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Allianz Research

Climate Change Trade-Offs: What does it take to keep our world insurable?

Executive Summary

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The world has long passed the point where a gradual and essentially smooth economic transition was possible to achieve the Paris goals and keep the rise in global temperature below 1.5C. Consequently, trade-offs between affordability and insurability – and between our current and sustainable lifestyles – are becoming more challenging.

The transition is still possible: But the necessary compromises won't be pain- or costless. And the life of every individual and business will be impacted.

For individuals, how we consume, live and save must change. While responsibility for making the necessary changes falls on every individual, supporting policies and measures are indispensable.

- Consumption: High carbon prices are needed to ensure the green premium paid for climate-friendly products disappear
- Lifestyle: Influence behaviors by nudges and prices as well as by adequate infrastructure, from public transport to comprehensive climate impact information
- Living places: Ensure risk-adequate prices to incentivize risk prevention and adaptation
- Savings: Incentivize long-term savings by tax breaks and subsidies

For companies, a similar logic applies: Financing, investments and the way inputs – labor, suppliers, and materials – are used must change. This, too, requires public support and incentives:

- Borrowing: Reduce the uncertainty of investments through instruments like contracts of difference
- Green investments: Make green investments profitable and scalable by subsidies
- Employees: Facilitate climate-related burdens by new forms of unemployment schemes
- Supply chains: Enable the change to sustainable and secure supply chains through holistic risk management solutions
- Materials: Overcome the cost argument by introducing quotas to establish a true circular economy

Solving these trade-offs and finding a new and better equilibrium require two decisive ingredients: first, insurers that disclose the real risks and incentivize sustainable behaviors and practices and second, public money that can accommodate the transition.

Ultimately, mastering the climate crisis is not a question of politics and money but of individual responsibility. An uninsurable world would be not only a world that failed to cope with climate change but also a metaphor for a collective ethical where each individuals dodges their moral obligation to reduce carbon emissions.

Heading towards an uninsurable world?

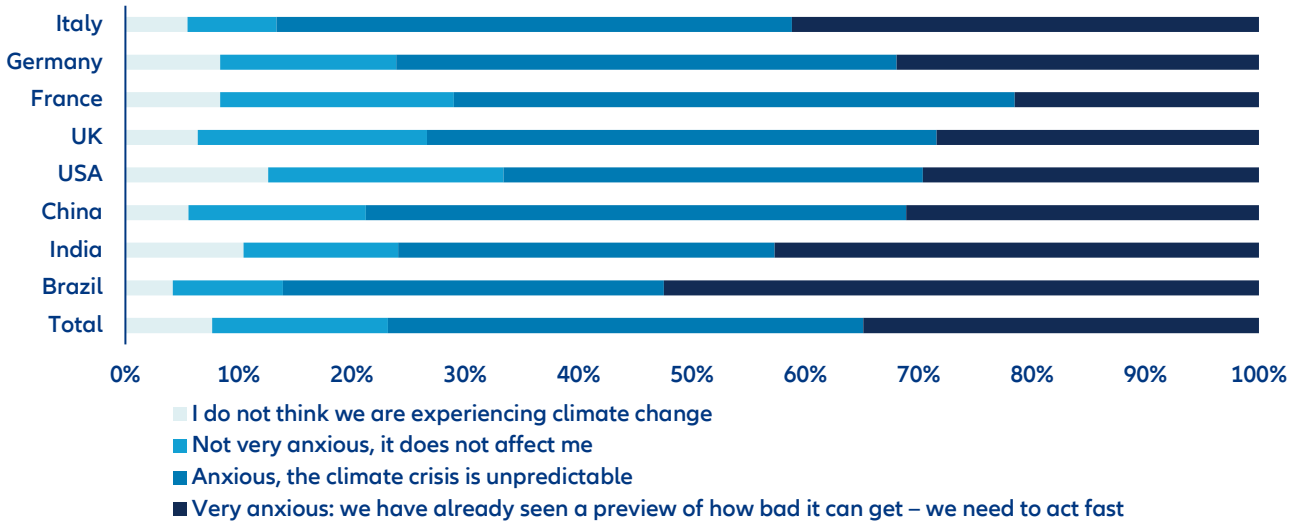
Risk is rising worldwide, be it caused by natural catastrophes, cyber-attacks, geopolitical fragmentation or economic uncertainty. Not surprisingly, protection gaps are also rising in absolute numbers, reaching a combined USD 2.8trn in 2020.[1] Given the trajectories of climate change, the numbers are set to increase further.

