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Securing critical infrastructure: the two-for-one of green investment

Executive Summary

Pablo Espinosa Uriel
Investment Strategist, Emerging Markets & Alternative Assets
pablo.espinosa-uriel@allianz.com

Jasmin Gröschl
Senior Economist for Europe
jasmin.groeschl@allianz.com

Arne Holzhausen
Head of Insurance, Wealth & ESG Research
arne.holzhausen@allianz.com

Ano Kuhanathan
Head of Corporate Research
ano.kuhanathan@allianz-trade.com

Maria Latorre
Sector Advisor, B2B
maria.latorre@allianz-trade.com

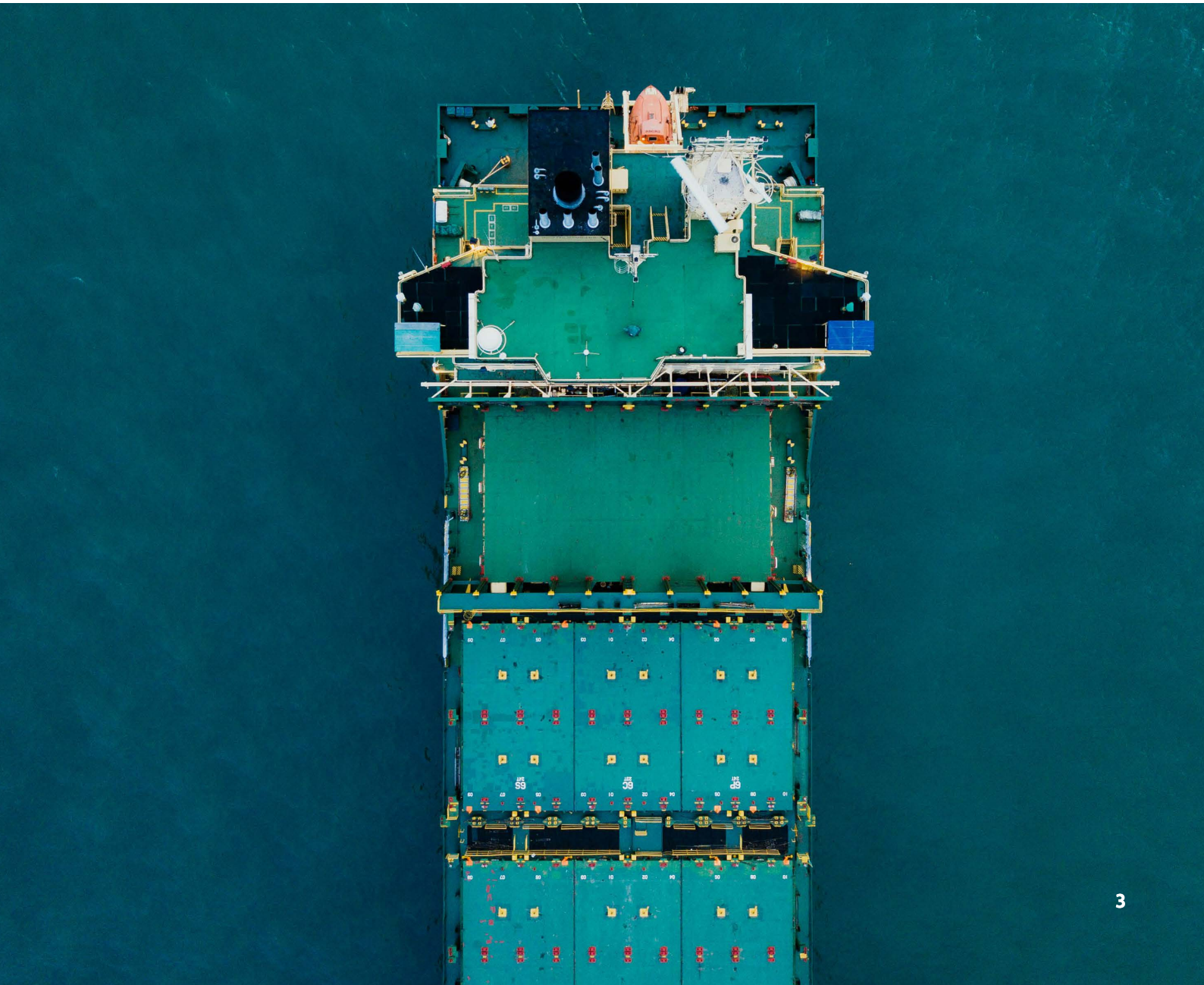
Yao Lu
Sector Advisor
yao.lu@allianz-trade.com

In a world of mounting geopolitical tensions and intensifying climate change, critical infrastructure is particularly at risk of disruption. Recent events have shown how vulnerable industry, energy and transport services can be to conflict or damages from increasingly frequent heatwaves, floods, storms and droughts. Nearly 85% of goods traded around the world are transported by container ships but tensions in the Red Sea have effectively blocked off the Suez Canal, a vital waterway for trade between Asia and Europe. As a result, shipping costs have surged by +92%. At the same time, fluctuating water levels are threatening inland transportation and ports are increasingly at risk from coastal floods. Meanwhile, energy supply is also at risk as power plants and pipelines can come under physical attack or sabotage, while droughts, flooding and storms could also lead to widespread power outages and business interruption, threatening both national security and global economic stability. Direct damages alone from climate change amount to USD30bn a year in high-income countries and USD18bn in low- and middle-income countries.

In this context, the geopolitical risk premium is increasing for both insurance and investments. By the end of last year, war risk insurance premiums for the Red Sea were increased to up to 1% of the value of the ship, from 0.07% before the Israel-Hamas war. Even companies that are rerouting their ships to avoid the area are paying a higher price for longer routes. Similarly, financial markets have reacted by demanding higher returns as the infrastructure investment landscape faces geopolitical risks, inflation, interest rates movements and an overall period of volatility and heightened sensitivity simultaneously.

But there is room for governments, investors and supranational institutions to work on prevention. And making critical infrastructure future-proof will pay off in the long term: adaptation costs are lower than mitigation costs and resilience can be built while we invest towards the green transition. After years of underfinancing that accelerated the aging of infrastructure and created inefficiencies, the tides seem to be changing. The EU has taken steps to build infrastructure resilience, first in the context of the green transition with the plans associated with the European Green Deal and, more recently, with the REPowerEU Plan, adding the focus on energy security. This has not only boosted projects in wind, solar and hydrogen energy (particularly in Germany, France and Spain) but also led to the modernization of the grid. The increased presence of private investors, and renewed interest in Public-Private Partnerships (PPP), also point in that direction. The climate transition holds the key to enhancing infrastructure investments further as resilience can be built alongside green initiatives without much of an additional cost. According to Global Infrastructure Hub, there is an estimated financing shortfall of USD1.5trn for infrastructure investment in Europe, based on infrastructure needs (USD10.6trn) and current investment trends.

But not everything is direct investment: regulatory changes that incentivize infrastructure investments can also have significant impact. The European Banking Authority and the European Insurance and Occupational Pensions Authority could (further) adjust capital requirements to make infrastructure investments more attractive in terms of capital charges or foster the inclusion of ESG guidelines in their lending and investment decisions. EU green bonds could also play a bigger role in boosting infrastructure investments across Europe as their syndicated nature aligns perfectly with the uses of trans-European infrastructure projects. In general, the promotion of blended finance, be it directly (leveraging or extending existing programs, guarantees) or via the creation of clear regulatory frameworks that provide clearer rules of the game, could be a significant step forward to close the (green) infrastructure gap.



