

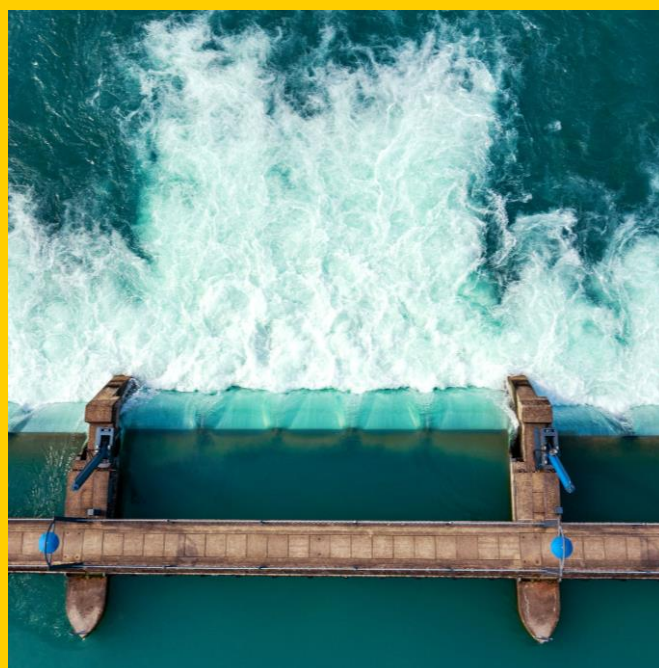
BlackRock

Climate resilience: an emerging investment theme

Moving beyond risk assessments to climate resilience as an investment theme.

**BlackRock
Investment
Institute**

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Summary

- The impact of climate change is being increasingly felt worldwide: in recent years, we've seen more frequent extreme weather events, rising global temperatures and ballooning spending on disaster recovery. **We're seeing a growing response across businesses, governments and society to address climate change on two fronts.** First, by building resilience to it – the focus of this paper. Second, by limiting it by transitioning to a low-carbon economy – one of five mega forces we see shaping markets and economies.
- Climate change is expected to continue over coming decades, no matter how the low-carbon transition unfolds from here. The result? **Climate-related damages are set to keep mounting in coming years.** It's difficult to put a number on the impact on human health and wellbeing – but the quantifiable economic damage is already growing fast. Our research suggests climate-related economic damages could detract about 5% from global GDP by 2050, varying widely by region.
- We think that means extensive investment will be needed in products and solutions that build climate resilience. Climate resilience refers to **the ability to prepare for, adapt to and withstand climate hazards and to rebuild better after climate-related damages.** Think early monitoring systems to predict floods, air conditioning to better cope with heatwaves, or retrofitting buildings so they better withstand extreme weather. It is distinct from decarbonization, or limiting future warming by reducing emissions.
- We expect demand to grow for products and services that increase resilience and help society assess and manage risks. Some market growth is already evident – and we think policy, regulation and markets will spur more. We also expect greater spending on rebuilding after climate disasters. **As this market grows, we see climate resilience emerging as a new investment theme.**
- Defining this emerging investment theme is complex, as it spans different types of responses such as early warning systems, climate technology and building materials to help protect against disparate types of climate hazards across sectors. **We divide climate resilience into three sub-themes: 1) assessing and quantifying risks, 2) managing risk and 3) rebuilding physical infrastructure.**
- Investing in climate resilience is both distinct from and complementary to investing in the low-carbon transition for several reasons, in our view. One reason is sector exposure: **we see investment opportunities in resilience solutions spanning sectors, including some subsectors underrepresented in typical transition exposures – such as healthcare, water utilities and professional services.**
- We believe there are opportunities to invest in climate resilience solutions across public and private equity and debt. **We think financial markets may be underappreciating the prospects for companies that enable climate resilience.**
- In public equities, we use our proprietary resilience metric to identify companies enabling climate resilience and define a broad investment universe. Combined with further analysis, this allows us to generate a concentrated thematic basket – our preferred approach given the many uncertainties around this new theme. Regardless of the portfolio approach taken, we find that, **in public equities, even a narrow definition can generate exposure to a broad spectrum of industries and sectors.**

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Climate risk: here and now

The effects of climate change are materializing now: multiple records have been broken in recent years, with average sea and surface temperatures hitting repeated new highs and Antarctic sea ice coverage shrinking to its smallest on record earlier this year, according to [NASA](#).