The consequences for individuals and businesses are profound. For individuals, health, income and assets are becoming less protected. For businesses, business continuity and physical assets are at stake.

The climate crisis is a case in point. The large number of extreme weather events – from heatwaves and drought to storms and flooding – makes it clear that climate change is happening now and already has a fatal impact. Many people are worried about the climate crisis. Our latest survey[2] on climate literacy confirms this. According to the survey, three-quarters of respondents stated that they were (very) anxious about climate change. In Italy and Brazil, the figure is even higher at more than 86%, whereas in the USA it is „only" two-thirds of respondents (the proportion of „climate deniers" is also highest in the US, at 12%). (Figure 1)

[1] See GFIA (2023), Global protection gaps and recommendations for bridging them.
[2] 2023-11-29-climate-literacy-AZ.pdf (allianz.com)

Figure 1: Climate Angst
Are you personally worried about climate change and its consequences (heat waves, drought, rising sea levels, etc.)? Answers in % by countries



Source: Allianz Research, 2023-11-29-climate-literacy-AZ.pdf (allianz.com)

The sector that is feeling this intensely is the insurance industry: 2023 is likely to be the fourth year in a row in which insured costs from natural disasters worldwide exceed the USD 100bn mark.[3] The risk landscape has also undergone a significant transformation: traditional primary perils like earthquakes and tropical cyclones are no longer the predominant threats. Instead, secondary perils, including hail, floods, storms, and wildfires – all of which have a discernible link to the changing climate – have taken center stage in the spectrum of hazards. At well over USD 1,000bn, their cumulative costs since the beginning of the millennium are now significantly higher than those of primary perils – despite such super disasters as Hurricane Katharina in the USA and the Tohoku earthquake in Japan.[4]

The problem is that people's climate angst and insurers' rising claims payments are not independent but meet at a neuralgic point: the question of adequate and affordable insurance cover. The decision of some US insurers to withdraw from covering some vulnerable areas is a brutal wake-up call. According to a study by the Geneva Association[5], well over 50% of respondents believe that it will be more difficult to obtain insurance coverage against natural hazards in the future; almost 20% of respondents in France, Germany and the US even fear that insurance cover could become impossible or far too expensive. Contrary to the widespread assumption that insurance is a far too complicated for most customers to understand, they are familiar with the basic logic: increasing losses inevitably lead to higher premiums.

Considering insurability criteria, concerns about the availability of insurance cover are undoubtedly justified. Berliner's frequently used approach makes this clear.[6] According to this, nine criteria constitute insurability, from the affordability of premiums to the size of the insurance pool and the probability of events occurring. The last point is particularly problematic concerning climate change: loss events are no longer purely random or unpredictable – heatwaves and floods occur with regularity. At the same time, the extent of damage caused by an event is becoming increasingly difficult to predict; the maximum level of damage can reach unmanageable dimensions. As climate change progresses, these problems will likely become even more significant in the coming years. From a theoretical point

[3] See Swiss Re: Insured losses from severe thunderstorms reach new all-time high of USD 60 billion in 2023, Swiss Re Institute estimates | Swiss Re
[4] See AON (2023), Weather, Climate and Catastrophe Insight.
[5] The Geneva Association (2023), The value of insurance in a changing landscape.
[6] Berliner, B. (1982), Limits of insurability of risks, Prentice Hall.

of view, the insurability of climate damage is, therefore, increasingly being called into question.

