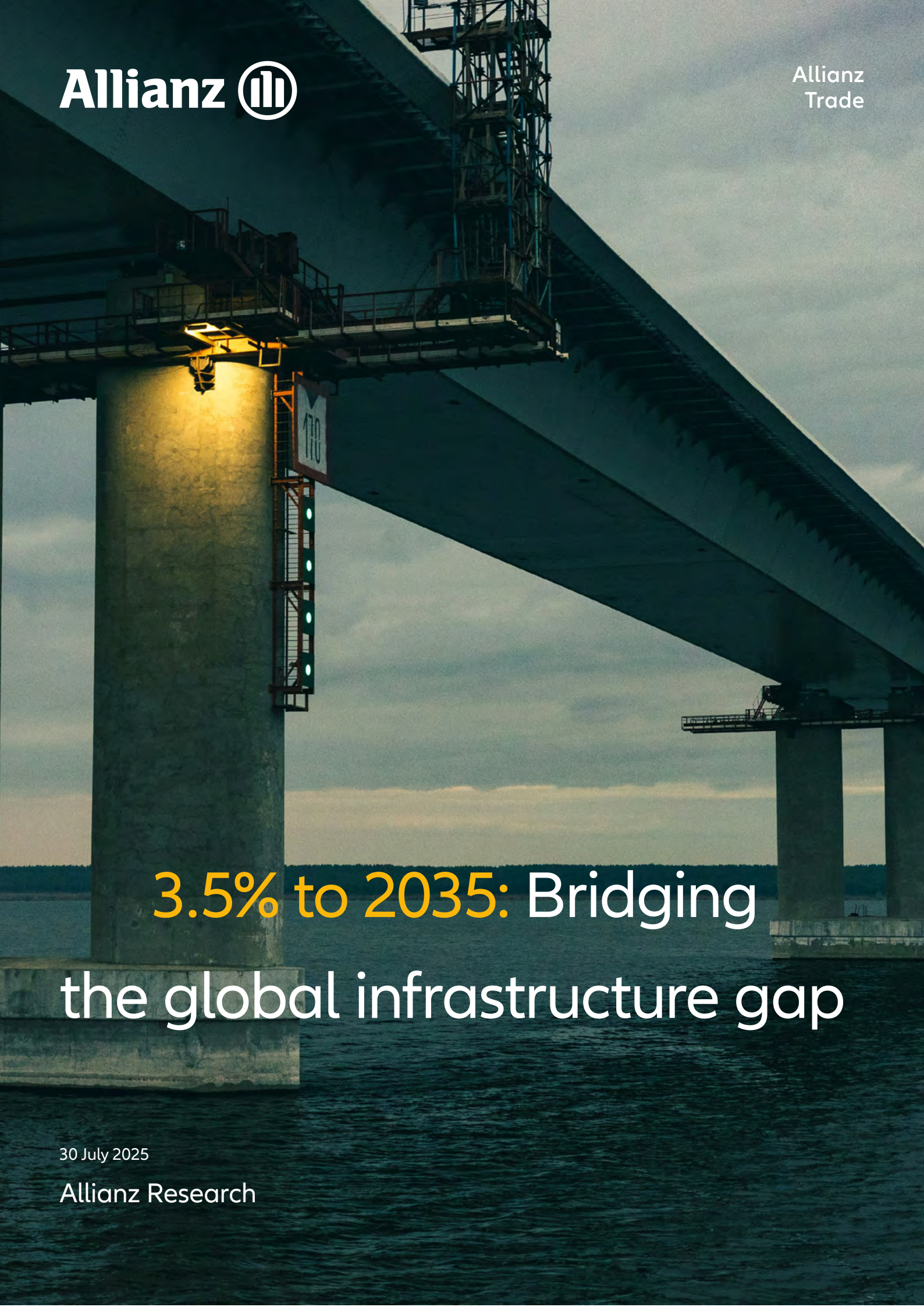

Allianz Trade

# 3.5% to 2035: Bridging the global infrastructure gap

30 July 2025

Allianz Research

# Content

# Executive Summary


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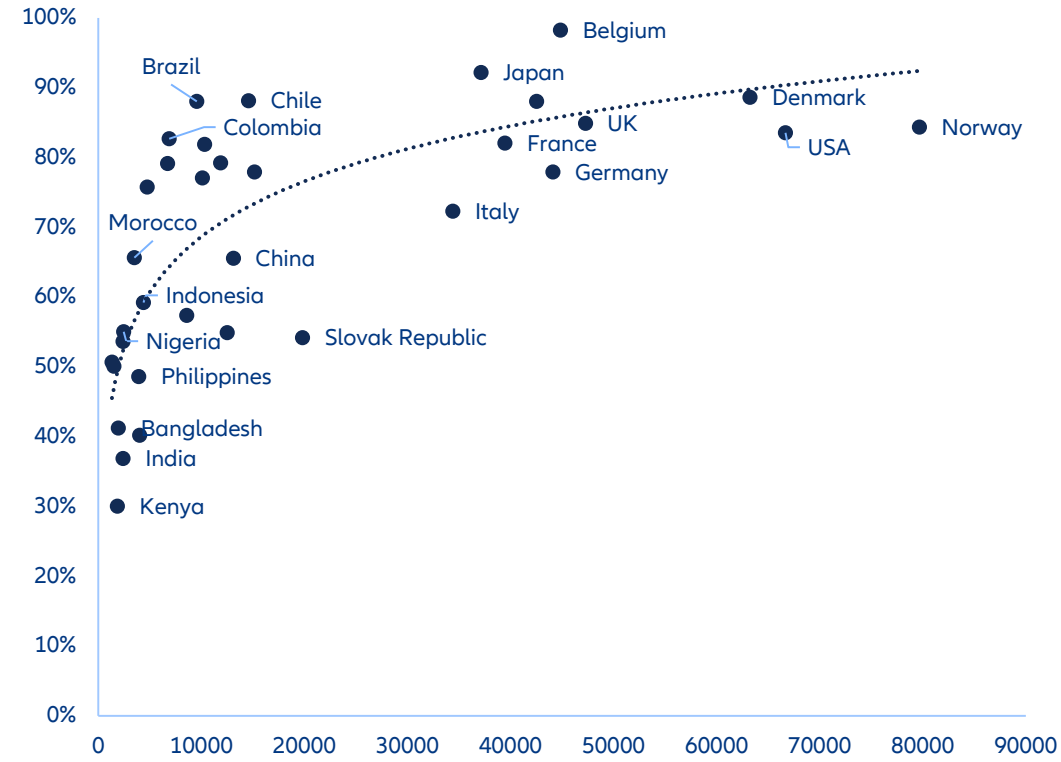
- **Over the next decade, the global economy will need to invest nearly 3.5% of GDP per year (USD 4.2trn) to future-proof social, transport, energy and digital infrastructure against megatrends such as urbanization, supply-chain disruptions and AI-driven digitalization.** Demographic shifts and urbanization are key drivers for infrastructure demand in emerging markets, while aging infrastructure needs an upgrade in developing markets. At the same time, geopolitical tensions and pandemic disruptions exposed the fragility of supply chains, prompting the US and Europe to reshore or "friendshore" some critical manufacturing, spurring demand for domestic manufacturing facilities and associated logistics infrastructure (warehouses, ports, rail). Digital infrastructure is already struggling to keep up with the surge in power demand as data centers multiply at a record pace amid the AI boom. We estimate that the US needs to invest over USD1trn over the next 10 years on non-energy infrastructure, especially on roads. China needs to reach USD1.5trn, while India will require approximately USD1trn. France, Germany, the UK and Spain need to invest a combined USD0.5trn. Overall, the global economy will need to spend USD11.5trn over 10 years, with two-thirds of that total required in emerging economies. Latin America exemplifies this dynamic: the region faces distinct infrastructure needs driven by rerouting, friendshoring and trade diversification, yet developers must also navigate elevated risk levels.
- **The global push to cut carbon emissions and electrify our economy is the major catalyst for infrastructure investment, reaching between USD26trn and USD30.2trn by 2035 (69% of the total).** Despite a doubling of renewable generation investment over the past decade, infrastructure development – such as grids and storage – has lagged, creating bottlenecks and driving up system costs. In Europe alone, an estimated USD110–150bn will be needed annually to develop electricity networks and energy storage, with major investments directed toward distribution and transmission grids and cross-country interconnections. Globally, the annual energy infrastructure investment gap remains at USD1.5trn, with underinvestment particularly acute in the US and emerging markets. Bridging this gap is essential not only to meet rising power demand, but also to align with climate goals and enhance energy security.
- **Against this backdrop, private capital has moved from gap-filler to the cornerstone of global infrastructure finance, with unlisted assets under management surging from <USD25bn in 2005 to >USD1.5trn in 2024.** Investors are pivoting from traditional transport and utilities toward energy-transition and digital platforms (grids, storage, data centers, fiber). Beyond capital, this shift brings lifecycle efficiency, delivery discipline, and risk-sharing via public-private partnerships, direct ownership, and a fast-growing private infrastructure debt market. Allocations are now segmented by risk, targeting steady, inflation-linked cash flows rather than private-equity-like upside. Most investors aim for 6–10% returns, consistent with our 8–10% forward view.

- **The next phase of global infrastructure investment must be defined by both ambition and execution.** While mobilizing 3.5% of global GDP annually is necessary, it is not sufficient. Now, what matters is aligning capital, policy, and system design to overcome the real-world constraints that continue to slow delivery. The barriers are increasingly structural, ranging from permitting delays and grid congestion to fragmented regulatory frameworks and institutional capacity gaps in EMDEs. Addressing these challenges will require a dual shift. First, governments must fast-track permitting and land-use approvals, harmonize remuneration and regulatory frameworks across jurisdictions, and introduce fast-track mechanisms for priority infrastructure. Simplifying and digitizing procurement processes can reduce lead times and improve transparency. Enhancing project preparation facilities and technical assistance, particularly in lower-income regions, will be key to moving projects from concept to bankability. Strengthening the capacity of subnational authorities and state-owned enterprises, which are often key implementers, is equally critical. Investors must transition from broad allocations to more targeted, theme-based strategies that focus on energy systems, digital infrastructure, resilient urban mobility, and social infrastructure to deliver resilient, inflation-linked returns. Greater use of blended finance and risk mitigation tools is also required to mobilize capital at scale in high-risk regions. Without this alignment, execution will remain the bottleneck. System costs will rise, stranded assets will proliferate, and the gap between infrastructure ambitions and physical delivery will continue to widen.

# The global rush for infrastructure

**Infrastructure is considered to be the foundation of economic activity, with the development of key infrastructure such as transportation networks, maritime ports, and aerodromes being pivotal to the promotion of economic growth and development.** A robust infrastructure has been demonstrated to enhance productivity, reduce costs and mitigate a range of risks for economic agents, with companies being particularly vulnerable to such consequences. In recent years, there has been a marked increase in global demand for infrastructure, driven by a number of trends across various economies. Emerging and developing markets (EMDEs) are demonstrating growth that is more than double that of advanced economies, thus creating a significant demand for new infrastructure. By 2040, the world's population is projected to have grown by 25%, with urban populations surging by 46% as people increasingly migrate to cities. This rapid urbanization is exerting significant strain on existing networks, thereby creating an urgent demand for the expansion of transport, housing, water and energy infrastructure in urban areas. Indeed, it is estimated that by 2050, 70% of the world's population will be living in urban areas, emphasizing the necessity for climate-resilient urban infrastructure (Figure 1).