From ports to power plants, disruption is the new normal

In a world of mounting geopolitical tensions, cyberattacks and intensifying climate change, critical infrastructure is particularly at risk of disruption. From the drought in the Panama Canal to tensions in the Red Sea, recent events have shown how vulnerable critical infrastructure can be to conflict and climate change. Any disruption to these complex, interconnected systems can have cascading negative effects, disrupting other key services across the global economy and generating a steep economic cost. For example, the potential annual damage to Europe's critical infrastructure from exacerbated climate change is projected to increase ten-fold to approximately EUR37bn by the end of the century.[1] If low water levels continue to slow down shipping in the Panama Canal, global trade could shrink by almost -7% by the end of 2024. On the other hand, any blockages in the South China Sea could increase oil prices by +20%, which would increase prices of other goods, cut productivity, and eat into global economic growth. Besides the immediate impact, infrastructure disruptions can also have long-term consequences on businesses' investments and strategic decisions. In Germany, for example, high energy prices could push companies in energy-intensive sectors to consider relocating. Similarly, unreliable transportation networks could force companies to increase their inventories, raising storage costs and further reducing the capital available for innovation. In this context, it is critical to develop proactive strategies to safeguard infrastructure against potential disruptions.

Ports are especially vulnerable to the increasing frequency of both droughts and coastal flooding. Ports are crucial for the global economy as they handle around 85% of traded goods. China is by far the uncontested global leader, with 2,035 coastal and inland ports (35 major and 2000 minor). It is also home to seven of the 10 busiest ports in the world. Europe is the second most important player in the maritime transport sector, accounting for 23% of port callings. But climate change poses a significant threat to maritime infrastructure. According to the European Environment Agency, without better coastal protection and climate-resilience measures, the frequency of extreme high coastal water levels would increase by a factor of 10 in most European coastlines by 2050 (Figure 1 and Figure 2),[2] with the Northern countries most at risk (Denmark, Northern Germany, Netherlands, Belgium and Northern France). In France, four out of the

[1] Forzieri, G., Bianchi, A., Batista e Silva, F., Marin Herrera, M., Leblois, A. Lavalle, C. Aerts, J., L. Feyen (2018). Escalating impacts of climate extremes on critical infrastructures in Europe, Global Environmental Change 48, 97-107.

[2] Please refer to the following link for more details: Extreme sea levels and coastal flooding in Europe | European Environment Agency's home page (europa.eu)

five most important ports are at high risk of coastal floods. Germany is also struggling with volatile water levels that pose a challenge to inland water transportation, which is critical for the flow of supply chains in the industrial sector. Low water levels risk grounding vessels grounding, while high water levels can prevent travel under some bridges.

This has pushed many companies to turn towards rail and road transport instead, even though they offer lower capacity and, in the case of road transport, can produce more emissions.

Table 1: Top 15 container ports in the EU in 2023 (total container throughput in 1000 TEUs)

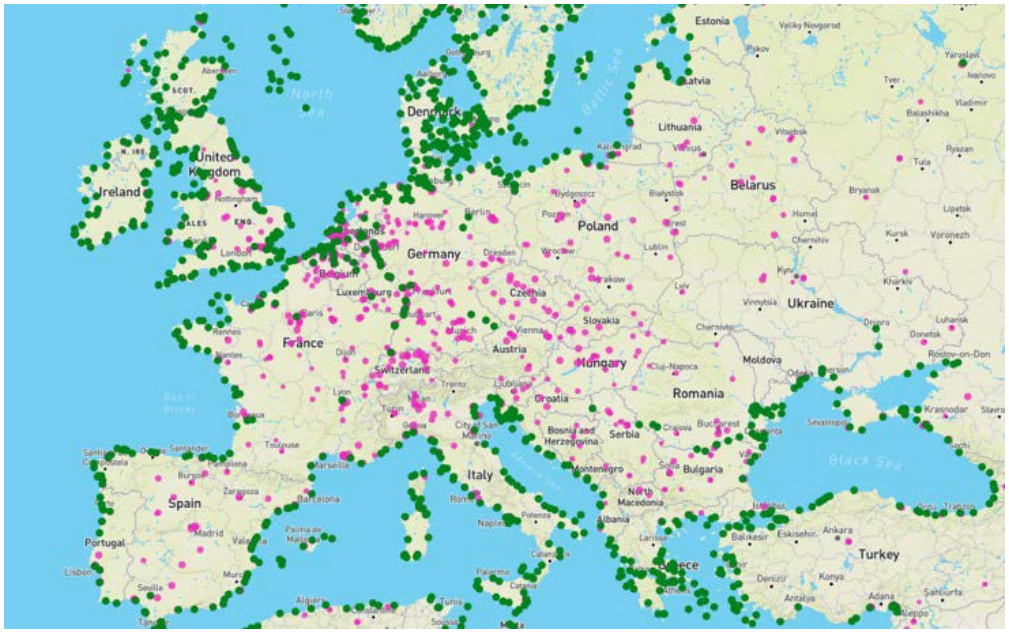
Rank 2023	Port	Container traffic 2023 (in 1000 TEU)	Growth 2022-2023	Growth 2007-2023
1	Rotterdam (NL)	13,447	-7.0%	24.6%
2	Antwerp-Bruges (BE)	12,515	-7.2%	22.7%
3	Hamburg (DE)	7,700	-6.9%	-22.1%
4	Piraeus (EL) (*)	5,100	2.0%	271.4%
5	Valencia (ES)	4,804	-4.9%	57.9%
6	Algeciras (ES)	4,733	-0.7%	38.4%
7	Bremerhaven (DE)	4,181	-8.6%	-14.5%
8	Gioia Tauro (IT)	3,549	5.0%	3.0%
9	Barcelona (ES)	3,280	-6.9%	25.7%
10	Marsaxlokk (MT)	2,800	-3.1%	47.4%
11	Ports of Genoa (IT) (***)	2,741	-2.1%	30.7%
12	HAROPA (FR) (**)	2,630	-15.2%	-6.6%
13	Gdansk (PL)	2,051	-1.1%	2016.4%
14	Sines (PT)	1,665	0.2%	1010.2%
15	Marseille (FR)	1,331	-13.0%	32.7%
	Top 15	72,527	-5.3%	17.5%
	Top 3	33,662	-7.0%	16.6%

Sources: PortEconomics, Allianz Research. (*) Estimate: traffic at Piers II and III amounted to 4.586 million TEU (+5.4%). Pier I traffic is estimated at around 515,000 TEU. (**) Maritime deepsea traffic of ports of Le Havre and Rouen. (***) Includes ports of Genoa, Savona, Vado Ligure and Pra'(managed by the Western Liguirian Sea Port Authority).