Are we moving towards an uninsurable future? Certainly, the trade-offs between affordability and insurability – or, more generally, between our current and sustainable lifestyles – are becoming more challenging because we have long passed the point when a gradual and smooth economic transformation would have been possible. Rapid action and thorough behavioral change are needed to achieve the Paris goals and keep the rise in temperature at 1.5C. This decade will be decisive as "we need to achieve in 10 years what has barely been achieved in 30".[7]

However, compromises can still be made to manage the transition: But they won't be pain- or costless. The life of every individual and business will be impacted. But what could these solutions look like? In the following, we analyze nine "moments of life" – from repair, mobility and home to consumption, investments and loans – to frame the trade-offs, sketch possible solutions and give stakeholder recommendations.

In the long run, the decarbonized economy will likely provide as much material prosperity as today's fuel-based economy, and living conditions and circumstances should be significantly better. But during the transition, compromises must be found and sacrifices made. The sooner these are addressed, the better. Leaving them open will only fuel the climate policy backlash, jeopardizing humanity's chances to cope with climate change successfully.

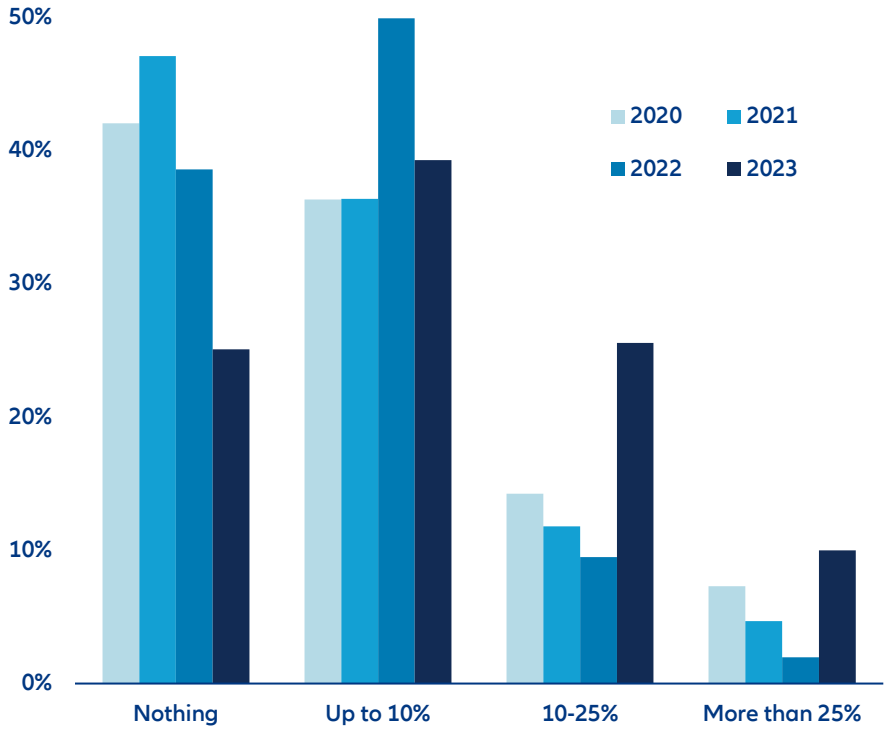
[7] Jean Pisany-Ferry, Selma Mahfouz (2023), The economic implications of climate action, A report to the French prime minister.

Navigating nine moments of life

1 What we consume: Shopping for the climate

The cost of buying green and convenience: How much comfort are we willing to trade in for the climate? As climate change advances, consumers will increasingly need to weigh the pros and cons of various product choices. But against the backdrop of high inflation and low growth, more shoppers are forced to balance sustainability with affordability. While sustainable products like plant-based detergents and eco-friendly clothing are widely available, the rising green premiums may strain consumers' finances. With inflation expected to stay elevated, not least due to the cost of fighting climate change, lower-income consumers in particular may face heightened tension over cost trade-offs. In a 2023 survey, we found that more consumers are willing to pay for climate-friendly products, but the majority are still only willing to pay a little more. However, the share of those willing to pay more than a 10% surcharge for sustainable products has increased from 11.5% to 35.6% between 2022 and 2023 (Figure 2), a welcome increase after the inflation-induced drop in 2022. At the same time, the share of those unwilling to pay more for climate-friendly products has decreased and reached a low of 25.1% in 2023.