**Figure 1:** GDP per capita (2015 USD - x-axis) vs urbanization rate (%)

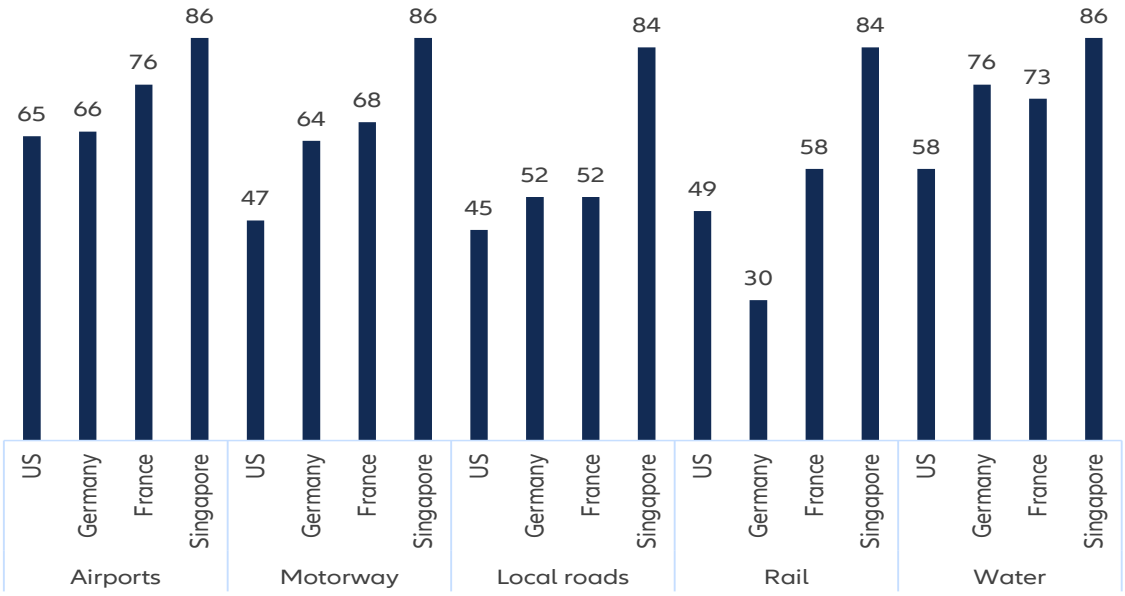



Sources: WDI, Allianz Research

**Demographic shifts and urbanization are identified as key drivers for infrastructure demand in emerging markets, whilst the necessity for upgrading aged infrastructures is a key factor in developing markets.** The rapid urbanization that is occurring in emerging economies with young, growing populations – such as India, Southeast Asia and some parts of Africa – is resulting in the need for extensive new infrastructure. This infrastructure includes roads, public transit systems, water/sanitation systems and power grids, which are required to service the rapidly growing cities. Concurrently, the rapid urbanization witnessed in Asia and Africa has precipitated an expansion in infrastructure, encompassing highways, railways, ports and airports. Conversely, numerous advanced economies are confronted with the challenge of ageing infrastructure, which was constructed during the mid-20th century and is now in need of renewal or replacement. For instance, a significant proportion of Europe's infrastructure was constructed during the post-WWII economic boom. The average age of EU power grids is now over 40 years, necessitating upgrades to ensure they can handle modern loads. The ageing demographics of Japan and Western Europe may result in a slight moderation of demand growth; however, even in these regions, there is a pressing need for substantial investment in order to maintain and modernize existing infrastructure. Such investment is essential for the reinforcement of bridges and the replacement of outdated water pipes, as well as for adapting infrastructure to the needs of an ageing population, including healthcare facilities and accessible transport (Figure 2).

**Supply-chain resilience and reshoring have also been identified as key factors contributing to the increased demand.** Geopolitical tensions and pandemic disruptions have exposed the fragility of supply chains, prompting the US and Europe to consider the repatriation of critical manufacturing. This trend is driving demand for domestic manufacturing facilities and associated logistics infrastructure (warehouses, ports, rail). For instance, the United States government's recent industrial policies – including the 2022 CHIPS Act and Inflation Reduction Act (IRA) – in conjunction with state incentives, have resulted in the allocation of over half a trillion dollars for domestic manufacturing and infrastructure. Since the year 2020, over 300 new manufacturing projects, with a total value of USD 400 billion, have been announced in North America. These projects will contribute to the addition of a minimum of 250 million square feet of factory space to the region's infrastructure during the current decade. Despite certain provisions of the IRA having been revised under the current administration, tariffs and trade policies are also being implemented with the aim of increasing manufacturing capacities in the US. In a similar manner, Europe is

**Figure 2:** Satisfaction levels regarding various infrastructure across selected countries (% very/fairly satisfied)




Sources: IEA, Allianz Research

engaged in the strategisation of measures to enhance supply-chain security in sectors such as semiconductors and batteries. This has resulted in the allocation of new investments in production plants, power infrastructure, and transport connectivity for industrial hubs. These endeavors are frequently supported by financial resources from the European Union, including the NGEU funds.

**The collective impact of these infrastructure demand-side elements gives rise to the necessity for non-energy infrastructure investment amounting to approximately 1% of global GDP.** In order to estimate non-energy infrastructure investment needs on a cross-national basis, the methodology outlined in the ADB (2017) study is adapted and applied. The present analysis is constrained to non-energy sectors, incorporating transport (including roads, railways, airports, and ports), telecommunications (with the exclusion of electricity-related infrastructure), and water supply and sanitation. The calculation of investment needs is based on a baseline approach, whereby projected demand for each type of infrastructure is estimated based on expected GDP growth, population and urbanization trends. These include access to paved roads, broadband access and improved sanitation. The fundamental premise asserts that nations must address prevailing infrastructure deficits and concurrently satisfy escalating demands associated with economic growth and urban expansion. In addition, maintenance for extant infrastructure is factored into our calculations, with different depreciation rates being applied to each type of infrastructure (for example, 2% for rail, 3% for roads and sanitation, and 5% for broadband). Utilizing this methodology, it is estimated that the US requires investments in excess of USD1trn over the forthcoming decade, with the majority allocated to road infrastructure development (Table 1). It is projected that China will require a total of USD1.5trn, while India's requirement is estimated at approximately USD1trn. France, Germany, the UK and Spain must collectively invest a minimum of USD 0.5 trillion. The global investment requirements are estimated at USD11.5trn, with the majority, approximately two-thirds, anticipated to originate from emerging economies.

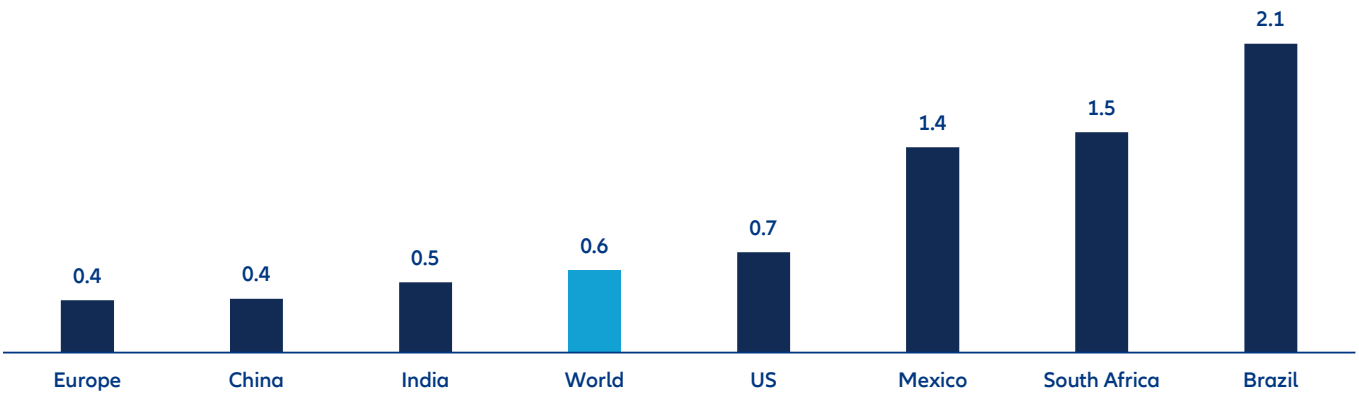
**Table 1:** Non-energy infrastructure investment needs through 2035 (2015 USD bn)

| Country | Air | Road | Rail | Port | Telecom/Digital | Sanitation | Total |
|---|---|---|---|---|---|---|---|
| China | 9.2 | 1 015.6 | 128.5 | 261.5 | 56.5 | 33.9 | 1 505.2 |
| United States | 8.2 | 872.2 | 104.4 | 41.0 | 31.5 | 0.8 | 1 058.0 |
| India | 1.5 | 814.4 | 43.2 | 41.2 | 94.1 | 52.0 | 1 046.4 |
| France | 0.7 | 130.9 | 16.5 | 6.5 | 0.7 | 0.5 | 155.7 |
| Germany | 0.8 | 99.6 | 19.1 | 13.6 | 1.1 | 0.2 | 134.5 |
| Turkiye | 0.9 | 85.5 | 11.6 | 13.3 | 7.8 | 1.4 | 120.5 |
| Spain | 0.6 | 94.6 | 11.5 | 11.4 | 1.5 | 0.3 | 119.8 |
| United Kingdom | 0.7 | 70.0 | 12.6 | 9.4 | 0.1 | 0.1 | 92.9 |
| Poland | 0.1 | 56.8 | 7.8 | 3.6 | 1.3 | 0.1 | 69.7 |
| Malaysia | 0.2 | 38.2 | 2.9 | 20.5 | 5.4 | 0.4 | 67.5 |
| Sweden | 0.3 | 49.8 | 5.8 | 1.4 | 0.5 | 0.0 | 57.8 |
| South Korea | 0.7 | 25.4 | 5.5 | 22.1 | 1.6 | 0.0 | 55.4 |
| Morocco | 0.1 | 19.3 | 3.0 | 8.2 | 6.3 | 1.1 | 38.0 |
| Chile | 0.1 | 23.1 | 3.7 | 3.7 | 2.6 | 0.1 | 33.4 |
| Netherlands | 0.4 | 19.3 | 2.8 | 9.0 | 0.7 | 0.0 | 32.2 |
| Belgium | 0.1 | 18.1 | 2.6 | 6.7 | 0.8 | 0.0 | 28.4 |
| Romania | 0.1 | 21.3 | 3.8 | 1.1 | 1.2 | 0.2 | 27.6 |
| Greece | 0.1 | 18.4 | 2.1 | 3.2 | 0.7 | 0.1 | 24.6 |
| Finland | 0.1 | 14.6 | 3.2 | 1.0 | 0.4 | 0.0 | 19.3 |
| Ireland | 0.4 | 11.0 | 1.7 | 1.0 | 0.2 | 0.1 | 14.3 |
| **Advanced Economies** | **35** | **2 415** | **380** | **201** | **173** | **69** | **3 795** |
| **Emerging Economies** | **76** | **5 635** | **759** | **604** | **518** | **621** | **7 590** |
| **World** | **115** | **8 050** | **1 150** | **805** | **690** | **690** | **11 500** |

Sources: Allianz Research

**The latest estimates indicate that the global infrastructure investment gap is approximately half a percentage point of global GDP, given the current investment commitments and expected needs.** It is evident that current levels of global infrastructure spending are inadequate in meeting the demands of achieving both economic development and sustainability goals. The G20 asserts that global investment in infrastructure is inadequate, with emerging economies experiencing particularly pronounced deficiencies in this regard (Figure 3). The level of investment by EMDEs has increased steadily over the past two decades, relative to the respective GDPs of the countries concerned. The gap between the investment levels of EMDEs and those of advanced economies has gradually narrowed, and in 2024 the investment levels of EMDEs surpassed those of advanced economies, reaching an average of 13% of GDP. However, the current investment rates of these countries have yet to reach the levels that advanced economies once sustained prior to the global financial crisis. Such levels are critical for enabling sustained infrastructure development, productive capacity and structural transformation. This would entail an augmentation in total investment (public and private) to a level equivalent to 5% of GDP. It is estimated that approximately 50% of this augmentation should be allocated to the development of transport infrastructure, with a specific emphasis on road infrastructure. This emphasis is indicative of bottlenecks in terms of connectivity and logistics. In the context of Latin America, a region that is increasingly playing a critical role amid escalating trade tensions (Global trade survey), it is imperative to reach and maintain these higher investment thresholds. This is not only essential to close persistent infrastructure gaps, but also to unlock long-term growth, reduce poverty and achieve greater interoperability across transport, energy and digital networks.