Figure 1: Coastal flood risk standard score (1=low risk, 5=high risk)

Sources: Bloomberg (as of 20 June 2024), Allianz Research

Figure 2: Seaports (green) and storage terminals (pink) across Europe



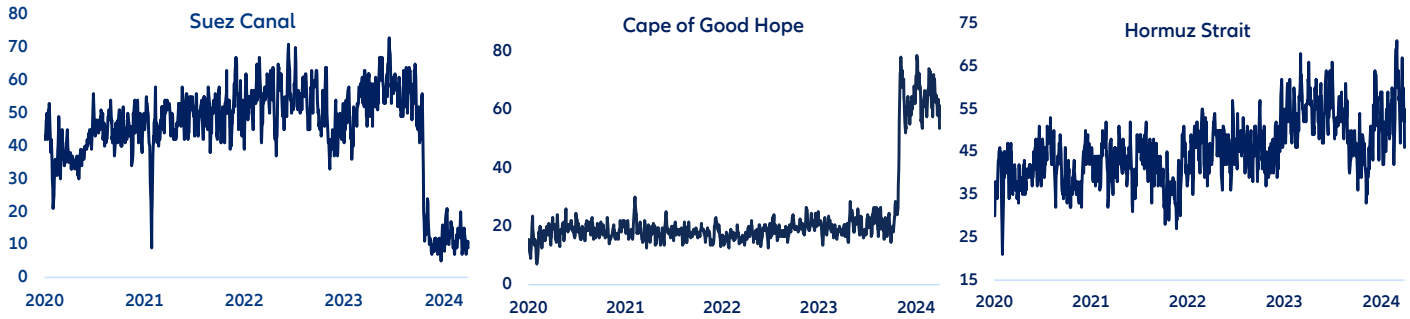
Sources: Bloomberg (as of 20 June 2024), Allianz Research

At the same time, geopolitical tensions have highlighted the risks of maritime chokepoints, with freight rates becoming very sensitive to external shocks. So far this year, Asia-to-Europe shipping rates have jumped by +92% as Red Sea tensions persist (Figure 3), forcing shipping liners to take the alternative route around the Cape of Good Hope. This adds 10 days to the journey, requiring double the amount of bunker oil, and comes with a heavy cost. Nevertheless, sea traffic around the Cape of Good Hope has tripled since the beginning of the Middle East conflict (Figure 4), with remarkable increases for oil tankers and vessels transporting derivative oil products as exporters from Saudi Arabia and Iraq have rerouted their shipments of oil destined for Europe.

Figure 3: Sonicshares Global Shipping ETF

Sources: Bloomberg, Allianz Research

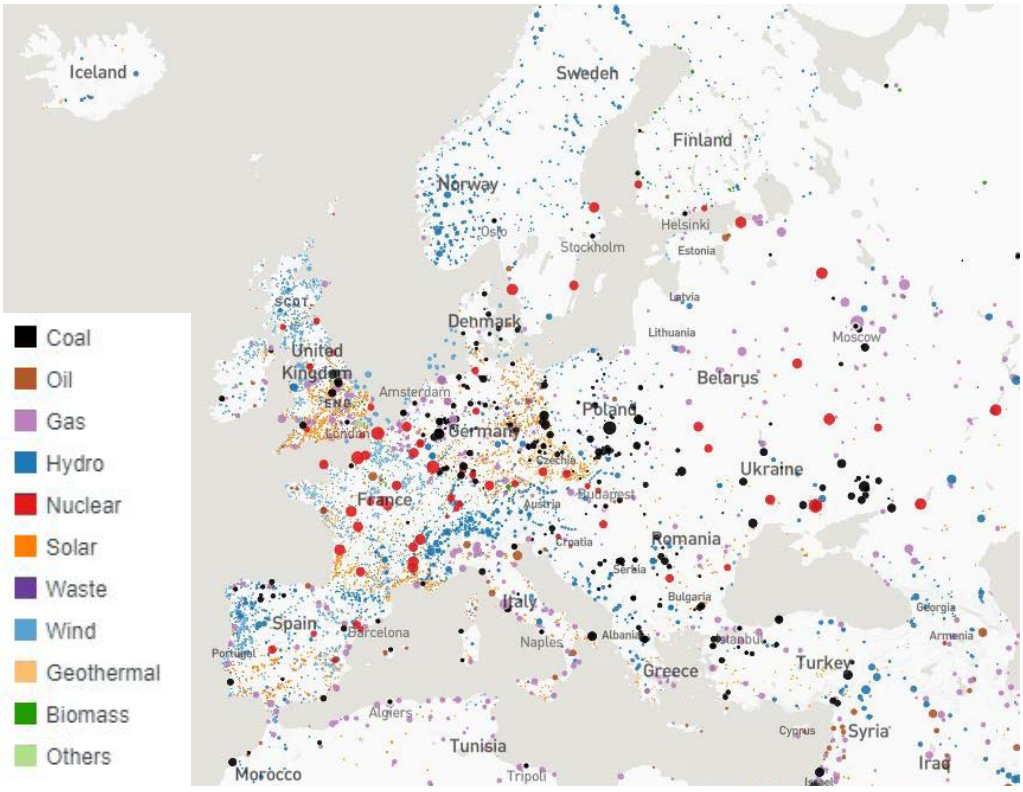
Figure 4: Number of containerships crossing key chokepoints, 7 days rolling



Sources: Bloomberg, Allianz Research

Energy infrastructure is also critical to global economic stability and increasingly facing threats from geopolitical tensions. Geopolitical tensions can disrupt energy infrastructure (Figure 5) through physical attacks and sabotage, as seen in September 2022 when the Nord Stream I pipeline, vital for transporting natural gas from Russia to Europe, was damaged. Although it came at a time when gas flows were interrupted, it still caused significant disruptions in gas markets. Similarly, regional instability in the Middle East threatens global energy supplies since it is a major oil producer. Sabotage can also take the form of cyber-attacks targeting energy infrastructure, as seen in May 2021 when the Colonial Pipeline, a major fuel pipeline in the US, was targeted by a ransomware attack, forcing a shutdown and causing fuel shortages. Geopolitical tensions can also lead to sanctions, with consequences for global oil supply and flows. The ongoing war in Ukraine is the most recent example, with implications for European energy security.

Figure 5: Power plants in Europe



Sources: Global Power Database, Allianz Research

Climate change also poses risks to energy infrastructure. Drought can lead to severe disruptions. For example, California and Brazil recently faced severe drought conditions, which significantly affected hydropower generation (Table 2). In France in 2023, low water levels constrained nuclear power output as water is required to cool down reactors. Flooding and storms are also another important risk, which can damage energy infrastructure. Oil refineries, power plants and LNG terminals are vulnerable to rising sea levels as they tend to be located near the coast.

Table 2: Risk exposure of energy infrastructure

Infrastructure	Drought	Flooding	Physical Attack	Cyber Attack	Heatwave	Rising Sea Level
Hydropower Plants	High	Medium	Low	Low	Low	Low
Nuclear Plants	High	Medium	Medium	Medium	Medium	Medium
Natural Gas Pipelines	Low	High	High	Medium	Low	Medium
Oil Refineries	Low	High	High	Medium	Low	High
Solar farms	Low	Low	Low	Low	High	Low
Wind farms	Low	Medium	Low	Low	Medium	Medium
LNG Terminals	Low	High	Medium	Medium	Low	High
Electric Grid	Low	Medium	Medium	High	High	Medium

Source: Allianz Research

Direct damages to power generation and transport infrastructure amount to USD30bn a year in high-income countries and USD18bn in low- and middle-income countries. But this underestimates the full impacts, which propagate through the consequences of power outages or transport disruptions. Climate-induced phenomena will increase stress on the power system due to the demand for air conditioning and are likely to increase the risk of outages and impact the efficiency energy plants. A 1°C increase in average temperature could reduce power output by a range between 0.45% and 0.85%.[3] Droughts and higher temperatures are also likely to affect the current rating of cables and power lines.