These are not one-offs that simply revert: climate change is manifesting as constant and gradual shifts over decades, the IPCC [reports](#). We're witnessing persistent increases in average annual temperatures, precipitation and sea levels. Climate change is also triggering acute weather events like extreme heat, widespread floods, wildfires and severe drought – and we've seen an [increase](#) in their frequency and intensity over recent years. Recent [advances](#) in “climate attribution science” are increasingly making it possible to quantify the extent to which such events are the result of climate change.

Climate-related events primarily affect human health and well-being – the economic cost of which is difficult to quantify. The economic damage that can be quantified is already material – and growing. The number of events with inflation-adjusted damages above US\$1 billion has steadily increased over the past roughly four decades. See the chart top right. The U.S. hit a record number of such events just nine months into 2023. Climate damages can disrupt economic activity and result in productivity losses. Take, for example, low water levels in the Panama Canal and Europe's River Rhine, due to droughts, that have at times [slowed](#) shipping activity. We also saw a [pullback](#) in nuclear power production in France last summer due to high water temperatures resulting from extreme heat.

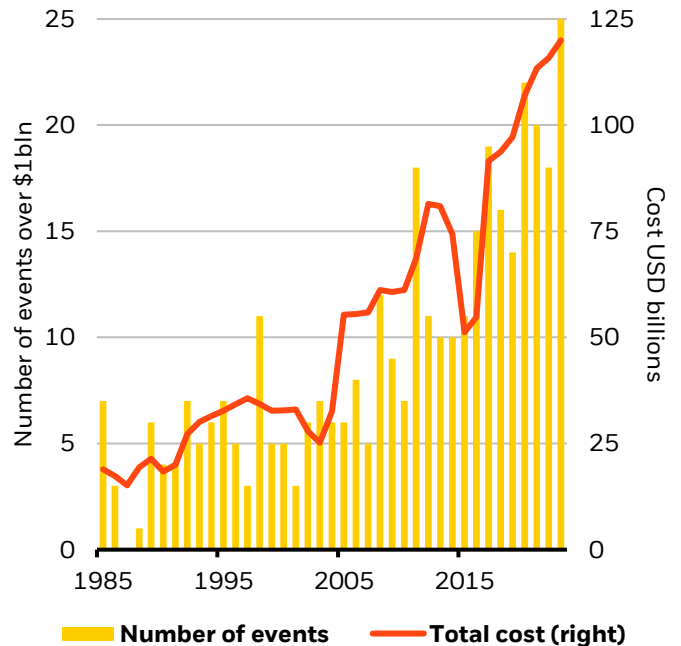
Yet impacts – economic and beyond – are set to keep increasing as most scientific institutions [expect](#) climate change to continue in the near term, regardless of the speed of the transition to a low-carbon world. The amount by which global temperatures rise over the next 10 years is nearly identical across the range of scenarios assessed by organizations such as the Intergovernmental Panel on Climate Change. See the chart below right. Longer term, a faster transition could limit climate risk and damages.

Our BlackRock Investment Institute Transition Scenario (BIITS) informs an assessment, on behalf of clients, of how the [low-carbon transition](#) is most likely to play out based on what we know and expect today – and the potential portfolio impact. The BIITS suggests that climate-related physical damages could detract more than 5% from GDP by 2050.

It also shows that emerging markets are likely to bear the major share of those losses. Why? Many are in tropical latitudes that are vulnerable to climate-related events and have fewer resources to invest in resilience solutions like upgraded infrastructure and early warning systems. They [typically](#) have less access to protective infrastructure, healthcare and insurance – and tend to be highly reliant on climate-sensitive sectors like agriculture.