**Figure 3:** Infrastructure investment gap (% of 2020 GDP)




Sources: G20 Global Infrastructure Hub, Allianz Research

## Between momentum and fragility: the infrastructure outlook for Latin America

**The Latin American region is currently experiencing a pivotal moment in its history.** On the one hand, there is significant untapped potential for growth driven by infrastructure, yet on the other, there are deep-rooted fiscal and political constraints that are challenging to surmount. The issue of chronic underinvestment, estimated at 2.5% of GDP annually, has had a significant impact on the development of transport, energy and digital systems, resulting in underdeveloped and overloaded infrastructure. At the same time, shifting trade routes, industrial reorganization and friendshoring trends have placed Latin America back on the global investment radar with increasing volumes of investment (Figures 4 and 5). The path forward is complex: while the rewards are substantial, including long-term productivity gains and enhanced trade competitiveness, so too are the risks – from project cancellations and arbitration disputes to tightening fiscal space and political uncertainty ahead of the 2026 electoral cycle.

**Figure 4:** Latin American infrastructure finance by source of financing, USD bn

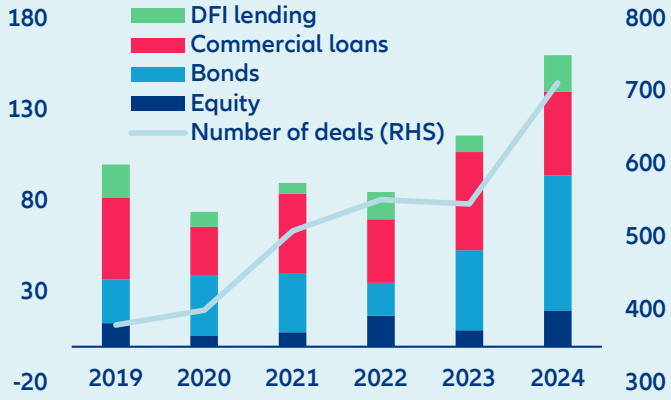
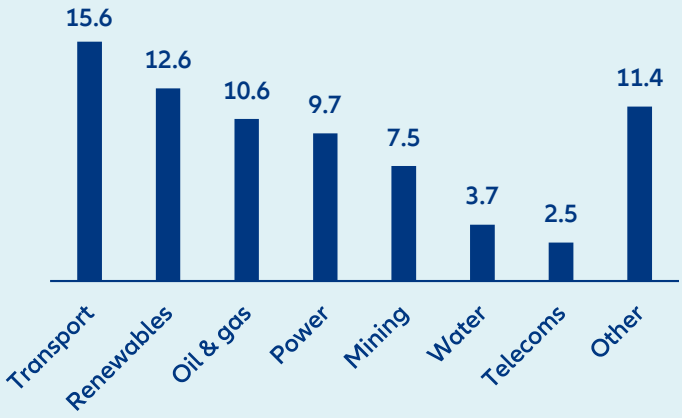



**Figure 5:** Project financing by sector in Latin America (2024), USD bn




Sources: NGFS, EPRA, Allianz Research

**The region is confronted with an ongoing challenge of inadequate infrastructure investment, a factor that is hindering growth prospects.** The failure to maintain or augment capital stocks has been estimated to incur a cost to LAC countries of approximately 1% of GDP on an annual basis, with a projected increase to approximately 15% loss over a decade. The total infrastructure investment gap in the region is estimated at approximately USD 150 billion per year, which is equivalent to 2.5% of GDP. To achieve the dual objectives of addressing fundamental needs and attaining Sustainable Development Goals targets by 2030, the Latin America and the Caribbean (LAC) region would necessitate an investment summing to approximately USD 2.2 trillion. This financial infusion would be allocated towards critical sectors, including water and sanitation, energy, transportation, and telecommunications, constituting an investment ratio of approximately 3.1% of GDP on an annual basis. This investment requirement is substantially higher than the current expenditure levels in these sectors. For instance, the elimination of transport bottlenecks alone has been shown to require approximately 1.4% of GDP per year. This figure stands in contrast to the 0.5% required for water, 0.8% for electricity, and 0.4% for broadband connectivity. In comparison, advanced economies allocate approximately 3-4% of their respective GDPs to public infrastructure, whereas LAC governments invest an average of 2.1%. The phenomenon of the "investment drought" is evident when observing the government revenues, which average 18.6% of GDP across the region. Furthermore, budget deficits are projected to close at 3.7% of GDP in 2024 (with our forecast for 2025 being 3.1%). Additionally, public debt has decreased to an average of 51%, despite elevated financing costs.

**Government entities and private organizations within the region are undertaking prominent development projects that have the potential to profoundly impact trade patterns and address existing regional disparities.** A notable example of this phenomenon can be observed in the case of Bogotá's El Dorado airport. The hub's strategic geographic positioning, robust airline networks, and a significant recovery in tourism contributed to its emergence as the region's busiest airport. It surpassed its competitors with substantial traffic growth. The Colombian hub has emerged as the

busiest airport in the region, surpassing Mexico City and São Paulo-Guarulhos with 45.4 million travelers in 2024 (+18 million over the past decade). Geographical considerations play a pivotal role in this regard, as they facilitate the provision of numerous airline connections to both the US and Europe. Furthermore, tourism to Colombia has demonstrated a noteworthy recovery, exhibiting a +58% increase since the pre-pandemic era. In the context of Latin America, Panama and Lima partially supplanted Mexico's ambitious plans to establish regional connectivity. These plans were suspended when then-President López Obrador canceled a new airport project during his first month in office in 2018.

**Several projects are also focusing on commercial and industrial diversification at a time of increasing trade protectionism and supply chain securitization from the northern hemisphere, including the review of the USMCA in 2026.** A case in point is Peru's recently constructed deepwater Chancay port, a project primarily financed by Chinese capital. This port is designed to reduce the Asia-Latin America maritime route by approximately ten days, with the objective of capturing half of China-South America container traffic. In a similar vein, Mexico is allocating a substantial USD 2.8 billion toward the development of the Isthmus of Tehuantepec Interoceanic Corridor. This ambitious endeavor encompasses the construction of a 188-mile rail and road network, stretching from the Pacific Ocean at Salina Cruz to the Gulf of Mexico at Coatzacoalcos. The primary objective of this initiative is to establish an alternative route to the Panama Canal, with the overarching goal of enhancing supply-chain resilience and promoting economic stability. Concurrently, foreign and domestic investors have been revitalizing the extractive and industrial sectors. Argentina's pro-investment regime and abundant mineral resources have attracted new capital. French direct investment (FDI) experienced a substantial surge of 43% in 2024, reaching a total of USD 7.6 billion, a notable increase driven, at least in part, by significant lithium-related projects. Chile has also adopted a policy of promoting renewable energy and mining using Public-Private Partnerships (PPPs).

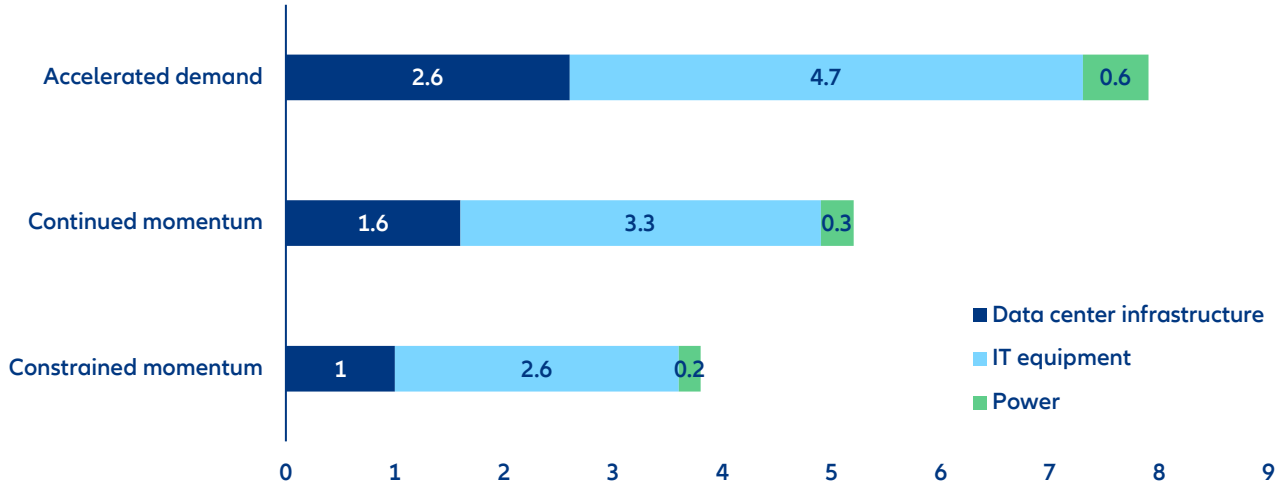
**The region's geographic advantage could attract infrastructure-driven growth; however, persistent gaps, a forthcoming round of elections in 2026 across the region, and pervasive political instability pose significant risks.** Regulatory uncertainty and project cancellations have contributed to a slowdown in progress in recent years. A state of underinvestment often results in numerous projects encountering cost overruns or delays. These occurrences frequently give rise to contract disputes. Latin American states have already established a notable presence in the realm of international arbitration. In 2024, approximately 28.5% of all publicly known investor-State claims involved LAC countries, and ICSID caseloads continued to increase (Argentina, Brazil, Mexico, and Peru being among the primary targets). Recent policy shifts exemplify the complexity of this challenge. The constitutional energy reform in Mexico in 2024 (which returned governmental control over energy production to the state) and Argentina's new investment law (which required certain projects to incorporate arbitration clauses) have prompted legal scrutiny. The financing of these projects is further complicated by high interest rates and decreasing fiscal space. Latin governments face the world's lowest public investment rates (only ~2.1% of GDP) and must allocate rising shares of budgets to debt service. Subnational governments are also vulnerable and exhibit different degrees of support, from Argentine provinces incurring foreign-currency debt to royalties transferred directly to the regions in Peru, underscoring potential fiscal strains at different levels. Finally, the region's nemesis, inflation, and the prolonged appreciation of the local currency against the USD could cause local costs to escalate, which is another typical trigger for project abandonment.

**Despite constrained financial resources, multilateral studies emphasize that investments in well-managed infrastructure generate significant economic returns.** For every million-dollar allocation on infrastructure, a return of 36,000 jobs and a 1.5-fold increase in the GDP over a five-year period can be anticipated. In summary, insufficient investment constitutes a risk for growth. The enhancement of infrastructure, particularly through the mobilization of private capital, has the potential to elevate productivity and facilitate the escape of Latin American and Caribbean (LAC) economies from secular stagnation at a time when their societies begin to exhibit signs of aging patterns. The potential benefits from infrastructure development in the region—including increased trade capacity, enhanced connectivity, and climate adaptation—are substantial. However, these benefits are accompanied by significant challenges. Investors should take note that robust governance and transparency in contracts are paramount. Well-structured projects, supported by multilateral development banks or political risk insurance, can serve as a bulwark against the potential volatility of populist policy shifts and the exorbitant costs associated with arbitration. As nations proceed into another electoral cycle, governments will be required to strike a balance between the aspiration of "building back" and the fiscal sustainability and rule-of-law confidence that are necessary for long-term development.

# Beyond bricks and bytes: Mapping the infrastructure investment frontier

**Digital infrastructure will require significant investments in the age of AI.** The proliferation of data on a global scale, accelerated by the advent of artificial intelligence and cloud computing, has led to a marked increase in demand for computing power. Data centers are being constructed at an unprecedented rate, yet the sector is encountering a paradox: while capital is being directed towards hyperscale and edge assets, power is emerging as the new constraint. This "digital power problem" is not merely hypothetical. In major markets such as the US and Asia, hyperscalers are confronted with limitations in energy availability, constraints in substation capacity, and delays in the process of interconnection. AI workloads, in particular, are responsible for a significant increase in energy consumption. According to McKinsey, there is a compelling argument to suggest that global demand for electricity from data centers could increase threefold by 2030. This considerable increase is predicated on the incompatibility of existing grids with the decarbonization timelines (Figures 6 and 7). The phenomenon of regional growth is being increasingly influenced by a combination of factors, including energy constraints and evolving political landscapes. In the US, the term "Data Center Alley" has been coined to describe the state of Virginia, where demand for data center space has reached saturation. This has prompted hyperscalers to seek alternative locations, such as Texas, Ohio and Georgia. However, a significant challenge that these hyperscalers face is the limited availability of substation access. The Trump administration has the option of relaxing permitting and regulation; however, uncertainty remains with regard to support for grid upgrades and clean energy incentives. Europe is advancing at a faster rate than anticipated, with the Nordic countries of Sweden, Finland and Norway offering a satisfactory combination of renewable energy, a cool climate and policy support. In contrast, Germany and the Netherlands are facing increasing zoning and ESG barriers, which may tighten further amid rising climate-skeptic political influence. In the Asian context, India is experiencing a substantial augmentation in its data center infrastructure in Tier II cities, facilitated by favorable localization policies. Meanwhile, Singapore is undertaking a cautious approach to development, characterized by stringent green building standards. Digital infrastructure is a high-growth segment, but its trajectory is increasingly contingent on power access, regulation and political will. This has resulted in overcrowding in certain regions.