Figure 2: Green price markup
Today, climate-friendly products are often more expensive than climate-unfriendly ones, as climate costs are not adequately considered. How much more would you pay for a climate-friendly product? Answers in % of total

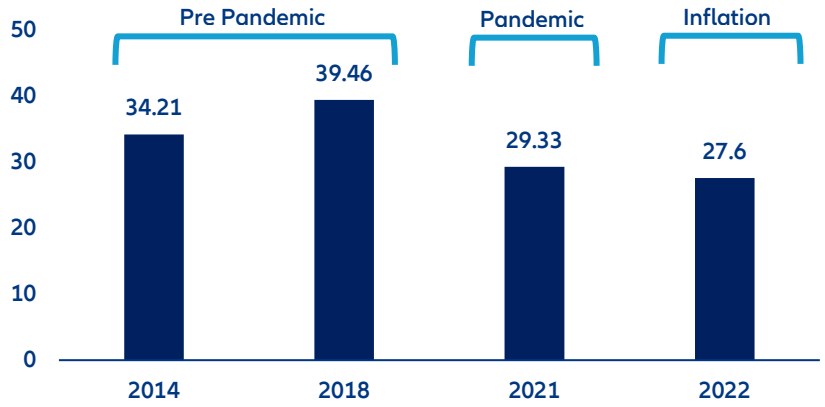


Sources: Allianz Research
Notes: Surveys conducted as Climate Literacy Survey in 2023 and Allianz Pulse in 2020 to 2022. 1,000 persons per country; countries covered are Brazil, India, China, USA, UK, France, Germany and Italy.

Change will only occur quickly if the green premium disappears. Implementing higher carbon prices on products that harm the climate could offer a partial solution and influence consumer decisions. As retailers seek to pass on cost pressures to consumers through price increases, unsustainable goods and services will rise while sustainable products and choices should remain unchanged. This would create a market that factors in the external costs of climate-harming products. Furthermore, companies and governments can be crucial in empowering consumers, citizens and workers. For example, consumers could be incentivized to purchase more sustainable and environmentally friendly products through tax breaks or subsidies, making them more affordable.

Additionally, companies can strive to make green products more accessible and convenient by providing a wider range of options in stores or online. In 2022, sustainable products held a market share of 17.3%, up 0.3pp compared to 2021. Compared to conventional products, their sustainable counterparts grew two times faster and, as a result, the green price premium continued to shrink by -11.9pp compared to pre-COVID times (Figure 3). However, 27.6% is still too high and surpasses most people's willingness to pay for climate-friendly products.

Figure 3: Green price premium for sustainable versus conventional products over time, in %



Sources: NYU Stern Center for Sustainable Business, Allianz Research

But buying only climate-friendly products is no solution either. Food is the prime example. Organic food is climate-friendlier than conventional food. But if all farmers switched to organic farming, the food supply would collapse as there would not be enough food to feed all mouths – if eating habits stay the same. Therefore, the key to sustainable consumption is a wide-range of cost-competitive, climate-friendly products and lifestyle changes. Climate change demands that we limit our choices; otherwise, we will have no choice at all.