Real physical damages mount

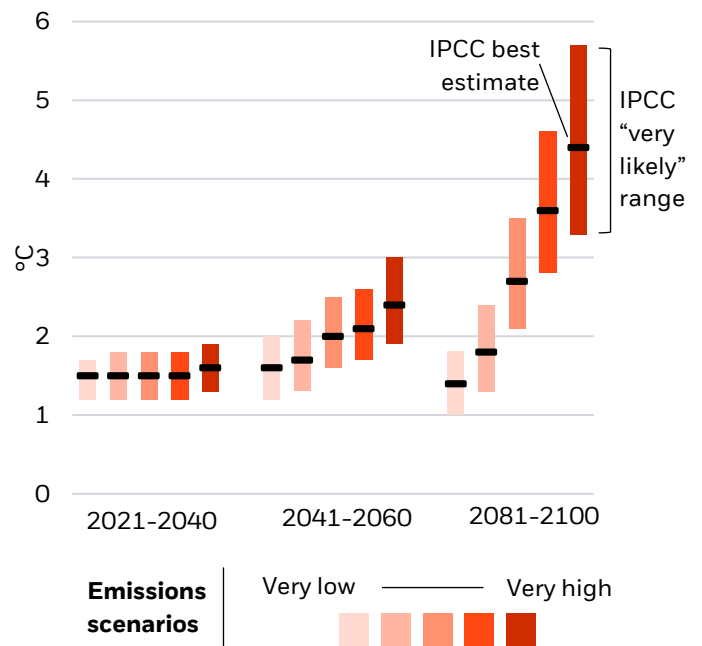
U.S. events with inflation-adjusted losses over \$1 billion



Sources: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2023), data as of November 2023. Notes: The yellow bars show the number of climate events with losses greater than US\$1 billion. The data include droughts, flooding, severe storms, hurricanes, wildfires, winter storms and freezes. The orange line shows the total cost as a ten-year moving average. The data are adjusted for inflation using 2022 dollars. All currency figures are in USD.

Rising temperatures

Global temperatures under different emissions scenarios



BlackRock Investment Institute and Aladdin Sustainability Analytics, with data from the IPCC Sixth Assessment Report Working Group 1 Summary for Policymakers, December 2023. Notes: The chart shows estimated increases in average global surface temperatures vs the 1850-1900 reference period over three different time horizons for five climate scenarios laid out by the IPCC. Black lines represent the IPCC's “best estimate.” Colored error bars represents an uncertainty range estimated by the IPCC as “very likely” (a probability of 90-100%). These scenarios cover a range of possible outcomes but there is no assessment of the likelihood of individual scenarios

Resilience: a growing market

We are already seeing early signs of increased demand for resilience solutions – products and services that help companies, households and economies anticipate, prepare for and cope with climate-related events. For example, consumers are increasingly seeking out solutions that help them cope with warmer temperatures and poorer air quality. A case in point: Demand for home air-filtration appliances in the northeastern U.S. [spiked](#) during the Canadian wildfires in early 2023. As the chart shows, air conditioner sales are also increasing. As temperatures climb, more and more U.S. households and firms are likely to install air conditioning, including in areas where a cooler climate has typically made it less prevalent, like northwestern and far northeastern U.S. Growth is expected to be even greater in other countries where heatwaves are becoming more frequent and air conditioning is less common. For example, only 19% of European households have air conditioning, up from 10% in 2000 and compared with 78% in North America, International Energy Agency [data from 2022 show](#).