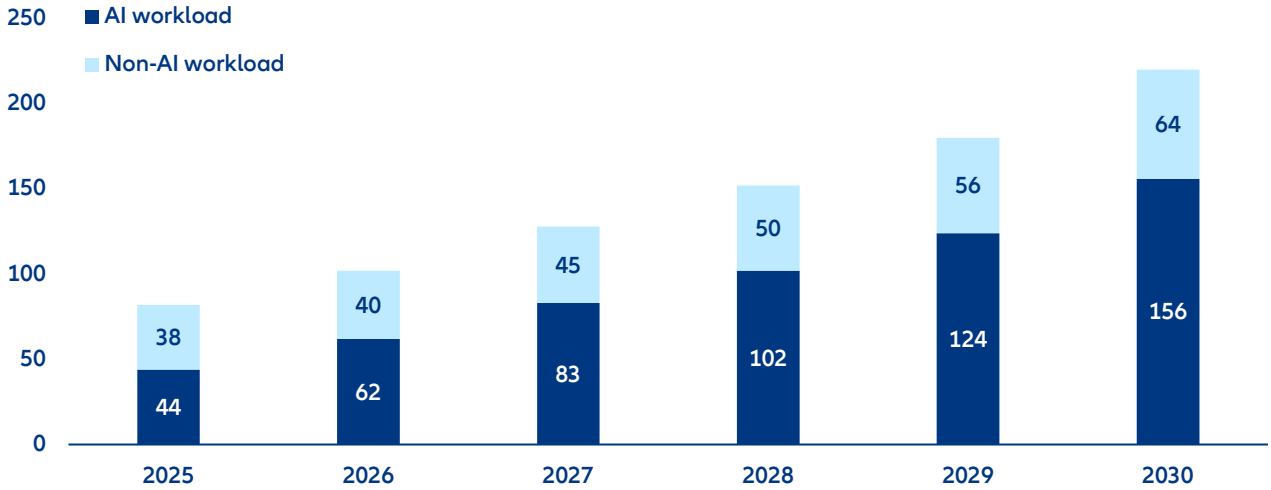
**Figure 6:** Global data center total capital expenditures driven by AI, by category and scenario, 2025-30 projection, $ tn




Sources: ISources: McKinsey and Company (link), McKinsey Data Center Capex TAM Model; McKinsey Data Center Demand Model, Allianz Research

Notes: Data center infrastructure excludes IT services and software due to their low capex. IT equipment includes servers, storage, and networking, with AI accelerators replaced every 4 years. Power costs ($2.2–$3.2B/GW) cover various generation scenarios, excluding distribution, as AI centers are typically >50 MW and grid-connected.

**Figure 7:** Estimated global data center capital demand, continued momentum scenario, in gigawatts

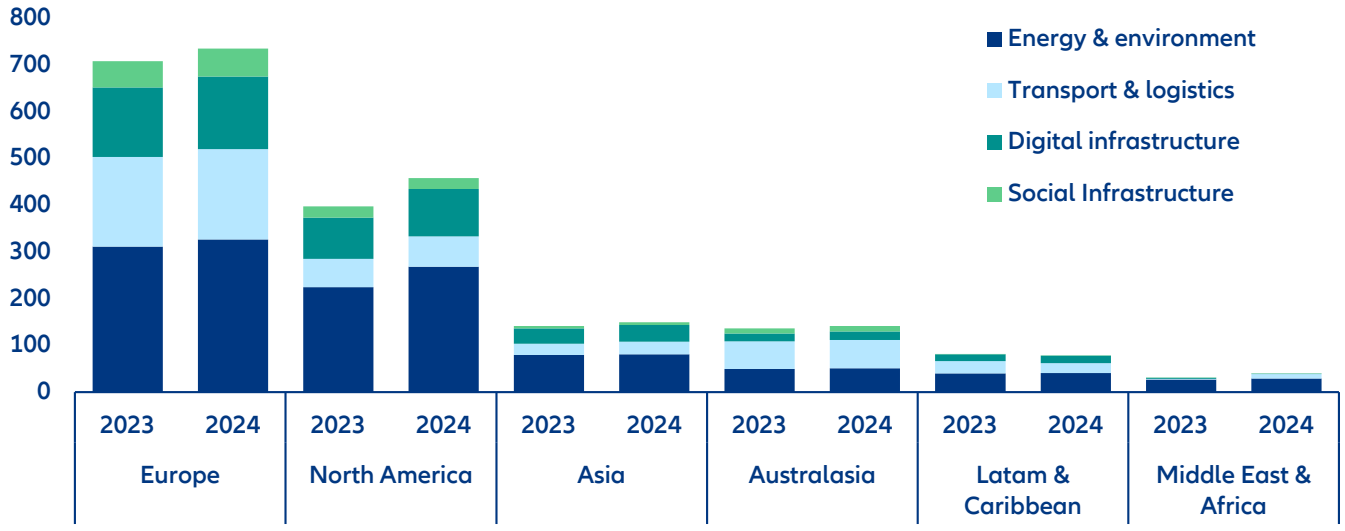



Sources: McKinsey and Company (link),McKinsey Data Center Demand Model, Gartner reports, IDC reports, Nvidia capital markets reports, Allianz Research

**At the same time, transport infrastructure is entering a new strategic phase as climate commitments, urbanization, and shifting trade dynamics converge with the rise of systems-based infrastructure planning.** The focus of attention is shifting from roads and runways to integrated, low-emission, digitally managed mobility networks. Investor appetite is following this pivot. While traditional assets continue to receive capital investment, there is an increasing focus on electrified rail, intermodal freight, low-carbon ports and urban transit systems. These assets offer embedded climate benefits, alignment with smart infrastructure, and act as structural hedges against volatile energy prices and supply chain disruptions. In recent times, governments have been increasingly utilizing transport infrastructure as both a fiscal stimulus lever and a tool to accelerate the net-zero transition. Institutional capital is re-engaging, particularly through brown-to-green retrofits, lifecycle concession models, and platform strategies that emphasize modal integration and operational resilience.

**Across different geographical areas, the transformation is manifesting in a variety of forms.** In Europe, transport is a key pillar of the EU Green Deal, with large-scale investment in rail electrification, cross-border logistics, and green maritime infrastructure, supported by the Connecting Europe Facility and national recovery plans. Germany's €500 billion stimulus package, including €100 billion allocated to climate infrastructure, and the TEN-T corridor upgrades, are indicative of this ongoing development. Historically underfunded Southern Europe is now witnessing unprecedented levels of EU support for logistics modernization and port decarbonization. In the United States, the Bipartisan Infrastructure Law is allocating over $300 billion to highways, rail, and transit. Nevertheless, the return of the Trump administration introduces a degree of policy uncertainty, particularly with regard to ESG-linked projects and intergovernmental coordination. State-level momentum is evident, particularly in California, the Northeast, and the Midwest, where the maintenance of resilient bridges, freight rail networks, and EV networks remains a high priority. In emerging markets such as Latin America and Africa, demand for blended finance models such as Public-Private Partnerships (PPPs) and development-backed light rail and Bus Rapid Transit (BRT) systems is being driven by rapid urbanization and fiscal constraints. Notwithstanding the persisting risks associated with execution, the long-term fundamentals, which include population growth, remain a primary concern (Figure 8).

**Figure 8:** Portfolio companies by geography and sector, 2023 & 24 (total number)

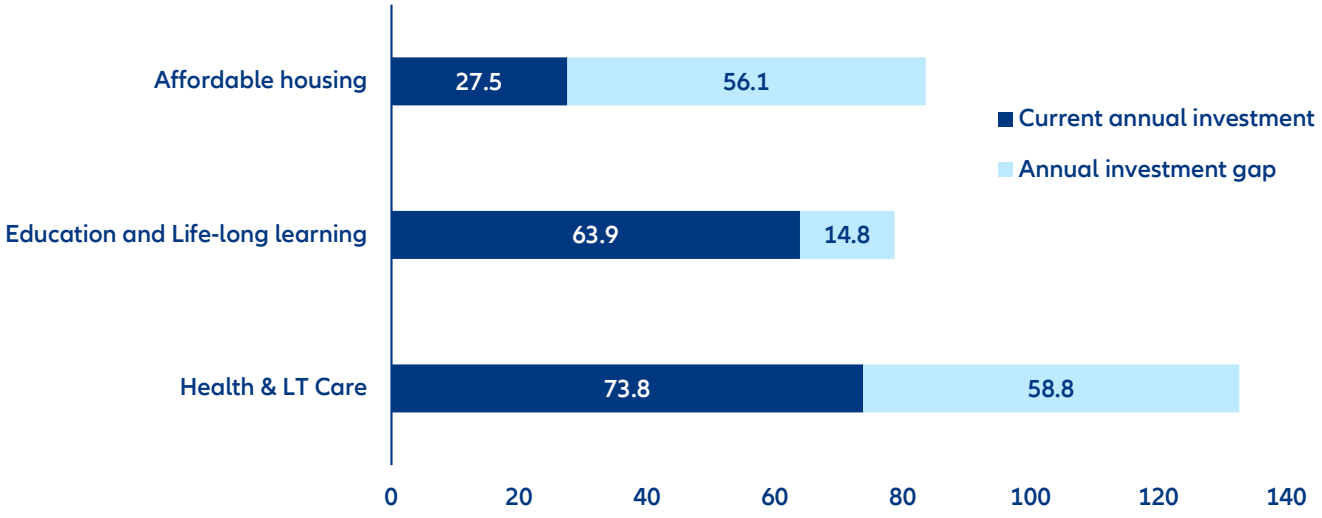



Sources: IBCG analysis (link), Allianz Research

Notes: Includes only portfolio investments made by 58 key infrastructure investors, representing more than 75% of all infrastructure assets under management.

**Often overlooked next to transport and energy megaprojects, social infrastructure is steadily moving to the forefront of long-term investment agendas.** The aforementioned sectors, which include healthcare, education, housing, water, and civic facilities, form the foundation of inclusive and resilient societies. Historically underfinanced due to its indirect returns and public-good nature, the sector is gaining new attention as demographic ageing, climate stress, and inequality prompt governments and investors to rethink priorities. The utilization of public-private partnerships, social bonds, impact funds and outcome-based financing mechanisms has seen a marked increase in recent years, with a view to mobilizing capital whilst preserving accountability. In parallel, the "S" in ESG is gaining traction, drawing institutional focus towards assets that support healthcare capacity, affordable housing, water resilience, and digital education — all of which are pivotal in enabling human capital and long-term economic productivity.gAcross various regions, there is an observable accumulation of momentum; however, it is important to note that the specific approaches employed vary significantly. In Europe, the social infrastructure sector has been identified as a central component of post-pandemic recovery strategies. This is evidenced by substantial investments in senior care, hospitals, and social housing made by Germany and Italy under the EU Recovery and Resilience Facility. **The Nordics have continued to integrate care and education assets into broader smart city frameworks.** In the US, despite the ongoing fragmentation of the education system, the American Rescue Plan and place-based investment programs have directed funds towards underserved schools, healthcare deserts, and the removal of lead pipes. However, fiscal constraints may impede the continuity of these initiatives. In the Asian context, notable examples of this commitment to universal access include India and Indonesia, which have initiated programs to enhance healthcare and educational opportunities through the utilization of blended finance mechanisms and multilateral support. In Africa and Latin America, concessional funding remains critical for extending basic services, including climate-resilient housing and clean water infrastructure. Though less prominent than hyperscale data centers or offshore wind, social infrastructure is increasingly regarded as a defensive, long-duration asset and a cornerstone of inclusive, sustainable growth (Figure 9).