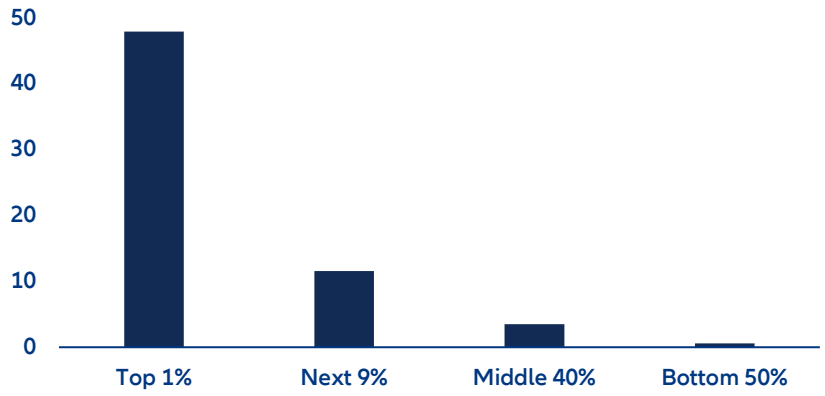
2 How we live our lives: changes are indispensable

Net zero relies on behavior change as new technology cannot entirely mitigate the effects of climate change. Many lifestyles are, per se, unsustainable, not only because of greenhouse gas emissions but also due to high energy consumption. This includes meat- and dairy-heavy diets, global trotting, fossil-fuel cars, heating and cooling of houses, food waste, single-use plastics, or missed waste recycling opportunities. Most emissions reductions need to come from lifestyle change: how we travel, how we build, power and heat our homes, and what we buy and eat. But the more a climate-saving measure changes the lifestyle, the less people support it. Many are willing to make at least some changes to their lives to reduce the effects of climate change – but this will probably not be enough, given the existing social and economic structures. In the end, those structures must change. Otherwise people might be forced by necessity to adapt their lifestyle concerning energy use, food consumption or transportation as climate change progresses.

The great carbon divide. But CO2 emissions are also highly unequally spread across income groups and regions. The wealthiest 1% live climate-insulated, air-conditioned lives. Their lifestyle choices account for more carbon emissions than the poorest 66%, which means their personal consumption, investment portfolios and share of government subsidies and infrastructure benefits accounted for 16% (5.9bn tCO2e) of global CO2 emissions. The lifestyle choices of the world's richest 10%

account for about 47% of all CO2 emissions. Typically, individuals in the lower 50% income group generate around one ton of CO2 annually, while the wealthiest 1% emit approximately 48 tons per capita (Figure 4). Regional variations exist; in Europe, the bottom 50% contribute a larger proportion of total emissions than the top 10%, whereas in Sub-Saharan Africa, the top 1% produce more carbon emissions than the bottom 50%.[8] Hence, lifestyle emissions matter tremendously: using airplanes, cars, helicopters, private jets or yachts and living in heated or air-conditioned homes, combined with financial investment and shareholding contributes an immense share of CO2 and equivalent greenhouse gas emissions annually.

Figure 4: Average carbon footprints of the top 1%, top 10%, middle 40% and bottom 50% of the global population, CO2 emissions per person in tons