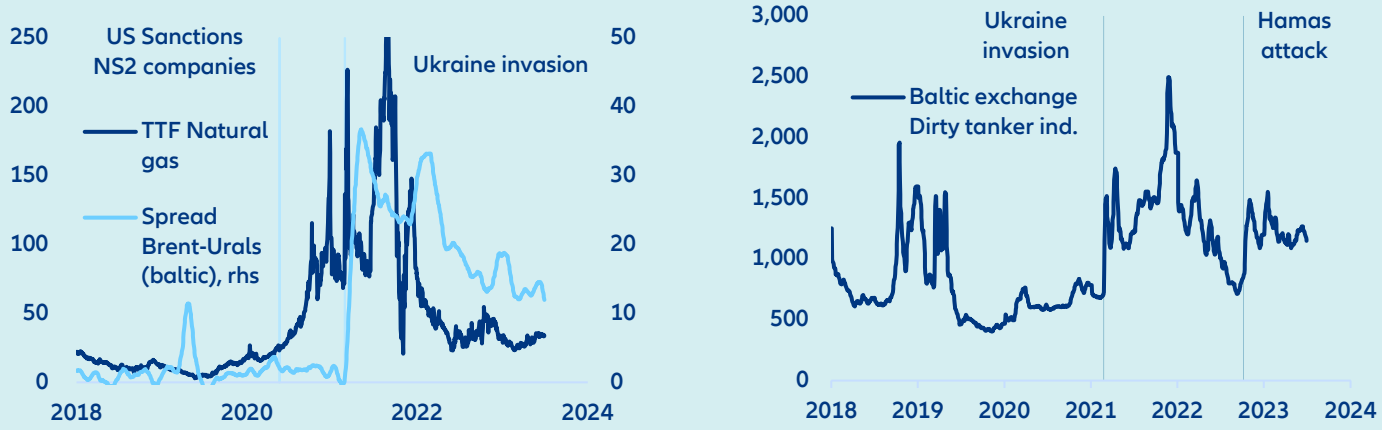
Besides the immediate direct and indirect economic costs, disruptions to energy infrastructure can create longer-term challenges. The major potential indirect costs include higher energy prices, slower economic activity through less production and productivity losses. Long-term losses due to energy infrastructure disruptions may occur as firms lose competitivity and investors/companies decide to locate production elsewhere due to energy uncertainty.

[3] Mideksa, T. and S. Kallbekken (2010). The impact of climate change on the electricity market: A review, Energy Policy 38(7), 3579-3585.

The multiple manifestations of geopolitical risk premium

Investors are becoming increasingly sensitive to the risks of geopolitical disruptions to critical infrastructure, which manifests in multiple ways, from volatility spikes in prices related to the infrastructure to changes in the investment premium. The events unleashed after the invasion of Ukraine have significantly heightened the perceived risk of infrastructure disruptions. Longer cargo trips due to vessels rerouting (Figure 6), being caught in the middle of the trade disputes between China and the US or sanctions against other countries or companies could all lead to higher costs and eventually even halt some projects. In addition, transitioning from one type of infrastructure to another (e.g., from gas pipelines to LNG terminals) also creates short-term imbalances that lead to higher costs: the availability of necessary construction materials, skilled labor and specialized equipment can become constrained. However, these higher costs have multiple dimensions: higher costs of inputs, higher insurance premiums and higher (geopolitical) investment premiums.

Figure 6: Examples of immediate consequences of geopolitical events



Sources: LSEG Datastream, Allianz Research

Rising geopolitical risks are driving up the costs of insuring infrastructure projects. As economies diverge, the legal and regulatory conditions also become fragmented, complicating underwriting and increasing costs at time when supply-chain disruptions make insurance even more crucial. Furthermore, heightened political risks can directly lead to insurers withdrawing from volatile regions. For example, in late 2023, the Joint War Committee (JWC) formed by top insurers, reinsurers and underwriters expanded the "high risk zone" in the Red Sea, which directly translates into higher premiums: At the turn of the year, war risk insurance premiums for the Red Sea were said to have increased up to 1% of the value of the ship, from 0.07% before the Israel-Hamas war. But even for the companies that decide to reroute their ships to avoid the area, the longer routes also translate into higher insurance premia.

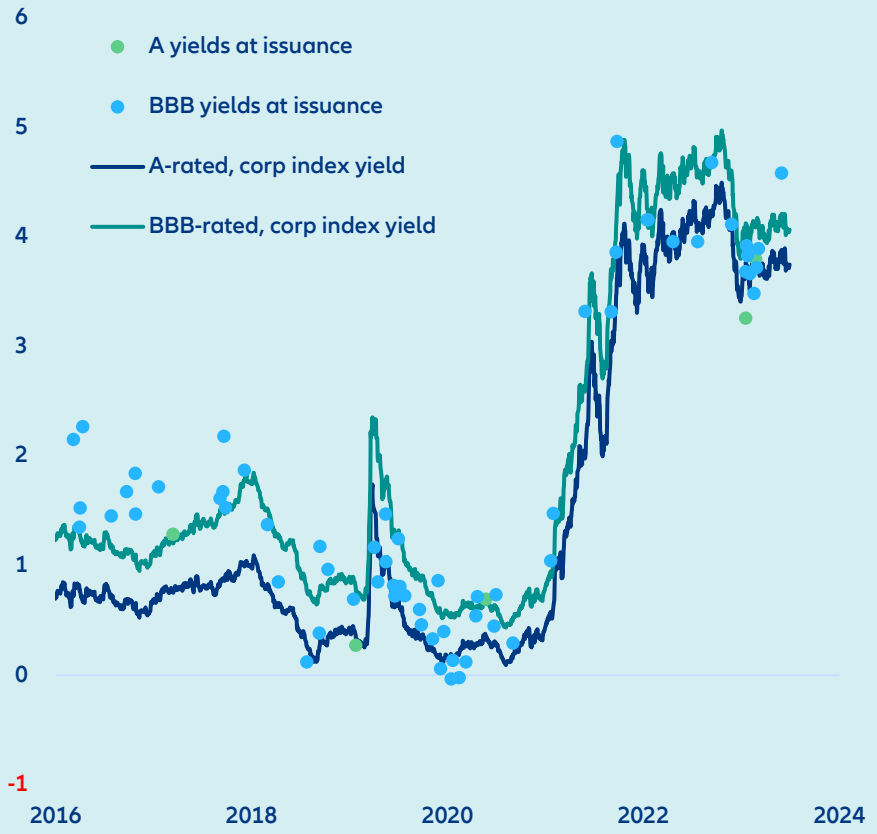
Financial markets often react to such instability by demanding higher returns to justify the increased risk. In the case of infrastructure, there are certain factors that make it especially vulnerable to these risks, often summarized as the "complexity premium". These include the longer shelf-life of projects (which increases the likelihood of the other risks across the project timespan), the involvement of substantial capital investment, the reliance on complex supply chains, being subject to regulatory and political changes, as well as the illiquidity premium. It is not easy to fully disentangle which part of the premium comes from geopolitical risks as they tend to interact with other key factors of infrastructure returns, such as inflation and interest rates[4]. However, looking at yields at inception[5] for a subset of euro-denominated, energy-related infrastructure debt deals, along with the yields of comparable non-financial corporates from 2016

[4] Note that there are also some factors that play in its favor and reduce the premium: lower default risk, diversification potential (low correlation with other asset classes due to its non-cyclical nature), inflation-hedge characteristics and, in some cases, favorable regulatory treatment (e.g. possibility for insurers to apply for reduced capital charges under Solvency II). Many of those advantages are in great part facilitated by the close ties between infrastructure projects and the public sector, which can include, but not necessarily, public guarantees.