**Figure 9:** Estimated European social infrastructure gap by 2030 (€ bn))



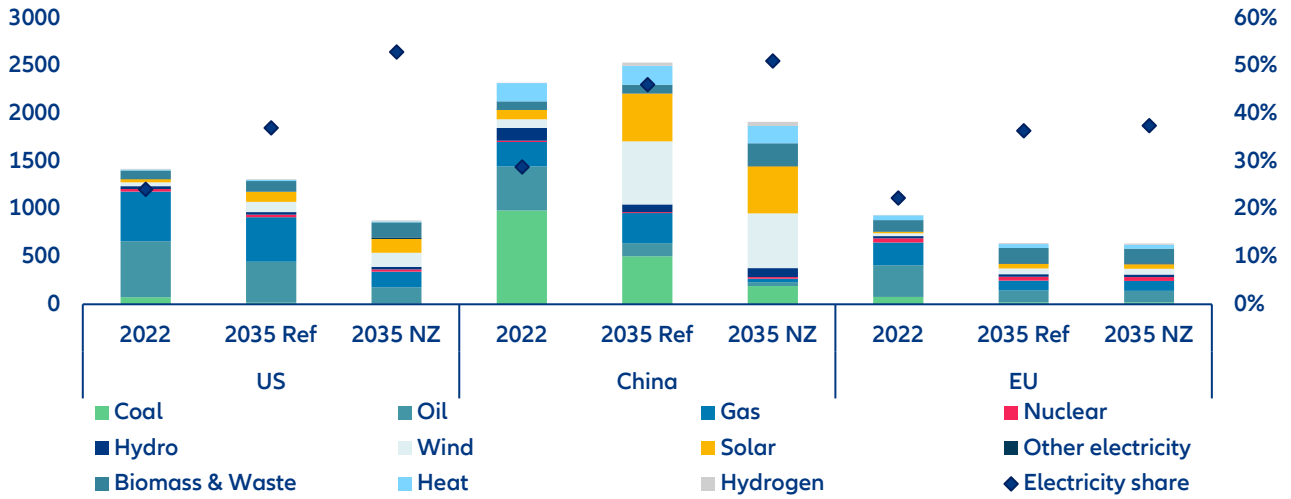

Sources: IFranklin Real Asset Advisors (link), European Comission, Eurostat, GIH, Allianz Research

# Power shift: Infrastructure demands of the net-zero economy

**The global push to reduce carbon emissions is fundamentally reshaping infrastructure priorities, driving a surge in investment needs across energy, transport, and buildings.** Achieving net-zero emissions by 2050 will require transformative upgrades, not only to accommodate baseline demand, but also to modernize and decarbonize essential systems. Massive investments are needed to expand renewable energy generation, modernize electric grids, deploy energy storage, electrify transport, and build climate-resilient infrastructure. Governments worldwide are mobilizing capital to meet these ambitious goals. In Europe, the Green Deal and related initiatives aim to cut emissions by 55% by 2030, triggering hundreds of billions of euros annually in clean energy, building retrofit, and transit projects. In the U.S., although federal funding for renewable energy has plateaued, the urgency of climate-resilient infrastructure remains. Meanwhile, China, the world's leading builder of low-carbon infrastructure, is rapidly advancing toward its targets of peak emissions by 2030 and carbon neutrality by 2060.

**Transitioning to a more electrified, low-carbon economy demands a significant overhaul of global energy markets.** This shift is particularly pronounced in ambitious climate transition scenarios, yet even under more moderate ambitions, substantial changes in our energy consumption mix are anticipated. Driven by the expected growth in electricity demand from data centers, automation and electrification, electricity consumption is projected to increase by +46.8% over the next decade. As a result, in the world's largest economies, the share of electricity in final energy consumption is projected to rise by 14–17pps by 2035 under our baseline scenario, and by 15–29pps under a net-zero consistent pathway (Figure 10). The expansion of wind and solar energy is projected to continue, with power output expected to more than double in Europe and increase sixfold in China. Additionally, biomass and waste, nuclear power and emerging sources like geothermal are projected to grow, while coal and other fossil fuels are gradually phased out.

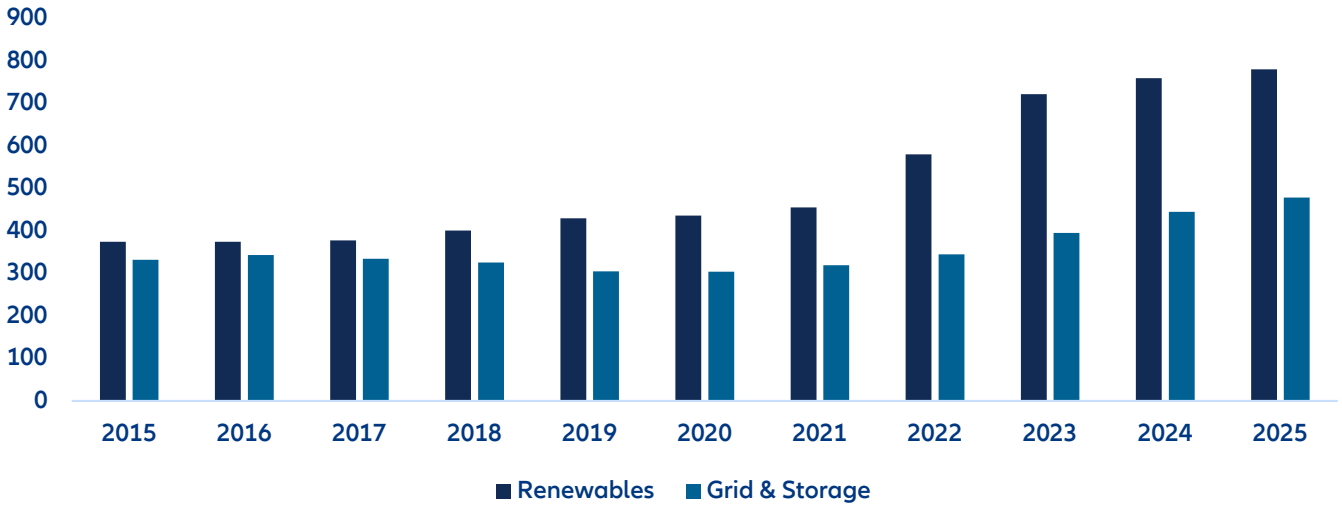
**Figure 10:** Evolution of final energy consumption by source (left axis: Million tons of oil equivalent, Mtoe) and electricity share (right axis: %) in both reference and net-zero scenarios, segmented by world region




Sources: LSEG Datastream, Allianz Research

**The change in energy consumption patterns, coupled with structural differences between intermittent renewable and traditional energy sources, necessitate new approaches to power system management and call for additional investments in supporting infrastructure.** As energy generation increasingly relies on electricity – particularly from wind and solar – mismatches between production and consumption become more pronounced, while power generation itself becomes more decentralized. At the same time, geopolitical conflicts underscore the strategic importance of energy diversification and autonomy, most notably illustrated by Europe's shift from pipeline-based gas to liquefied natural gas (LNG) following the Russian invasion of Ukraine. This underscores that investment in the energy sector is driven not only by climate targets and rising demand, but also by the imperative to enhance energy security. These evolving dynamics demand significant capital not just for new generation technologies, but also for critical enabling infrastructure such as electricity grids, battery storage, hydrogen systems, and gas storage facilities. However, while investment in renewable generation has more than doubled over the past decade, infrastructure development has lagged behind, increasing by only 44.2% over the same period (Figure 11). This imbalance has led to a growing backlog of grid connection requests for new power production and has significantly raised system management costs. In Europe, these costs rose by 55%, reaching USD4.6bn between 2018 and 2023.

**Figure 11:** Divergence between renewables and grid infrastructure investment globally (in USD bn)




Sources:Allianz Research, IEA World Energy Investment 2025

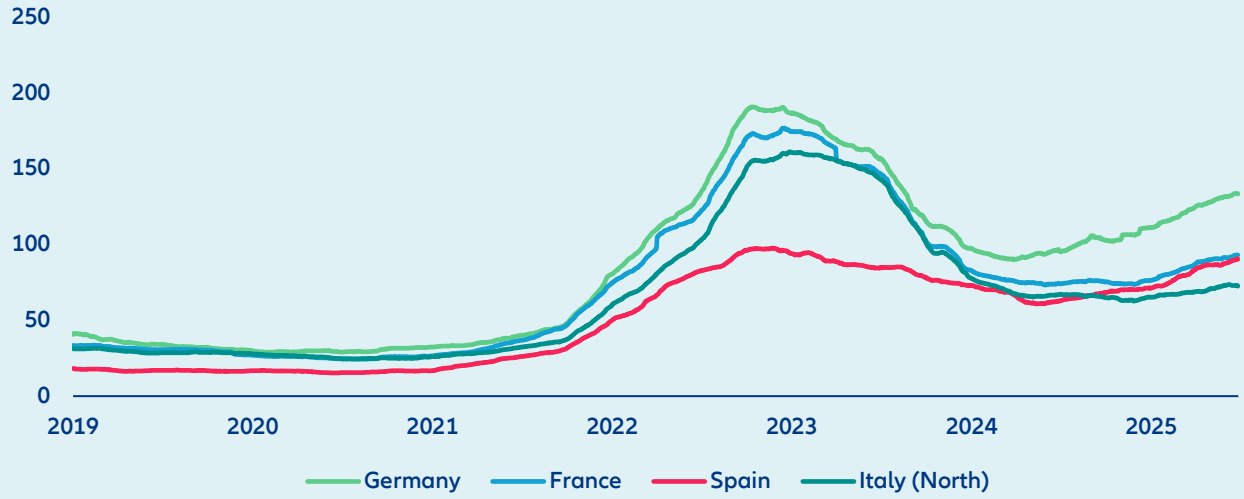
## Enabling infrastructure for power market resilience in Europe

**As global energy markets undergo a structural shift towards electricity and renewables, questions about energy security and reliability arise, creating opportunities for the development of new and enabling infrastructure.** As the cornerstone of the green transition, intermittent renewables offer several benefits including comparatively short construction times (usually a few months up to two years) and lower levelized costs compared to traditional power generation infrastructure[1]. However, they also pose additional challenges for power system management and network stability as their output is more volatile throughout the day and depends on local and seasonal weather conditions. To mitigate the variability of wind and solar generation, it is essential to strengthen grid interconnections and scale up energy storage as both play a crucial role in improving flexibility and supporting grid stability.

**Enhancing power market interconnectivity and expanding battery storage capacity are critical steps toward minimizing supply disruptions and reducing average electricity prices.** As electricity markets become more integrated, local supply-demand imbalances can be more effectively managed, with shortfalls offset by imports from neighboring regions. When paired with fast-response battery storage systems, which store excess energy during periods of low demand and release it during peak hours, grid stability and operational efficiency improve significantly. This dual approach reduces the risk of power outages, such as those observed in Spain earlier this year. Moreover, greater interconnection and storage capacity help to smooth out price fluctuations and reduce regional price disparities. According to an analysis by Bruegel, a fully integrated European electricity market could generate annual benefits of up to EUR43bn by 2030, while cutting power system management costs by 25%.[2]

**Despite progress since the energy crisis, Europe continues to experience elevated electricity prices and significant intraday price spreads, largely driven by the intermittency of wind and solar generation (Figure 12).** These price spreads, and the resulting arbitrage opportunities, have accelerated investment in fast-response battery storage technologies, particularly lithium-ion batteries, which are expected to grow substantially in Europe's largest economies in the coming years (Figure 13). While the expansion of battery storage offers much-needed relief for the region's power markets, grid operators are struggling to accommodate the surge in connection requests, leading to substantial backlogs. Moreover, there are signs of overcrowding in some markets such as Germany, where the volume of requested capacity exceeds what would be needed under the expected energy transition scenarios[3]. These structural bottlenecks highlight that while progress is underway, targeted investment and coordinated planning remain essential to align infrastructure development with long-term decarbonization goals.

