, efficiency, and select industrial transition pathways where execution visibility is improving.

Importantly, this is not a binary allocation between 'green' and 'brown' but a forward-looking assessment of which business models are positioned to remain competitive as the transition unfolds. Tools such as Neuberger's Net-Zero Alignment Indicator help to identify companies as they advance their transition plans, while understanding the risks for companies whose transitions may be delayed by technological limitations.

Stewardship and Governance

As dispersion widens, stewardship increasingly serves as a tool for information gathering, risk signaling, and escalation. Engagement focused on the credibility of transition plans—particularly the linkage between strategy, capital expenditure, and financing—helps investors assess whether stated ambitions are likely to translate into durable performance or remain vulnerable to reversal.

Governance mechanisms, including discussions around incentive structures tied to credible transition KPIs, can provide insight into management priorities and execution discipline.

Beyond the firm level, engagement on supply-chain exposure, just transition considerations, and dependency on upstream or downstream constraints helps investors better understand hidden sources of transition risk. Similarly, emphasis on data quality—through ISSB-aligned

reporting, third-party assurance, and more granular Scope 3 disclosures—supports comparability and reduces the risk of mispricing transition exposure due to inconsistent or low-confidence data.

Portfolio Construction and Risk Management

Portfolio construction translates transition views into measurable time-bound risk frameworks. Setting portfolio-level interim targets, particularly with a 2030 horizon, allows investors to monitor progress without relying solely on long-dated net-zero commitments. When paired with sector-specific pathways and outcome-based metrics, these targets function as early warning signals rather than fixed endpoints.

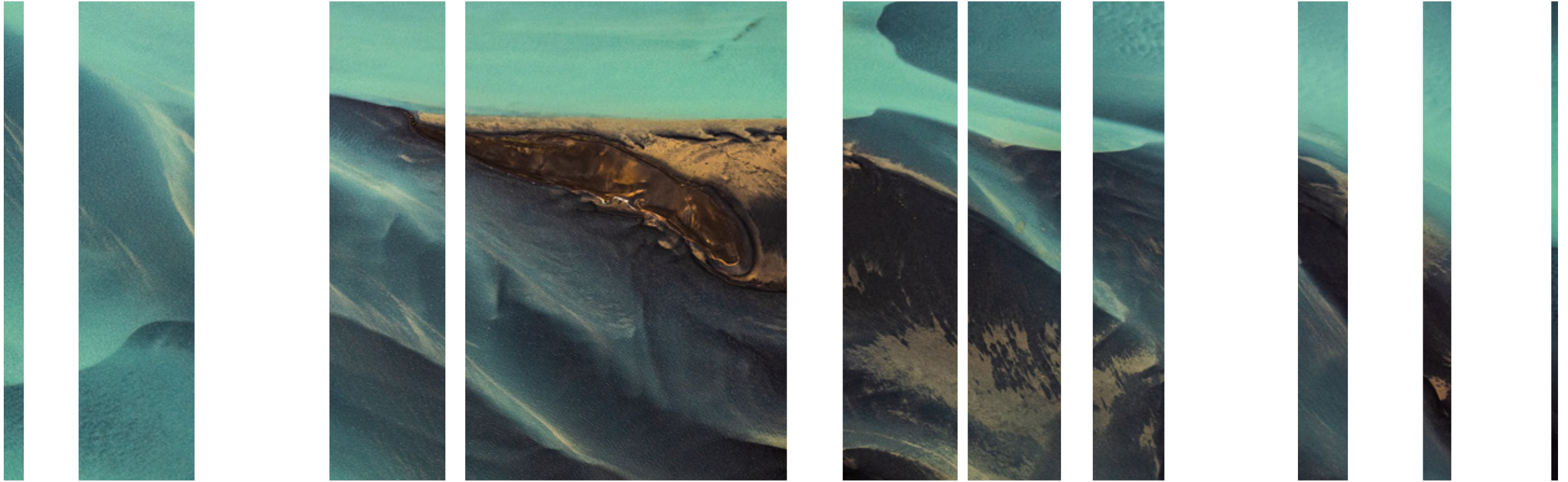
Pure divest-to-decarbonize approaches continue to face limitations as a risk-management strategy. While divestment can reduce reported emissions, it may increase exposure to transition uncertainty by eliminating engagement optionality and concentrating portfolios in narrower opportunity sets. A more robust approach retains exposure where risk/reward remains attractive, while applying time-bound triggers and escalation frameworks to reassess positions as execution risks evolve.

Navigating an Uneven Transition

Taken together, these levers allow investors to navigate the transition as a dynamic path-dependent process rather than a linear glidepath. The central investment question is increasingly where capital, policy, and technology are likely to align, and where structural constraints, financing gaps, or governance weaknesses may persist. As the transition progresses, investors who deploy these levers deliberately are better positioned to manage downside risk, capture selective upside, and adapt portfolios as transition pathways continue to diverge.