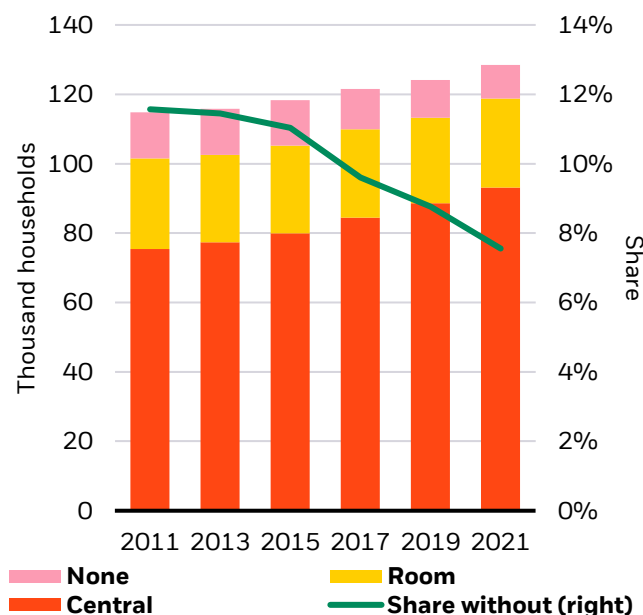
Disaster aid in the U.S. has reached record levels in recent years, driven both by increasing numbers of extreme weather events and by huge Covid-related spending. The five-year running average in the U.S. has now reached over \$25 billion a year, including pandemic spending, or \$15 billion a year excluding it – five times, or three times respectively, the amount it was spending a decade ago, according to Federal Emergency Management Agency 2022 estimates. Should the recent trend persist, the cost of disaster rebuilding in coming years could reach levels akin to the \$39 billion of energy investments linked to the more widely discussed [U.S. Inflation Reduction Act](#).

What’s clear: it’s likely to take extensive investment in coming years to build society’s resilience to growing climate impacts – and we see potentially attractive investment opportunities from doing so. Sizing the opportunity requires answering two key questions, in our view: What’s the growth potential in the likely market for resilience-related products and services? How much growth have markets already priced in? We see both growth and pricing creating investment opportunities.

We also see policy, regulation and economic forces driving market growth for resilience products. U.S. public spending on climate resilience includes US\$50 billion from the Infrastructure Investment and Jobs Act and over US\$20 billion from the Inflation Reduction Act. Other policy support comes from building code updates in the [U.S.](#) and the [EU](#) that explicitly focus on improving climate resilience or, in Asia, the [AIIB](#)’s bond issue specifically targeting resilient infrastructure. Regulatory disclosure requirements may also catalyze resilience investments – for instance, jurisdictions around the world are [mandating](#) climate risk disclosure for firms, and adapting to climate change is one of the six environmental objectives of the EU Taxonomy introduced in 2021.

Keeping cool

U.S. household air-conditioning, 2011-2021



Sources: BlackRock Investment Institute and U.S. Census, with data from the American Housing Survey, December 2023. Notes: The chart shows the number of U.S. households that have air conditioning installed either centrally and covering the whole home (red bars) or in an individual room (yellow bars), as well as the number (pink bars) and share (green line) of households that do not have any type of air conditioning.

Markets are starting to price in physical risks, as a recent [review](#) by the Bank of International Settlements found. As market participants become more attuned to the impacts of extreme weather, they are seeking to reduce their exposure to related losses.

For example, energy companies, insurers and financial investors are increasingly utilizing weather derivatives, investment contracts whose payoff is determined by weather variables like temperature, precipitation, snowfall or wind. Data compiled by [Reuters](#) shows that open interest in weather derivatives is rising and reached new monthly highs of 200,000 contracts in 2023, a fourfold increase in just a year. Another example is insurance markets. In Florida, annual property insurance payments [rose](#) to an average of \$4,200 in 2022 – triple the U.S. average – as several insurance providers pulled out of the market. Yet our [assessment](#) of U.S. municipal bond and publicly listed utilities found that those risks are still largely underpriced, presenting possible investment implications, in our view.

As markets better price in risks, we expect they will also start pricing in growth in demand for resilience solutions (see next page). In our view, this will be driven both by projected revenue growth and by investor sentiment, as investors with sustainability objectives increasingly recognize resilience as a theme driving sustainability outcomes.