**Figure 12:** 12-month rolling average of intra-day power spreads across major EU economies (in EUR/MWh)



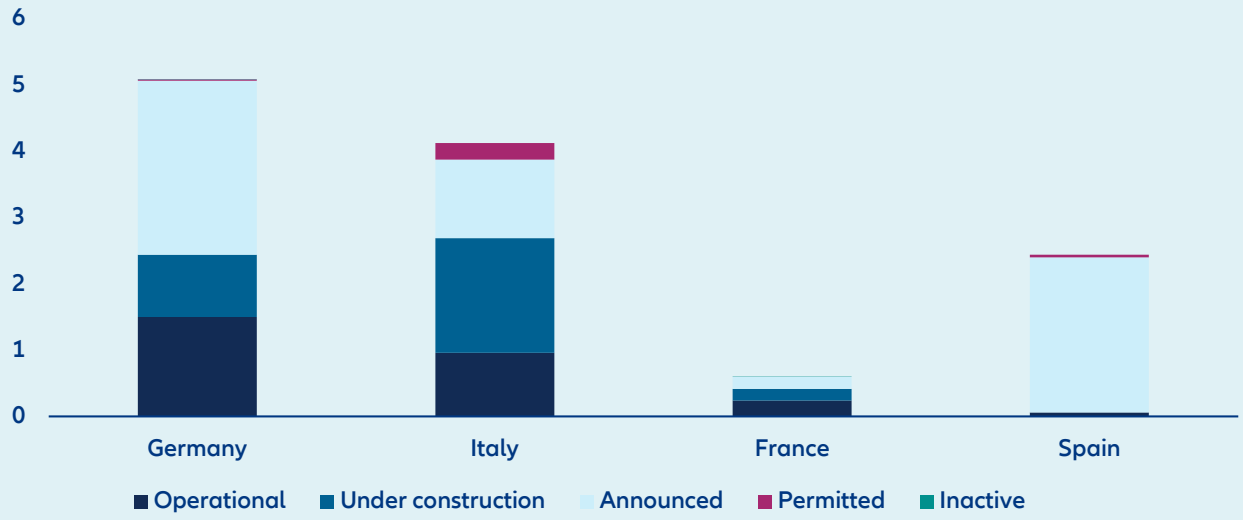

Sources:Allianz Research, ENTSO-E Transparency Platform

[1] Levelized Cost of Energy+ (LCOE+) | Lazard

[2] Unity in power, power in unity: why the EU needs more integrated electricity markets

[3] "Battery tsunami"? Projects totalling 226 gigawatts seek connection approval in Germany | Clean Energy Wire

**Figure 13:** "Fast-response" energy storage projects in Europe by country and project status (in GW)




Sources: Allianz Research, European Energy Storage Inventory JRC, Note: Fast-response storage solutions comprise lithium-ion, and lithium-titanite batteries as well as flywheels

**Meeting the demands of a decarbonized, electrified economy will require an estimated EUR150.9bn in investment for interconnection infrastructure and utility-scale battery storage by 2040 across Europe's largest economies (Table 2).** The highest investment needs are in Germany, which not only acts as a central hub in Europe's power market, but also requires EUR68.1bn in battery storage to support the projected growth in variable renewable generation. France, on the other hand, faces comparatively lower storage investment needs, as its significant share of nuclear power provides stable baseload power, reducing the system's dependence on short-term balancing solutions.

**Table 2:** Cumulative infrastructure investment needs for interconnection and utility-scale storage in Europe (in EUR bn)

| Region | Year | Interconnection | Battery storage |
|---|---|---|---|
| Spain | 2030 | 2.3 | 7.1 |
| | 2040 | 7.0 | 9.0 |
| Italy | 2030 | 3.9 | 10.0 |
| | 2040 | 6.3 | 17.5 |
| France | 2030 | 8.9 | 0.2 |
| | 2040 | 20.3 | 3.1 |
| Germany | 2030 | 11.2 | 1.2 |
| | 2040 | 19.5 | 68.1 |

Sources: Author calculations based TYNDP 2024 (ENTSO-E),

Note: calculations are based on system needs analysis and battery storage trajectory under NT+ scenarios. CAPEX values are taken from investment candidate averages for interconnectors and utility-scale battery estimates using the TYNDP Methodology information.

**Taking all into account the global annual investment gap for energy infrastructure remains significant at USD1.5trn, but regional variations point to different focus areas (Table 3).** In both Europe and China, substantial growth in renewable energy investments over the past five years has aligned the two regions with an Ambitious Transition Scenario (ATS). However, underinvestment in grid and storage infrastructure raises concerns about their ability to sustain the current pace of capacity expansion. In the US, significant investment gaps remain across all key focus areas. With power demand projected to increase by 25% by 2030, swift action is required to address infrastructure shortfalls and ensure a reliable energy supply. While nuclear and gas generation feature prominently in the current administration's plans, the magnitude of expected demand growth – after two decades of flat demand – will likely necessitate the deployment of all available generation options, including wind and solar. As a result, renewable energy investments are projected to rise by +45% in our reference scenario through 2035. Overall, we expect cumulative energy investments to reach USD26trn by 2035 in the reference case and up to USD30.2trn in a more ambitious transition scenario.

**Amid rising global power demand and heightened risks of an economic slowdown, scaling back high existing fossil fuel investments remains one of the central challenges.** Staying on a below 2°C pathway will require a reduction of approximately -50% in global fossil fuel investment levels and an even steeper decrease of more than -80% in the three highlighted regions that together account for more than half of global CO2 emissions. Achieving this while meeting expanding energy needs will demand a fundamental shift in capital allocation, policy alignment and sustained acceleration of clean energy deployment.

**Table 3:** Annual energy sector investments in reference and advanced transition scenarios (in USD bn)

| | | | 2035 annual investments | | %-change | |
|---|---|---|---|---|---|---|
| | | Current Investments | RTS | ATS | RTS | ATS |
| World | Fossils | 1139 | 810 | 570 | -29% | -50% |
| | Renewables | 659 | 714 | 1268 | 8% | 92% |
| | Nuclear | 68 | 63 | 115 | -7% | 68% |
| | Grids | 358 | 749 | 1008 | 109% | 182% |
| | Electricity Storage | 39 | 134 | 259 | 244% | 567% |
| EU | Fossils | 31 | 15 | 11 | -51% | -64% |
| | Renewables | 104 | 102 | 113 | -2% | 9% |
| | Nuclear | 15 | 12 | 15 | -16% | 2% |
| | Grids | 58 | 96 | 126 | 65% | 117% |
| | Electricity Storage | 11 | 13 | 24 | 20% | 112% |
| US | Fossils | 214 | 128 | 40 | -40% | -81% |
| | Renewables | 85 | 123 | 170 | 45% | 99% |
| | Nuclear | 7 | 10 | - | 45% | - |
| | Grids | 99 | 157 | 162 | 59% | 64% |
| | Electricity Storage | 13 | 20 | - | 59% | - |
| China | Fossils | 245 | 84 | 30 | -66% | -88% |
| | Renewables | 282 | 241 | 270 | -15% | -4% |
| | Nuclear | 16 | 13 | 31 | -15% | 101% |
| | Grids | 79 | 288 | 318 | 264% | 302% |
| | Electricity Storage | 12 | 43 | 83 | 264% | 597% |

Sources: Allianz Research, IEA, NGFS v5 REMIND-MagPIE, IRENA, European Commission;
Notes: RTS := Reference Transition Scenario; ATS := Ambitious Transition Scenario

**Aligning power demand needs, energy security considerations and a reduction of power sector emissions in line with below 2°C warming levels necessitate a global approach to the clean transition.** This is not only a matter of accelerating investment within advanced economies, but also of recognizing the critical role that emerging and developing economies (EMDEs) will play in delivering a sustainable, secure, and equitable energy future. More than USD700bn in renewable energy investments will be required outside the three major emitting regions to stay on track with global climate goals. However, the continued concentration of capital in developed markets poses a significant hurdle for power market development in EMDEs, increasingly restricting their long-term economic growth potential. Unlocking these investments is not just a climate imperative – it can also be a strategic opportunity. Advanced economies can benefit by supporting the development of clean energy infrastructure abroad, securing long-term access to low-cost green energy and strengthening critical supply chains. Europe in particular stands to gain from deeper energy partnerships with Africa, leveraging the continent's abundant renewable resources to develop green hydrogen and enhance regional energy security.

**From a private capital deployment perspective, energy infrastructure has become the fulcrum of global investment strategy.** In a world that is rapidly transitioning towards decarbonization, electrification, and resilience, the concept of energy assets has evolved beyond the confines of mere generation. These assets now encompass a multifaceted, interconnected ecosystem comprising grids, storage, clean fuels, demand-response systems, and infrastructure for cross-border flow. As policymakers tighten climate targets and investors seek long-term, inflation-protected returns, energy is emerging not just as an essential service but as the strategic backbone of the net-zero economy.

**The infrastructure challenge is substantial. According to the IEA and McKinsey, electricity demand could double by 2040, driven by electric vehicles, heat pumps, data centers, and green industrial production.** However, this surge is encountering impediments in the form of bottlenecks in permitting, transmission capacity, and system integration. In many regions, power availability has emerged as the predominant constraint on economic development. Energy infrastructure, once reactive and regulated, must now evolve into a state of anticipatory and intelligent operation.

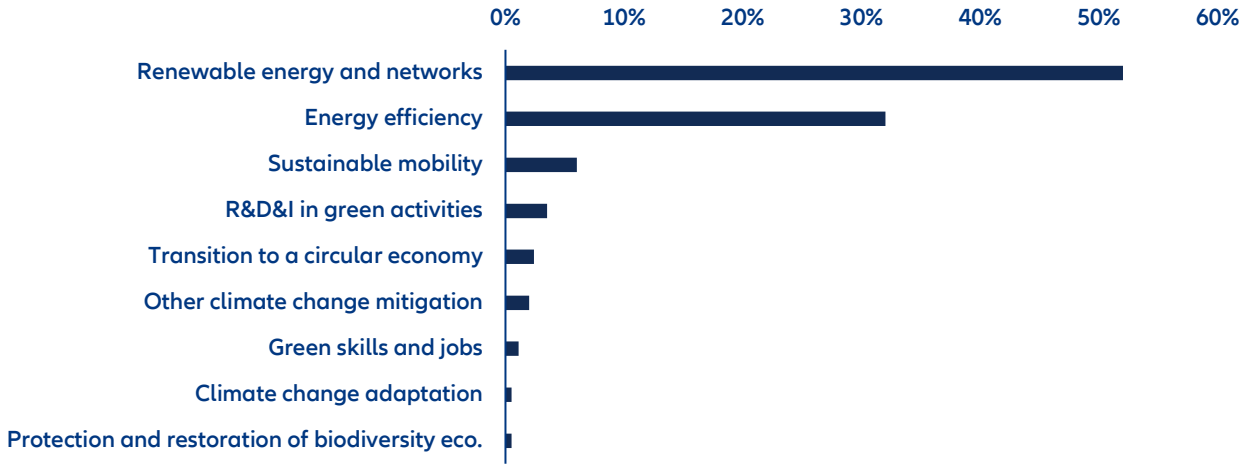
**Across various geographical regions, policy responses and investment momentum exhibit heterogeneity.** However, the energy transition functions as a unifying phenomenon, reshaping infrastructure strategies on a global scale. In Europe, energy infrastructure occupies a central role in both the Green Deal and industrial policy. The REPowerEU plan is a comprehensive strategy aimed at accelerating the modernization of energy grids, expanding offshore wind energy infrastructure, and establishing hydrogen corridors. Germany, Spain, and Denmark are at the forefront of initiatives related to cross-border interconnectors and battery storage, while France and Belgium are reevaluating their reliance on nuclear energy with the aim of stabilizing base-load power. The implementation of accelerated permitting processes and reforms to the auction system has contributed to the resolution of project delays.