Appendix



DECARBONIZATION DASHBOARD Underlying data

METRICS	2022	2023	2024	2025	INDICATOR	SOURCE
Emissions Outcomes						
Global greenhouse-gas emissions (bn tonnes CO ₂)	53.52	54.09	54.43	55.03*	Decelerating decarbonization	Greenhouse gas emissions - Our World in Data Global Carbon Budget 2025- CSIRO
<i>YoY change</i>	1.6%	1.1%	0.6%	1.1%		
Projected 2030 emissions (current policies)	58	56	57	58	Decelerating decarbonization	UN Emissions Gap Report 2022 UN Emissions Gap Report 2023 UN Emissions Gap Report 2024 UN Emissions Gap Report 2025
Emissions gap with below 2°C-scenario	17	15	17	17		
<i>YoY change</i>	5.5%	-3.4%	1.8%	1.8%		
Climate Consequences						
Global economic losses from natural disasters (\$bn)	376	412	397	260	Neutral	AON 2026 Climate and Catastrophe Report
21 st century average						
<i>YoY change</i>	-11.7%	8.7%	-3.8%	-52.7%		
Avg global temperature anomaly (land and ocean) in degrees Celsius	0.9	1.19	1.29	1.13	Decelerating decarbonization	Climate at a Glance Global Time Series National Centers for Environmental Information (NCEI) (noaa.gov)
<i>YoY change</i>	3.3%	24.4%	7.8%	-14.2%		
Structural Drivers						
Global energy demand growth	Average of 2013 to 2023 ->	1.3%	2.2%	4.5%	Decelerating decarbonization	Global Energy Trends: Clean Energy Growth and Rising Demand World Resources Institute
<i>YoY change</i>			40.9%	51.1%		
Global coal consumption (Mt)	8,483	8,678	8,806	8,845*	Decelerating decarbonization	Global coal consumption, 2000-2030 – Charts – Data & Statistics - IEA
<i>YoY change</i>	4.7%	2.2%	1.5%	0.4%		
Oil and gas consumption (TWh)	93,621.76	94,989.90	96,570.35	97,370.18*	Decelerating decarbonization	Global direct primary energy consumption IEA Oil Market Report July 2025 IEA 2026 Q1 2026 Report
<i>YoY change</i>	1.7%	1.4%	1.6%	0.8%		
Annual GDP per capita (\$US in thousands)	13.06	13.51	13.90	14.61	N/A	World Economic Outlook (October 2025) - GDP per capita, current prices
<i>YoY change</i>	3.2%	3.3%	2.8%	4.9%		
Energy intensity (kWh)	1.30	1.28	1.27	1.24	Accelerating decarbonization	Our World in Data - Energy Intensity IEA Energy Efficiency 2025
<i>YoY change</i>	-1.5%	-1.5%	-1.1%	-1.8%		
Population	8,021,407,196	8,091,734,933	8,161,972,572	8,231,613,070	N/A	World population by year - Worldometer
<i>YoY change</i>	0.8%	0.9%	0.9%	0.8%		
Enabling Conditions						
Average carbon price	22.00	20.00	19.00	19.00	Neutral	State and Trends of Carbon Pricing 2025
<i>YoY change</i>	40.9%	-10.0%	-5.3%	0.0%		
Adoption of ISSB transition plans (countries adopted or planning to adopt)	<i>Launched in 2023</i>	10	36	37	Accelerating decarbonization	June 2025 – Where does the world stand on ISSB adoption? S&P Global Adoption Status ISSB Standards
<i>YoY change</i>		100.0%	72.2%	2.7%		

* Estimated

Clean energy capex (\$ bn)	1630	1871	2033	2154	Accelerating decarbonization	Executive summary – World Energy Investment 2025 – Analysis - IEA
<i>YoY change</i>	14.5%	12.9%	8.0%	5.6%		
Relative WACC	1.02	1.02	1.02	1.04	Neutral	Historical and future projected costs of capital for ten energy technologies across 176 countries Scientific Data
<i>YoY change</i>	-1.1%	-0.1%	0.3%	1.8%		
Wind and solar global average WACC	13.87	13.54	13.34	12.82		
<i>YoY change</i>	30.0%	-2.5%	-1.5%	-4.0%		
Gas global average WACC	13.59	13.27	13.04	12.31		
<i>YoY change</i>	30.8%	-2.4%	-1.8%	-5.9%		
Deployment and Substitution						
Renewable electricity generation share (%)	29.45%	30.26%	31.82%	34.30%**	Accelerating decarbonization	IEA Share of Renewable Electricity Generation IEA Renewables 2025 Ember Energy Mid 2025
<i>YoY change</i>	4.6%	2.7%	4.9%	7.2%		
Operational carbon capture (Mt CO ₂ per Q1 of each year)		47.4	50.5	50.9	Neutral	CCUS projects around the world are reaching new milestones – Analysis - IEA
Acceleration needed to stay on track for NZE scenario			100-120x			
<i>YoY change</i>			6.1%	0.8%		
Technology-readiness levels (% of technologies at Early Adoption/Market Uptake stage or higher)	34%	38%	41%	2025 not yet available	Accelerating decarbonization	ETP Clean Energy Technology Guide – Data Tools - IEA
<i>YoY change</i>	9.4%	10.6%	6.6%			
Electric vehicles % of sales share	14%	18%	20%	25%*	Accelerating decarbonization	Trends in electric car markets – Global EV Outlook 2025 – Analysis - IEA
<i>YoY change</i>	71.4%	22.2%	9.5%	20.4%		
SAF production (as % of global fuel use)	0.1%	0.2%	0.3%	0.6%*	Accelerating decarbonization	Net zero 2050: sustainable aviation fuels (SAF)
<i>YoY change</i>		50.0%	33.3%	50.0%		

* Estimated

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