[5] Expected returns or income from an investment at the time it is first made.

to 2024 (Figure 7), we can see that premiums were high in the late 2010s and then compressed after the pandemic, converging towards fewer deals and wider variation after 2022. Based on this, we are able to observe the additional infrastructure spread, which reached minimums in 2020 and 2021 and then widened significantly in early 2022, just as the Ukraine invasion unfolded but also coincident with the increase in inflation and interest rates. Similarly, the number of deals sunk significantly. Both trends seem to have receded slightly in late 2023 and early 2024 following the growing optimism of a soft landing, with Germany and Spain showing a steep increase in activity. This observed increase in spreads can partly be attributed to the geopolitical risk premium, particularly influenced by the events surrounding the Ukraine invasion, in contrast to the late 2010s when factors specific to infrastructure financing played a dominant role.

Figure 7: In search for the infrastructure premium: inception yields of infrastructure debt (only utilities) vs. corporate yields (investment grade, EUR)



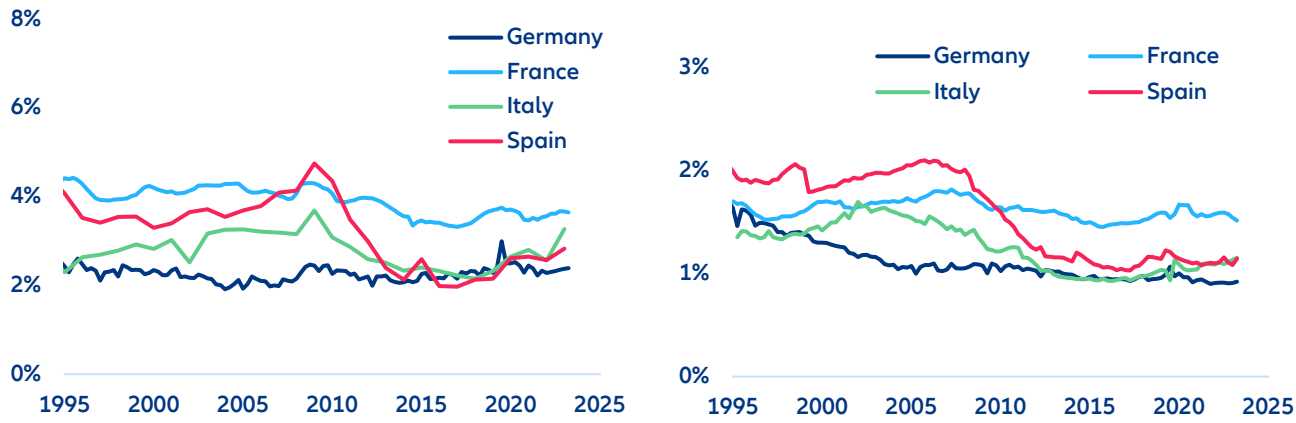
Sources: Bloomberg, LSEG Datastream, Allianz Research. Note: Not adjusted by maturity.

Long-term governmental strategies and interventions can mitigate these effects. Governments may provide cheaper, more available and more flexible credit options to support infrastructure projects. This intervention can lower borrowing costs and mitigate the investment risk premium. The EU's REPowerEU program is a good example. But governments can also lower risk premiums via enhanced protection of critical infrastructure through increased security measures, both in terms of physical and cyber security. This reduces the likelihood of successful attacks and thereby lowers insurance premiums. Insurance schemes backed by government guarantees can also lower premiums by reducing the risk perceived by private insurers. Finally, the establishment of strategic reserves for critical materials and energy sources can provide a buffer against supply disruptions, lowering the overall risk. Diversifying energy sources and supply routes diminishes reliance on any single supplier, reducing geopolitical risk and the associated premium.

The infrastructure financing gap

Infrastructure investment across most EU countries has been anemic, consistently falling below the long-term historical average in recent years. Public capital investment in infrastructure, measured through gross fixed capital formation (GFCF), had declined significantly as a share of output since the early 1990s, a trend that was accentuated after the 2008 crisis (Figure 8). Measured as a share of GDP, public infrastructure investment in France, Italy and Spain fell from the 5-7% range to 3-5% in the 1990s, and to 2-3.5% in the 2010s. Germany, with structurally lower figures, followed a slightly different path post-reunification, but it has remained without major moves on the 2-3% level. Looking at the public and private figures together, the picture is not better (Figure 8, rhs), with Italy and Spain having almost halved their investments since the mid-2000s. This secular decline of investments has meant, on the one hand, not keeping up to date with the latest, more efficient trends, and on the other hand, caused a rapid aging of the existing stock due to the lack of investments.

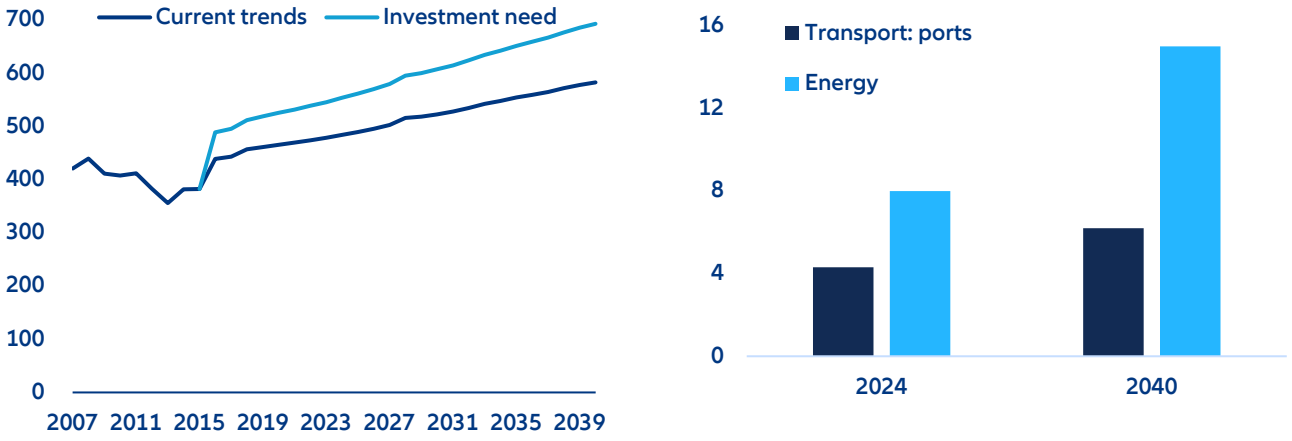
Figure 8: Gross fixed capital formation as % GDP by source: government (left) and by use of the funds: other structures (right)



Sources: LSEG Datastream, Allianz Research. Note: Gross fixed capital formation (GFCF) encompasses various types of capital, not all of which are classified as infrastructure. For government expenditure (on the left-hand side), GFCF is typically used as a representative measure. However, this is not the case for private investments, as GFCF is to a large extent residential housing. Therefore, on the right-hand side, we focus on a specific subset of GFCF referred to as 'other structures,' which includes both public and private investments (split between private and public is only available for few countries). It is important to note that magnitude on the left and right is not directly comparable.