**In the US, the energy transition has become increasingly uncertain.** The initial phase of the IRA's implementation resulted in a surge of investments in clean energy, as evidenced by the development of gigafactories, solar manufacturing facilities, and hydrogen hubs. However, the rollback initiated under the Trump administration in July 2025 has led to a reduction in crucial tax incentives and a tightening of regulations for ESG-linked and foreign-owned projects. Nevertheless, momentum persists at the state level: The California, Northeast, and Midwest coalitions are promoting grid upgrades, storage mandates, and the integration of clean energy sources, often circumventing federal ambiguity.tIn Asia, the deployment of clean energy is undergoing a rapid acceleration, spearheaded by China and India. However, both nations are confronted with challenges related to grid integration and storage. China is allocating resources to the development of ultra-high-voltage transmission infrastructure with the objective of mitigating curtailment issues. In contrast, India is undertaking experimental endeavors involving hybrid energy sources and storage-linked tenders. Japan has demonstrated a capacity for balancing offshore wind and liquefied natural gas (LNG), while Southeast Asia has initiated steps towards regional power trading, though this progress is impeded by regulatory fragmentation. In the Middle East and North Africa (MENA) region, there is an observable shift in focus toward the export of clean energy on a global scale. Saudi Arabia, the UAE, Egypt, and Morocco are developing large-scale solar, wind, and green hydrogen projects. Flagship initiatives such as NEOM, Benban, and Masdar aspire to establish the region as a supplier

of green fuels to Europe and Asia, capitalizing on the affordability of land, the abundance of renewables, and the backing of sovereign capital.iIn this context, energy infrastructure has evolved from a mere utility investment to a macroeconomic strategy that involves the reindustrialization of economies, the restructuring of power markets, and the geopolitical reconfiguration of energy flows (Figure 14).

**This transformation is also reshaping how investors approach energy infrastructure as an asset class.** The prevailing paradigm regarding investment categories has undergone a significant transformation, whereby they are now regarded as a multifaceted ecosystem. This paradigm shift has led to the recognition that each subsector within this ecosystem exhibits distinct risk, revenue, and regulatory characteristics. This has prompted a shift from broad thematic exposure to more granular, strategy-driven allocation. Investors are progressively segmenting their portfolios based on the maturity and stability of different energy technologies, their sensitivity to market dynamics, and their alignment with long-term ESG objectives. This more sophisticated approach mirrors the intricacies inherent in the energy transition and underscores the necessity for customized investment strategies that can harmonize reliability, growth, and impact across a rapidly evolving landscape (Table 4).

**Figure 14:** Breakdown of expenditure in the Repower EU chapters towards climate objectives per policy area




Sources: Allianz Research, European Commission

**Table 4:** Key energy-related infrastructure subsectors: risk-return profiles and ESG fit

| Subsector | Risk Profile | Revenue Model | Volatility | ESG Alignment |
|---|---|---|---|---|
| Renewables (solar, wind) | Low–Moderate | PPA or merchant-based | Moderate | Very strong |
| Transmission & grid | Low–Moderate | Regulated return (WACC) | Low | Very strong |
| Midstream pipelines | Moderate | Fee-based contracts | Moderate | Mixed |
| Battery storage | Moderate-High | Ancillary/grid revenues | Moderate-High | Strong-Very strong |
| Vertically integrated utilities | Low–Moderate | Mixed (regulated + market) | Low–Moderate | Strong |

Sources: Allianz Research

# From funding gap to investment core: How private capital is powering the shift

**Private capital has emerged as a pivotal element in the development, financing, and maintenance of infrastructure on a global scale.** In the context of constrained governmental budgets and competing priorities—particularly in the aftermath of the pandemic and a series of economic shocks—many governments are increasingly turning to private investors to help fill the funding gap and deliver critical projects. Consequently, infrastructure has undergone a transition from a domain exclusively funded by taxpayers to a significant investment opportunity for private investors.

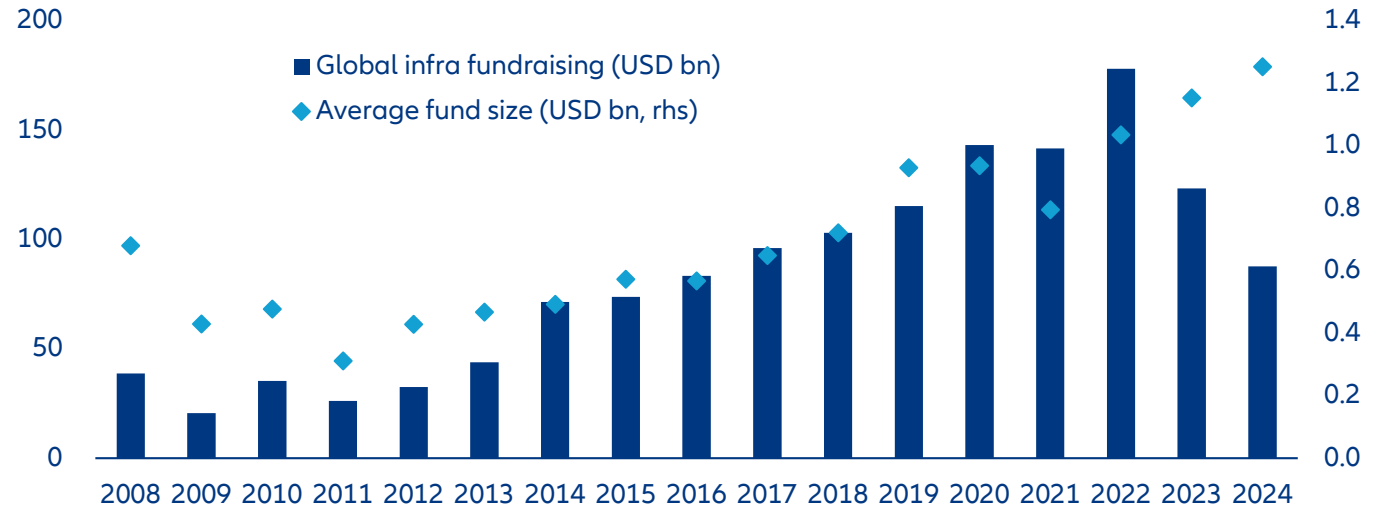
**The role of private capital extends beyond mere provision of capital; it also introduces expertise, long-term planning, and enhanced efficiency in infrastructure delivery and management.** By incentivizing life-cycle cost optimization and innovation in design, private participation has the potential to reduce costs and enhance service quality. When partnerships between the public and private sectors are adequately structured, significant efficiency gains and on-time delivery are often achieved. Private ownership or operation also tends to impose greater accountability and performance monitoring, as investors' returns depend on the asset's success. The involvement of private capital has been demonstrated to result in enhanced project and asset management.

**The scale of private involvement has grown dramatically over the past two decades.** The total amount of unlisted infrastructure assets under management (AuM) has increased significantly on a global scale. In 2009, these assets were valued at approximately USD20bn. By 2024, this figure had grown to more than USD1.5trn. This growth

can be attributed to increased allocations from pension funds, insurance companies, and sovereign wealth funds. Fund vehicles have exhibited a parallel growth trajectory, with the average fund size increasing more than twofold over this period, reaching approximately USD1trn this year. At the same time, annual fundraising has averaged USD95–155bn over the past five years, despite higher interest rates. The scope of deal activity has expanded from conventional sectors such as transportation and utilities to encompass energy transition and digital infrastructure themes. This evolution is evidenced by the prominence of data centers, fiber networks, renewable platforms, and battery storage among the most substantial annual transactions. This rapid expansion indicates that private capital is not only filling existing funding gaps but also reshaping the infrastructure landscape by financing new technologies and business models (Figure 15).

**There are numerous ways in which private capital is involved in infrastructure.** One common approach is public-private partnerships (PPPs), wherein governments engage in collaborative endeavors with private entities to design, finance, construct, and frequently operate assets such as roads, hospitals, and schools. These long-term contractual arrangements generally entail the private partner assuming substantial financial and operational responsibilities in exchange for availability payments or a share of user revenues. The utilization of PPPs has been demonstrated to facilitate the alignment of incentives, the distribution of risks, and the capitalization of private-sector efficiency. This strategic framework is instrumental in ensuring the timely and cost-effective delivery of projects. An alternative approach entails direct investment, thereby affording private investors greater control and the ability to align project characteristics with their specific risk-return profiles. Infrastructure's typically stable, inflation-linked, and long-duration cash flows make it a natural fit for long-term, liability-driven investors such as pension funds and insurers. Moreover, the private infrastructure debt sector has witnessed a surge in prominence, traditionally dominated by banking institutions. In recent years, infrastructure debt funds with a specific focus and institutional lenders have become increasingly involved, especially in projects requiring substantial financing but offering stable returns that are protected against unfavorable outcomes. Infrastructure loans frequently benefit from asset backing and predictable cash flows, rendering them appealing in a rising rate environment. In the wake of diminished lending by banking institutions, private debt funds have capitalized on the opportunity to provide financing for projects under more accommodating terms.

**Figure 15:** Infrastructure capital raised ($ bn) by region

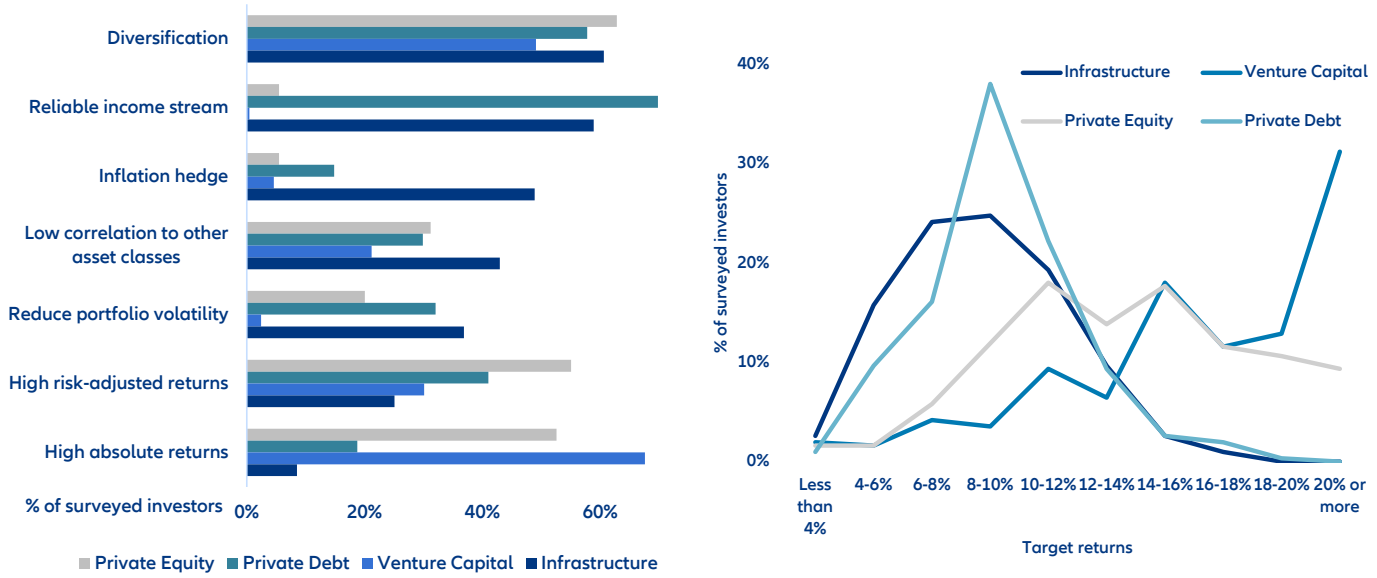



Sources: Pitchbook, Allianz Research

**As the infrastructure market matures, private investors have adopted a more segmented and strategic approach to capital deployment, organizing investments according to risk-return profiles.** Investments in the lower end of the risk spectrum are referred to as core and core-plus investments. These investments center on regulated, income-generating assets with limited market exposure. Examples of such assets include regulated utilities and mature toll roads. These investments offer low volatility and long-term cash flows. Value-add strategies are positioned intermediately, with the objective of implementing operational improvements or asset repositioning to enhance returns. At the higher end of the spectrum are opportunistic investments, including greenfield projects and emerging technologies. These investments offer a greater return potential but also carry higher risk and execution uncertainty. This tiered framework enables investors to align their infrastructure exposure with specific risk tolerances, liability structures, and return objectives.

**The demand for infrastructure from institutions has been shown to be increasingly driven by its defensive characteristics, especially in an environment of heightened macro uncertainty and rising stagflationary risks from tariff policies.** In contrast to the focus on high returns in private equity, infrastructure allocations are primarily driven by the objective of stable cash flows and mitigating portfolio volatility (Figure 16, left). Indeed, high absolute or risk-adjusted returns are among the least cited reasons for infrastructure investment, underscoring its evolving role as a downside mitigator rather than a growth driver. This phenomenon is also reflected in the return expectations of investors, who typically target annual returns within the range of 6% to 10%. This is notably lower than the double-digit returns typically observed in private equity investments (see Figure 17, right). Despite the diversification and increased complexity of investment strategies, infrastructure investing maintains its foundation in fundamental principles: the generation of dependable income, minimal correlation with traditional assets, and resilience through economic cycles.