Defining the opportunities

Much of our past climate modelling and analytics has been focused on understanding and quantifying physical risk. We recognized that investors increasingly needed tools that could allow them to quantify and incorporate climate risks in their portfolios. We now have a much better understanding of those risks – and how to assess them. We continue that research, but we also now expand it. We have developed a new framework that helps define resilience solutions, which enables us to better identify investment opportunities, as we explore on the next page.

Up to now, climate resilience has largely been considered a financial risk issue and an area requiring public finance – and less an area ripe for private investment. Yet public financing is still well below investment needs, particularly in infrastructure and in emerging markets. We believe capital markets can play a role in plugging part of this investment gap, notably when it comes to financing products and services that provide climate resilience. Yet what might be considered an investment in climate resilience is not straightforward: different types of climate risk warrant different responses, and they can vary further still across sectors. As a result, myriad taxonomies have been developed by different organizations and firms as an effort to categorize resilience as an investment theme.

We distinguish between activities that *prepare* for climate damage and those that *repair* it. Resilience infrastructure (bright yellow sections in the table below) is largely the purview of public finance, so we focus on investment opportunities in resilience solutions (light yellow sections), grouping them under three key subthemes:

- **Prepare: Assess and quantify risks:** Here we include products and services that help monitor conditions like air or water quality, predict imminent disasters and enable immediate action.

- **Prepare: Manage risks:** This category refers to solutions that: 1) help prepare for climate impacts; 2) ensure resilient and reliable supply of essentials like water, food and energy; and 3) improve quality of life. It also includes solutions in the fields of disaster preparedness and recovery.
- **Repair: Built environment:** In this category, we include activities to upgrade physical structures – like buildings, energy grids, water supply – so they are more resilient to climate-related events. Not all rebuilding adds resilience; in some cases they may actually reduce it. So, it's key to differentiate here.

The table below provides some examples of products and services for each subtheme. We believe they are likely to benefit – to varying degrees – from the growing demand for climate resilience. We think markets likely underappreciate the extent of that growth in demand, creating potential investment opportunities.

Investing in climate resilience is complementary to investing in the low-carbon transition for several reasons, in our view. One reason is sector exposure: we see investment opportunities in resilience solutions spanning sectors, including some subsectors underrepresented in typical transition exposures – such as healthcare, water utilities and professional services. We recognize some aspects of investing in climate resilience may be at odds with investing in the low-carbon transition. For example, the manufacture or operation of some resilience solutions may generate emissions, like production of cement for sea walls. Investors with transition-related goals can seek out synergies across the two themes – for instance, power grid stability and batteries, or energy-efficient heating, ventilation and air conditioning that could benefit as the grid decarbonizes.

Example resilience activities by category

	PREPARE: Assess and manage risk		REPAIR: (Re)Build smarter	
Type	Resilience solutions			Resilience infrastructure
	Assess & quantify risks	Manage risks	Built environment	
Asset classes	Public equity, private equity, corporate credit			Municipal/sovereign bonds, real assets, project finance
Examples	<p>Monitoring: air quality sensors, weather stations, satellites</p> <p>Analytics: weather forecasting, early-warning systems, climate risk analytics</p> <p>Business intelligence: supply chain analytics, industrial production and operations</p>	<p>Food/ag.: precision agriculture technology, drought-resistant crops, aseptic packaging</p> <p>Health: cold/cool item transportation, disease surveillance, remote healthcare (telehealth)</p> <p>Risk transfer: parametric insurance*, weather derivatives</p>	<p>Construction: heating, ventilation and air conditioning; weather-resistant materials and paints</p> <p>Water supply: on-site harvesting/recycling, smart water meters</p> <p>Energy supply: on-site generation and storage</p>	<p>Flood protection: seawalls, levees, stormwater management</p> <p>Water supply: treatment, storage desalination</p> <p>Energy supply: distributed grids, microgrids, storage, weatherized infra</p>

Source: BlackRock Investment Institute, Aladdin Sustainability Analytics, December 2023. Notes: The table is for illustrative purposes and is subject to change without notice.

*Parametric insurance is insurance that pays out a prespecified amount if a given event occurs, as opposed to an amount based on the actual losses incurred.