Yet, ramping up infrastructure investment has never been more urgent. According to Global Infrastructure Hub, Europe will need an estimated USD10.6trn for infrastructure investment in Europe from 2024 to 2040 (Figure 9). However, based on current trends, only USD9.1trn is expected to be invested, resulting in a significant financing shortfall of USD1.5trn, which represents 14.3% of the total investment needed. The annual financing gap for ports would range from USD4bn in 2024 to USD8bn by 2040, and from USD6bn to USD15bn for energy.

Figure 9: Infrastructure investment gap in Europe (USD bn): general trend (left) and needs by key sector (right)

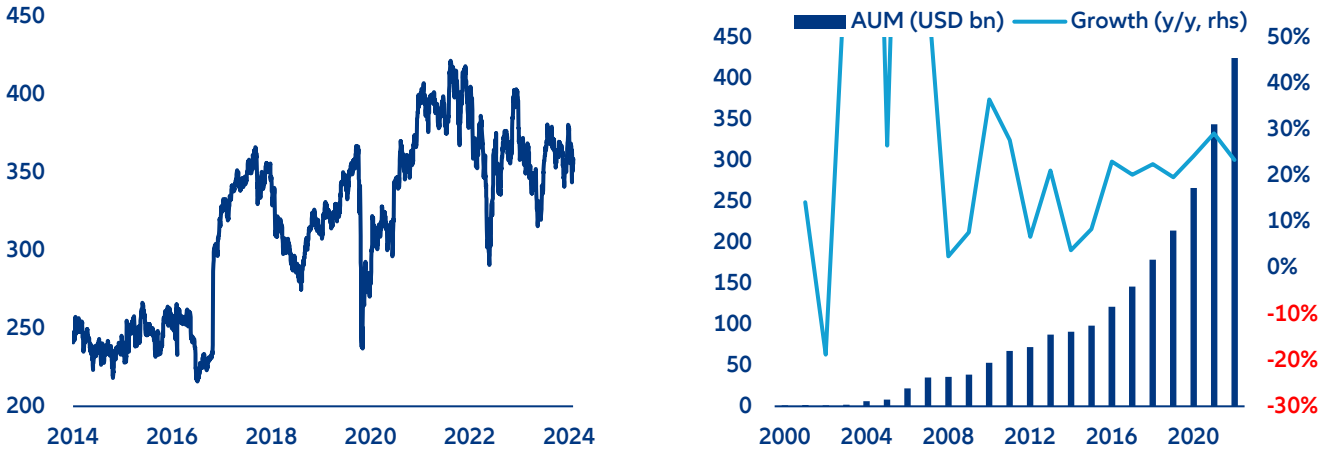


Sources: Global Infrastructure Hub, Allianz Research. Note: calculations are built based on a continuation of current trends. The rest of the gap is made up of needs in other transport infrastructures (mainly road and rail, but also airports), telecommunications and water-related.

The private sector is taking note and significantly increasing its presence in infrastructure investments. For private sector investors, especially those with long-term investment horizons such as sovereign wealth funds, pensions and endowments, infrastructure appears as an attractive investment option given its ability to provide stable and often inflation-hedged returns. As a result, infrastructure has attracted significant investment from the private sector, evolving into a standalone asset class over the past two decades.

On the public market side, there has been notable expansion over the past ten years. The market capitalization of listed infrastructure in Europe, as proxied by the Dow Jones Brookfield Europe Infrastructure Index, increased by +46.8% over the decade, reaching USD363.7bn by the end of May 2024 (Figure 10). This trend is also visible in private investments: As one of the fastest growing asset classes in the private market, unlisted infrastructure in Europe has expanded from merely USD1.4bn assets under management in 2000 to USD425.2bn in 2022, a more than 300-fold surge.

Figure 10: Private sector investment in infrastructure in Europe, market cap of listed infrastructure in Europe (USD bn, left) and private infrastructure assets under management in Europe (right)



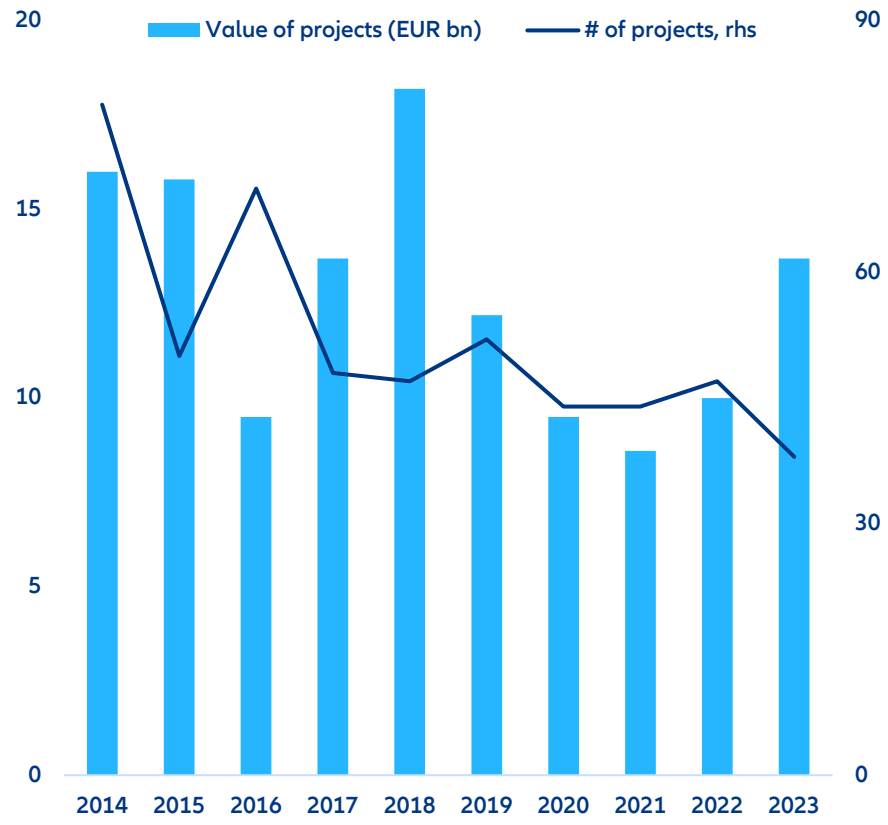
Sources: Bloomberg, Preqin, Allianz Research. Note: Dow Jones Brookfield Europe Infrastructure Index is used as the proxy to reflect the listed infrastructure market in Europe.

However, the public sector faces budget constraints and social impacts that can may delay or derail critical initiatives. These fiscal challenges necessitate coordinated efforts at national and EU levels to secure adequate funding and enhance project efficiency. Meanwhile, the private sector focuses on risk-adjusted returns, often overlooking broader societal benefits. A nuanced approach involving strategic collaboration between public and private sectors is essential to bridge the financing gap for critical, sustainable infrastructure. This will likely require innovative financing, increased government support and long-term investment strategies aligned with global climate targets.

The collaboration between public and private sectors presents an excellent opportunity to narrow the gap if the potential synergies are well managed, and it is especially important in times of geopolitical uncertainties. The public sector can leverage the private sector's expertise to enhance operational efficiency and risk management, while the private sector gains access to a variety of infrastructure projects offering diverse risk-return profiles (from safer core assets with stable returns, to riskier value-added or opportunistic assets). At the same time, public-private collaboration is particularly vital during times of geopolitical instability to prevent against physical and cyber threats facilitates a smooth

management of infrastructure, as opposed to a scenario of a materialization of disruptions that lead to economic losses that ultimately affect both. For the time being, considering the tough financial environment in the last two years, with borrowing costs having doubled vs. 2020, the recent evolution (Figure 11) could be considered as a good starting point, with an increase of 30% vs. 2021 in real terms. As we detail later, the EU has taken different initiatives to promote these types of deals, both through direct investments and through guarantees.