**Figure 16 & 17:** Motivations among investors for private assets (left) and their target returns distribution (right)




Source: Preqin, Allianz Research

**Indeed, private infrastructure returns have historically exhibited low correlations with other asset classes and have remained relatively stable across various economic cycles.** From 2004 to 2024, private infrastructure exhibited a correlation of 0.48 with global equities and 0.14 with global fixed income (). Over the same period, its annualized volatility was 8%, compared with 17% for global equities, 7% for global bonds, and 17% for listed infrastructure. The study also documented minor drawdowns, with an average return across its ten most unfavorable quarters measuring –2.9%. This performance was benchmarked against global equities, which returned –14.7%, global bonds with –5.2%, and listed infrastructure with –13.9%. In the ten worst equity quarters for global stocks, private infrastructure still delivered an average quarterly return of –0.1%, underscoring its downside resilience. These characteristics persist even under stressed conditions, such as periods of high inflation. Historically, private infrastructure has yielded comparatively stable and positive returns while other asset classes have experienced significant losses, thereby reinforcing its role as a source of downside protection (Figure 18, 19 & 20).

**While defensive characteristics have historically served as a cornerstone of infrastructure investing, secular trends are now contributing to a significant growth acceleration in this asset class.** As the opportunity set expands beyond traditional assets such as utilities and transport, the definition of infrastructure continues to evolve. Key drivers of this evolution include megatrends such as decarbonization, energy security, and digitalization. The proliferation of artificial intelligence (AI), in conjunction with the escalating demand for data storage, is catalyzing an unparalleled surge in data center demand, which has already surpassed supply. It is anticipated that data centers, in conjunction with the broader electrification of end-use sectors, including electric vehicles, will contribute to an annual increase in electricity demand of approximately 3–4% in advanced economies through 2026, thereby reversing decades of stagnation. Moreover, the ongoing efforts to reduce carbon emissions and enhance energy independence are projected to further increase annual expenditures on energy infrastructure. It is anticipated that infrastructure returns will persist within the 8-10% range in the

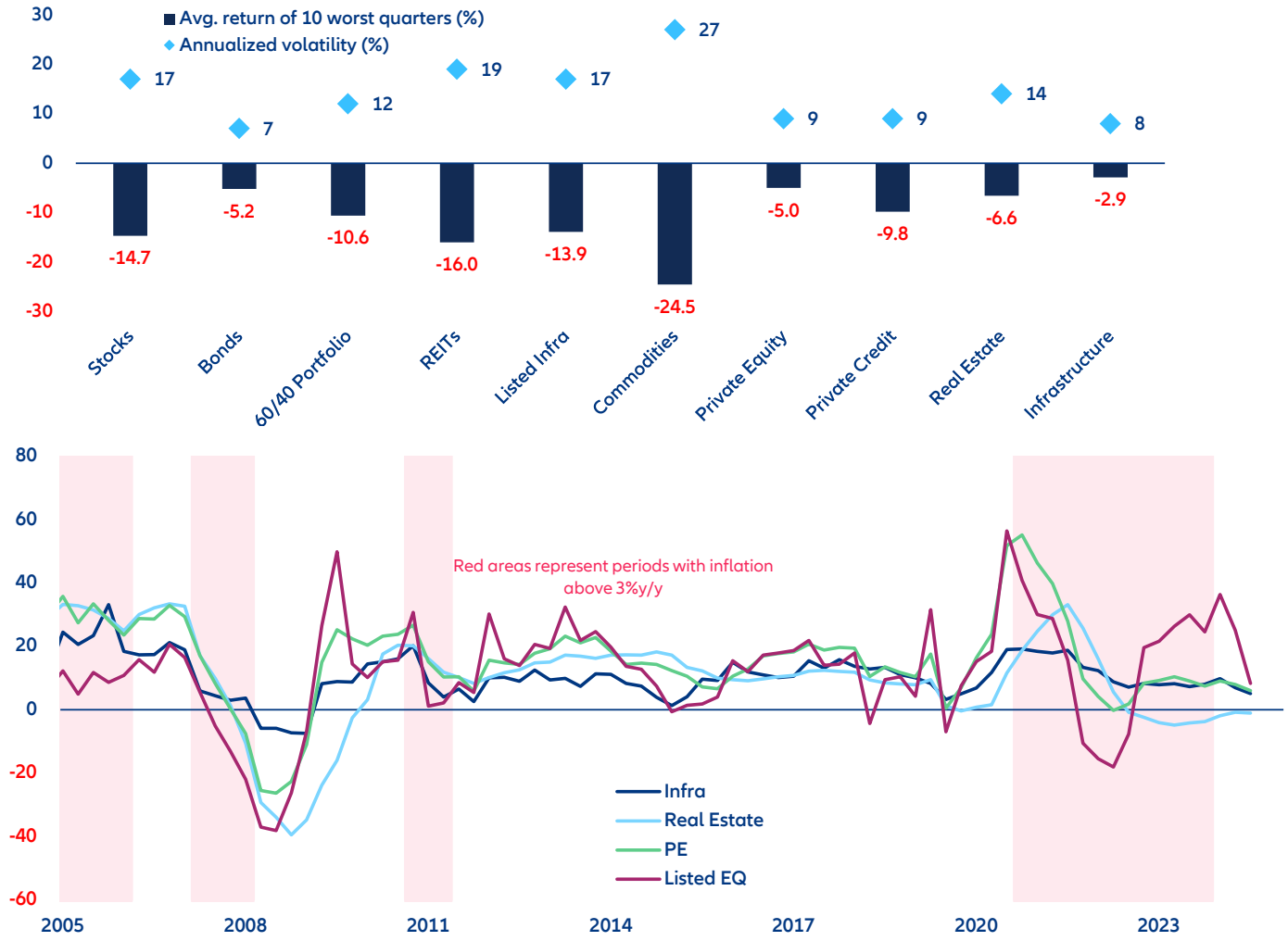
**Figure 18:** Resilient infra returns across economic cycles

| | Stocks | Bonds | 60/40 | REITs | Listed Infra | Commodities | PE | PC | RE | Infrastructure |
|---|---|---|---|---|---|---|---|---|---|---|
| Stocks | 1.00 | | | | | | | | | |
| Bonds | 0.36 | 1.00 | | | | | | | | |
| 60/40 | 0.99 | 0.49 | 1.00 | | | | | | | |
| REITs | 0.77 | 0.37 | 0.76 | 1.00 | | | | | | |
| Listed Infra | 0.87 | 0.47 | 0.88 | 0.79 | 1.00 | | | | | |
| Commodities | 0.49 | -0.06 | 0.45 | 0.29 | 0.53 | 1.00 | | | | |
| PE | 0.78 | 0.12 | 0.74 | 0.68 | 0.70 | 0.47 | 1.00 | | | |
| PC | 0.24 | 0.02 | 0.22 | 0.19 | 0.24 | 0.20 | 0.28 | 1.00 | | |
| REITs | 0.33 | -0.07 | 0.30 | 0.38 | 0.39 | 0.29 | 0.72 | 0.10 | 1.00 | |
| Infra | 0.48 | 0.14 | 0.47 | 0.40 | 0.46 | 0.27 | 0.62 | 0.12 | 0.53 | 1.00 |

Sources: Bloomberg, LSEG Datastream, Cambridge Associates, Allianz Research

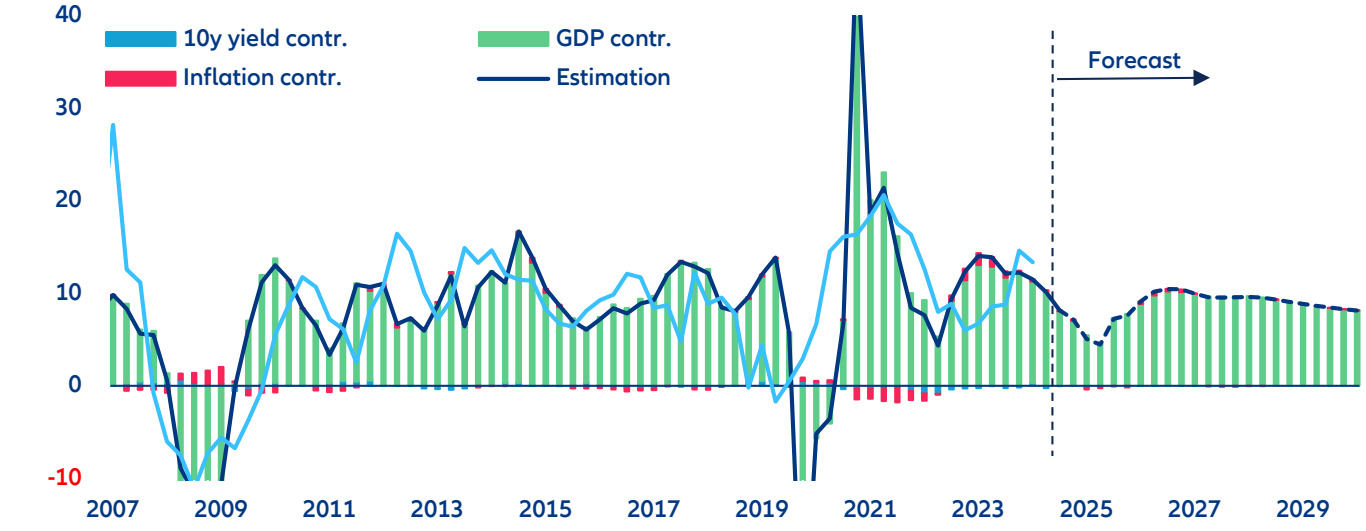
Note: Benchmarks for the asset classes are as follows: Stocks: MSCI ACWI; Bonds: Bloomberg Global Aggregate Bond Index; 60/40: 60% MSCI ACWI + 40% Bloomberg Global Aggregate Bond Index; REITs: S&P Global REITs; Listed Infra: S&P Global Infrastructure Index; Commodities: S&P GSCI; PE: Cambridge Associates US buyout; PC: Cambridge Associates US Senior Lending; RE: Cambridge Associates US Real Estate; Infra: Cambridge Associates US Infrastructure

**Figure 19 & 20 :** Average return by asset class during the worst ten quarters and performance during high-inflation scenarios




Source: Bloomberg, LSEG Datastream, Cambridge Associates, Allianz Research

**Figure 21:** Expected return for US private infrastructure investments (y/y%)




Source: Pitchbook, LSEG Datastream, Allianz Research

**In considering the future of the global infrastructure agenda, it is essential to recognize that the manner in which capital is allocated and the amount of capital mobilized are equally pivotal.** Achieving an annual growth rate of approximately 3.5% of global GDP necessitates the resolution of the binding constraints that have emerged in relation to grids, storage, permits, and institutional capacity. This is particularly salient in EMDEs, where two-thirds of the nonenergy gap is concentrated. Energy constitutes nearly 70% of the total volume of infrastructure transactions worldwide, reflecting a transition from the augmentation of renewable energy generation to the facilitation of system flexibility. In parallel, digital infrastructure confronts a similar physical limitation as artificial intelligence (AI)-driven demand intersects with power shortages.

**Consequently, the objective of reducing the existing gap necessitates a dual realignment.** From a policy perspective, the acceleration of permits, the standardization and derisking of remuneration frameworks, the strengthening of transmission and interconnection planning ("grid-first"), and the scaling of blended finance and risk mitigation tools for EMDEs are fundamental to the transformation of ambition into executable pipelines. From an investor's perspective, the shift from a broad, defensive allocation of assets to a more nuanced, theme-driven strategy will be instrumental in generating returns that demonstrate resilience, with an anticipated range of 8–10%. Absent this alignment, the consequence will be rising system costs, stranded capacity, and widening gaps between stated transition targets and physical delivery. The imminent task is the execution of these strategies, which entails aligning capital, regulation, and system design at the rate dictated by demand growth, climate commitments, and the geopolitical premium on energy security.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Allianz Research encompasses Allianz Group Economic Research and the Economic Research department of Allianz Trade.

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