Moving to implementation

Implementing this emerging investment theme in portfolios requires a solid understanding of climate risks and how they might evolve. That helps investors form a view on which resilience solutions and companies are most likely to see growth.

We think investors need tools that allow them to carry out such an assessment. As an example, BlackRock’s Aladdin Climate models how climate-related hazards – tropical cyclones, wildfires, extreme temperatures – and their related damages may impact asset values, business continuity and labor productivity. We then use asset valuation models to calculate the financial impacts at the security and portfolio levels under different climate scenarios. Investors use these insights to evaluate the impact on valuations of publicly traded securities, including municipal bonds and mortgage-backed securities, as well as for ongoing risk monitoring.

Climate analytics can help us establish what corporate investment needs and priorities might be in terms of insulating business operations from specific climate impacts. For example, extreme heat and drought strain agricultural yields – so companies or regions that are particularly exposed to that risk may invest heavily in crop protection solutions. Through this analysis, we can build a picture of where we see market opportunities for resilience solutions.

We believe there are opportunities to invest in climate resilience across public and private equity and debt. In public equity, we find them by first identifying companies enabling climate resilience. This is not always obvious as those companies don’t typically market their products specifically as “climate resilient”, and existing datasets don’t yet explicitly capture exposure to climate resilience. We have developed our proprietary resilience metric, taking a data-driven approach and using both revenue-based metrics and natural language processing – into which we input our definitional framework.

This metric provides a systematic way for us to identify companies involved in the activities identified in our framework as resilience solutions (excluding infrastructure, since that’s typically the purview of public finance). This helps to define a broad investment universe for climate resilience. We then apply research and fundamental expertise to inform our view and look at company fundamentals to validate our findings.

We can use our proprietary resilience metric in portfolios to gain broad-based exposure to climate resilience, tilting into companies that score well on our metric, and we can adjust thresholds and weights based on conviction and client choice.

We can also use the investment universe as the starting point for further analysis of company fundamentals and the application of investment criteria to generate a concentrated thematic basket. We like the fundamental thematic approach for resilience, since resilience is still an emerging theme with many uncertainties. That’s why it takes deep industry knowledge and research to pick suitable stocks – making this theme fertile ground for potential opportunities for portfolio managers with access to thematic and sector expertise.

Regardless of the approach taken, we find that, in public equities, even a narrow definition of resilience would speak in favor of getting exposure to a broad spectrum of industries and sectors. Materials and industrial sectors are likely to feature more heavily given the physical requirements of adapting buildings and infrastructure. The utilities and energy sectors have a dual role to play: they are adapting both to decarbonize and to be more resilient to climate events.

Technology is another sector with an outsized role: connectivity and communication are crucial to predicting and responding to weather events and to monitoring environmental conditions.

Climate resilience solutions in practice

Category	Climate risk	Resilience opportunity	Example company solution
Prepare: Assess and quantify risks	Water shortages and reliable supply: In many advanced economies, water utility and supply infrastructure is decades old and not equipped to be regularly stressed by heatwaves, flooding and unseasonal precipitation.	Innovative technology: U.S. water meter producers are monitoring source water quality so they can respond to water chemistry changes (due to storms, algae blooms, industrial discharge).	A U.S. company is driving adoption of “advanced metering infrastructure” that allows for real-time water measurement. Alarms and triangulation enable a fast response to burst pipes and leaks, reducing water loss and system downtime.
Repair: Buildings and infrastructure	Extreme weather: Most homes are not built for extreme weather. External parts of a house are especially likely to be exposed to increased variability in humidity and temperature.	Expansion of addressable market for niche products: High-performance building materials exist, but their use may be limited. Examples include high-performance glass, insulation and heat-resistant paint.	A large U.S. decking company has a proprietary process to convert waste into durable, weather-resilient and visually appealing composite decking.

Source: BlackRock Investment Institute, December 2023. Notes: The table offers hypothetical examples of climate resilience solutions and is for illustrative purposes only. Views are subject to change.

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