Figure 11: Snapshot of European PPPs



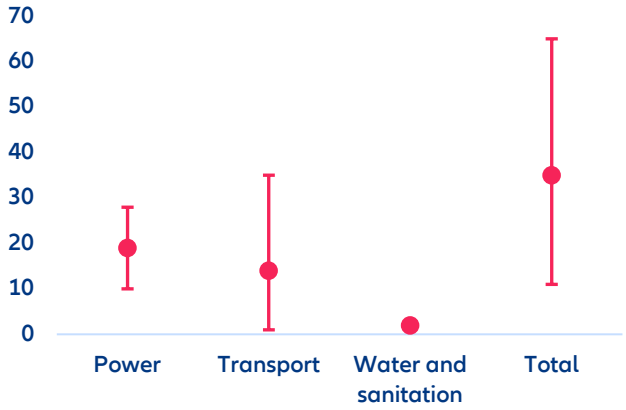
Sources: EIB, Allianz Research. Note: this chart does not include all types of PPPs, only those with at least EUR10mn, that are financed through project finance, and that meet certain conditions in terms of how the public-private relationship is operated.

However, as risks increase, the costs associated with these risks will inevitably impact all stakeholders involved. Higher risk profiles typically push projects up the risk-return spectrum, necessitating increased returns expected by private investors to justify their investment. The extent to which these additional costs can be transferred to end consumers depends largely on the regulatory environment and market dynamics. For assets with higher pricing power, passing on costs might be more feasible, enabling the sustainability of investments despite elevated risks. On the other hand, the public sector often plays a crucial role in absorbing some of these costs, especially for projects that deliver significant societal benefits. This absorption of costs by the public sector helps advance projects that contribute to cleaner energy solutions and enhanced connectivity, fostering broader economic and environmental benefits. By subsidizing part of the investment, the public sector can alleviate some of the financial burdens on private investors and consumers, ensuring that essential projects are not stalled by financial constraints or risk aversion. This balanced approach is essential for maintaining momentum in critical infrastructure development that supports sustainable growth and societal well-being.

Green investment for infrastructure: killing two birds with one stone

The good news is that there is no investment wall: adaptation costs are lower than mitigation costs. The incremental cost of building up the resilience of infrastructure assets is small compared to the benefits. Improving the resilience of assets that are exposed to hazards would increase investment needs in power, water, sanitation and transport by USD11bn to USD65bn a year (Figure 12) but this is far less in size than costs from disruptions. For comparison, the winter storms in Texas 2021 caused widespread power outages, resulting in estimated economic losses of USD 200bn.[6] Adaption finance in Western Europe in 2021-22 was USD4.2bn according to the Climate Policy initiative, which is about a tenth of mitigation costs.

Figure 12: Incremental average annual cost of increasing the resilience of future infrastructure investments based on spending scenarios, in USD bn



Sources: Hallegatte, Rentschler, Rozenberg (2019), Allianz Research; Note: Incremental annual capital cost for more resilient infrastructure for 2015-2030. The upper and lower bars indicate the range on uncertainty about how much will be invested on infrastructure and the technologies chosen.

[6] Reliability and Resilience in the Balance: Winter Storms Report. Texas Section of the American Society of Civil Engineers, 2022.

More importantly, resilience can be built while we invest towards the green transition. The transition towards renewable energy could significantly enhance the resilience of energy infrastructure as it entails shifting from fossil fuels to renewable energy sources, especially wind and solar, coupled with advanced technologies and smart grid systems. The integration of these elements can bolster the resilience of energy infrastructure in several keyways. Firstly, the diversification of energy sources reduces dependency on a single type of fuel, mitigating the risks associated with supply disruptions. For instance, incorporating solar, wind and hydroelectric power into the energy mix can protect not only against the volatility of fossil-fuel prices but also the supply and the geopolitical tensions that they carry. Moreover, renewable energy systems, particularly when paired with storage solutions, can enhance the flexibility and adaptability of the power grid. Technologies such as grid-scale batteries and other energy-storage systems allow for the accumulation of excess energy produced during periods of low demand, which can then be used during peak usage times or when renewable energy generation is low. This is essential for maintaining a stable energy supply and preventing outages. This flexibility can also be achieved through nuclear power plants. Although not a renewable and sustainable source, more nuclear capacity can enhance energy resilience. Furthermore, smart grids can enhance energy efficiency as they use digital technology to detect and react to local changes in consumption, while microgrids, which can operate independently from the main grid, provide localized energy solutions that can continue functioning during broader grid failures. In addition to improving resilience through technological and infrastructural improvements, the energy transition helps mitigate climate change, which is a significant threat to energy infrastructure itself. Doing the transition is also key to reduce risks going forward. Furthermore, end-users from firms to consumers can also participate in the greening and resilience of energy infrastructure through technologies like rooftop PV, heat pumps or even small modular reactors (SMRs) for firms. By rolling-out these technologies, we could decentralize energy generation, making end-users less dependent on a central grid and hence reducing the risk of power outages.

The EU is already taking steps in this direction... Scaling up infrastructure and adapting it to the new realities of i) climate change and ii) digitalization were among the main goals of the post-pandemic fiscal stimulus[7], notably the European Green Deal. The main sources of funding are NextGeneration EU (NGEU) with the Recovery and Resilience Facility as the main instrument. Another initiative worth mentioning in this regard is the InvestEU program (the successor of the Juncker Plan), which although smaller in public budget contribution aims at mobilizing private funds through a facility mechanism that mitigates the risks associated with these kinds of investments by agreeing to cover part of the losses.

...while the invasion of Ukraine and the subsequent escalation of geopolitical risk has also ramped up the focus on infrastructure resilience. Investments are being directed towards securing supply chains and enhancing the protection of critical infrastructure. The REPowerEU Plan[8] marked a significant turning point in the EU's energy strategy, shifting from a primary focus on green energy to a more balanced approach that equally emphasizes energy security. This has not only led to accelerated projects in wind, solar and hydrogen energy (particularly in Germany, France and Spain) but also to the modernization of the grid. The latter, which also includes cross-borders interconnectors, would help to handle the increased loads of renewable sources while at the same time enhancing resilience, distribution and security against disruptions. There have also been efforts directed towards diversifying the European (global) energy supply chain, such as the renovated push for hydrogen (doubling the targets established in 2020 in the EU hydrogen strategy, strengthening the energy links with North Africa beyond gas), the Critical Raw Materials Act[9] (which it directly targets key components needed for renewable energy components, such as batteries) or the impulse to liquified natural gas (LNG) to repurpose some of the gas infrastructure (through the expansion of LNG regasification terminals at ports).

[7] See our piece on the matter, in which we compared them to the US infrastructure stimulus plans: 2021_12_16_Infrastructure-EU-US.pdf (allianz.com)

[8] This plan was launched in response to the geopolitical crisis triggered by Russia's invasion of Ukraine, which highlighted the EU's vulnerabilities due to its heavy reliance on Russian fossil fuels

[9] Read the full analysis here Critical raw materials – Is Europe ready to go back to the future? (allianz.com)

The EU is also reinventing existing tools such as Projects of Common Interest (PCIs) and Trans-European Networks for Energy and Transport (TEN-E, TEN-T) to give them a new focus. PCIs are key cross-border infrastructure projects designed to enhance the interconnectivity, integration and resilience of the EU's energy networks. Launched in 2018, they have evolved to align closely with REPowerEU goals today. These projects are selected based on their potential to significantly impact at least two EU member states, contribute to market integration, enhance the security of supply and reduce CO2 emissions through sustainable development. The selection process involves extensive consultations with stakeholders, including member states, project promoters, and regulatory authorities, and is governed by the Trans-European Networks for Energy (TEN-E) Regulation. PCIs benefit from streamlined permitting processes and access to funding through the Connecting Europe Facility (CEF), which provides financial support to facilitate the development and implementation of these critical infrastructure projects. The current list of projects focuses on electricity interconnection (including offshore grids) but also includes hydrogen pipelines, carbon-capture projects and some gas pipelines in the East Mediterranean. Similarly, the TEN-T is also moving towards projects that prioritize the EU's strategic independence and logistical resilience (not only through the sea), including those that increase port capacity, provide support for alternative energy routes and ensure military mobility through those same corridors.

Regulatory changes that incentivize infrastructure investments can have significant impact. The European Investment Bank (EIB) and the European Investment Fund (EIF) are key in promoting infrastructure investments in the EU, particularly by public-private partnerships (PPPs). As the EU's main lending institution, the EIB provides a wide range of financial products, including loans, guarantees and equity investments, aimed at leveraging private sector capital to meet the large-scale funding requirements of infrastructure projects. The European Investment Fund (EIF), which is part of the EIB Group, complements these efforts by focusing on improving access to finance for small and medium-sized enterprises (SMEs) and supporting smaller-scale projects that contribute to larger infrastructure initiatives. In 2023 alone, the EIB allocated (both public and private funding) nearly EUR66.5bn for high-impact projects within the EU, while the EIF provided EUR14.9bn in financing. In total, the EIB Group mobilized more than EUR11bn worth of investments in Italy, France and Spain, and EUR8.6bn in Germany. Beyond this, the European Banking Authority (EBA), and the European Insurance and Occupational Pensions Authority (EIOPA) can adjust capital requirements to make them more attractive in terms of capital charges or foster the inclusion of ESG guidelines in their lending and investments decisions. EU green bonds could also play a bigger role in boosting infrastructure investments across Europe, as their syndicated nature aligns perfectly with the uses of trans-European infrastructure projects. In general, the promotion of blended finance, be it directly (leveraging or extending existing programs, guarantees) or via the creation of clear regulatory frameworks that provide clearer rules of the game, could be a significant step forward to close the (green) infrastructure gap.

Insurance, partner in resilience

Insurance makes critical infrastructure more resilient. Disruptions to critical infrastructures pose high risks – not least for the insurance sector. The interdependencies can lead to an accumulation of losses that trigger claims in many lines of business, from business interruption to property damage, liability or even in health and life insurance. Therefore, the insurance sector has an inherent interest in making critical infrastructure more resilient. Operational resilience is the key. It is not just about business continuity, i.e. restoring the status quo after an interruption, but also about continuous improvement and adaptation to continue to provide services.

Insurance is a natural partner as a product provider that offers financial compensation after an interruption, but above all as a risk advisor that is already active beforehand. This implies a change of the insurance industry's business model: away from a simple product logic focused on financial compensation towards comprehensive solutions for risk mitigation and prevention, for managing adaptation, mitigation and resilience measures. The result are long-term partnerships for shared expertise and better understanding of risk. This is of utmost importance for the energy transition. De-risking investments is the key for keeping projects bankable and insurable, and thus mobilizing the trillions of euros necessary for the transformation.

The risk-management instruments remain the same, but their application is becoming more challenging in view of the strong interconnectedness. Regarding cyber risks in particular, fundamental improvements are also required, especially better modeling and quantification of cyber risks. In addition to better risk modeling – which could remain inadequate in view of the cumulative effects – further steps include better data collection and a more intensive exchange of information. Pooling risks and transferring risks to the capital markets are also ways of increasing the insurability of cyber risks. Nevertheless, a disruption to critical infrastructure can easily lead to losses that exceed the limits of insurability. Therefore, besides innovative insurance solutions, public-private partnerships are also needed, with the state assuming the role of "reinsurer of last resort", acting as a backstop in the event of a loss that exceeds the capacity of the insurance sector. This ensures that risks can continue to be insured and insurance cover remains accessible and affordable.


Our
team

Chief Economist
Allianz SE

Ludovic Subran
ludovic.subran@allianz.com

Head of Economic Research
Allianz Trade

Ana Boata
ana.boata@allianz-trade.com

Head of Insurance, Wealth & ESG Research
Allianz SE

Arne Holzhausen
arne.holzhausen@allianz.com

Macroeconomic Research

Lluis Dalmau
Economist for Africa & Middle East
lluis.dalmau@allianz-trade.com

Maxime Darmet Cucchiarini
Senior Economist for US & France
maxime.darmet@allianz-trade.com

Jasmin Gröschl
Senior Economist for Europe
jasmin.groeschl@allianz.com

Françoise Huang
Senior Economist for Asia Pacific
francoise.huang@allianz-trade.com

Maddalena Martini
Senior Economist for Italy, Greece & Benelux
maddalena.martini@allianz.com

Luca Moneta
Senior Economist for Emerging Markets
luca.moneta@allianz-trade.com

Manfred Stamer
Senior Economist for Middle East & Emerging Europe
manfred.stamer@allianz-trade.com

Corporate Research

Ano Kuhanathan
Head of Corporate Research
ano.kuhanathan@allianz-trade.com

Maria Latorre
Sector Advisor, B2B
maria.latorre@allianz-trade.com

Maxime Lemerle
Lead Advisor, Insolvency Research
maxime.lemerle@allianz-trade.com

Yao Lu
Sector Advisor
yao.lu@allianz-trade.com

Capital Markets Research

Jordi Basco Carrera
Lead Investment Strategist
jordi.basco_carrera@allianz.com

Bjoern Griesbach
Senior Investment Strategist & Eurozone Economist
bjoern.griesbach@allianz.com

Pablo Espinosa Uriel
Investment Strategist, Emerging Markets & Alternative Assets
pablo.espinosa-uriel@allianz.com

Insurance, Wealth and Trends Research

Michaela Grimm
Senior Economist, Demography & Social Protection
michaela.grimm@allianz.com

Patrick Hoffmann
Economist, ESG & AI
patrick.hoffmann@allianz.com

Hazem Krichene
Senior Economist, Climate
hazem.krichene@allianz.com

Patricia Pelayo-Romero
Senior Economist, Insurance & ESG
patricia.pelayo-romero@allianz.com

Kathrin Stoffel
Economist, Insurance & Wealth
kathrin.stoffel@allianz.com

Markus Zimmer
Senior Economist, ESG
markus.zimmer@allianz.com

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Director of Publications
Ludovic Subran, Chief Economist
Allianz Research
Phone +49 89 3800 7859

Allianz Group Economic Research
https://www.allianz.com/en/economic_research
http://www.allianz-trade.com/economic-research
Königinstraße 28 | 80802 Munich | Germany
allianz.research@allianz.com

@allianz

allianz

Allianz Trade Economic Research
http://www.allianz-trade.com/economic-research
1 Place des Saisons | 92048 Paris-La-Défense Cedex | France
research@allianz-trade.com

@allianz-trade

allianz-trade

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