Sources: Bruckner et al. (2022), Allianz Research

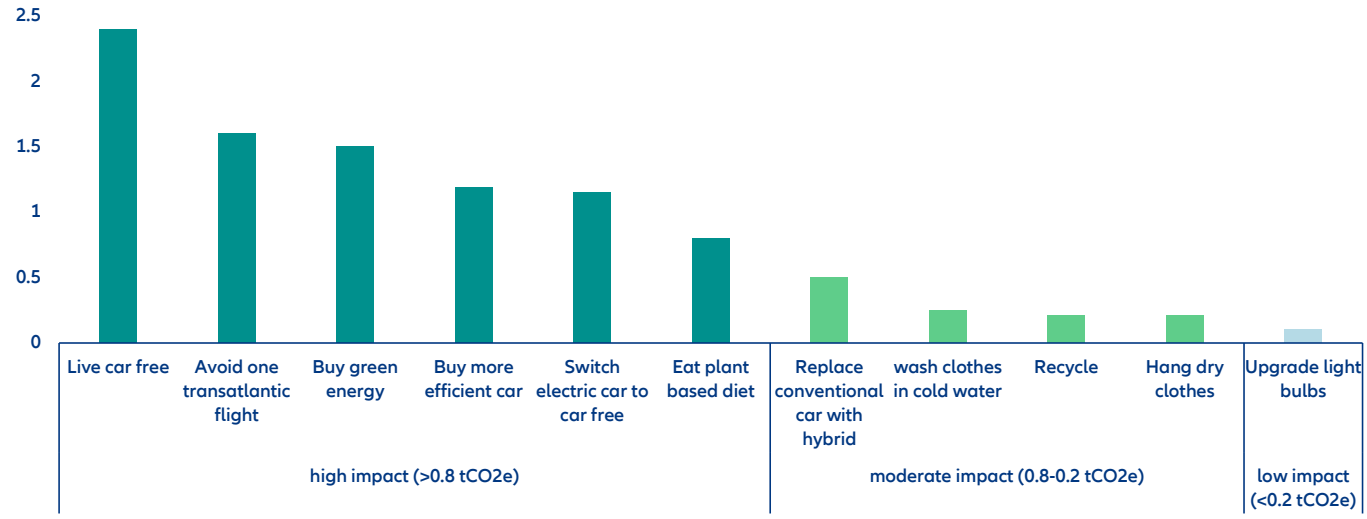
Climate change requires behavioral changes, prompting many consumers to alter their behavior to protect the environment. Lifestyle choices with the highest reduction in greenhouse gas emissions and, thus, the most impactful actions with systemic change potential include living car-free (2.4 tCO2e saved annually), avoiding air travel (1.6 tCO2e saved per transatlantic flight) and adopting a plant-based diet (0.8 tCO2e saved yearly)[9] (Figure 5). These actions surpass commonly promoted strategies like recycling and changing lightbulbs regarding emission reduction effectiveness. The means to influence consumer behavior towards environmentally friendly choices and promote a significant shift towards more sustainable lifestyles include:

- incentives and adjusted prices,
- making unsustainable options more costly,
- and changing economic structures – from public transport to comprehensive information about climate impacts.

The new equilibrium advocates for healthier diets and reduced energy consumption, potentially impacting luxury and individual freedom. Insurance can play a role in facilitating this transition by using premium differentiation to nudge individuals towards more sustainable behaviors, aligning with the changing equilibrium and promoting environmental consciousness.

[8] Bruckner, B., Hubacek, K., Shan, Y, Zhong, H. and K. Feng (2022). Impacts of poverty alleviation on national and global carbon emissions, Nature Sustainability 5, 311-320.
[9] Wynes, S. and K.A. Nicholas (2017). The climate mitigation gap: education and government recommendations miss the most effective individual actions, Environmental Research Letters 12.

Figure 5: Emissions savings, tCO2e per year

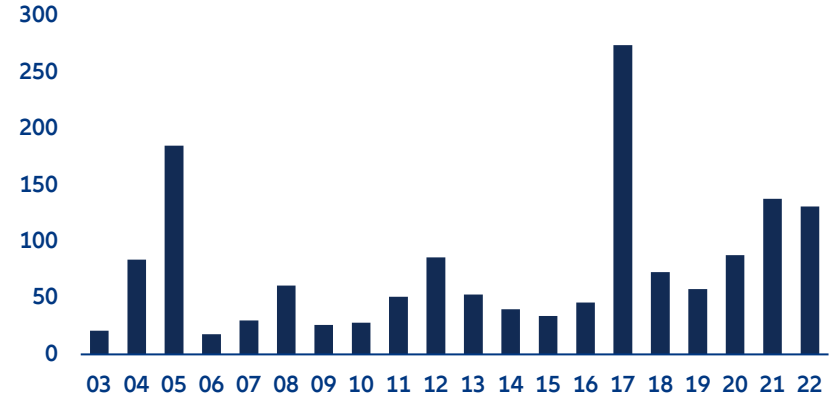


Sources: Wynes and Nicholas (2017), Allianz Research
Notes: A comparison of the emissions reductions from various individual actions. The height of the bar represents the mean of all studies identified in developed nations. Actions are classified into high (green), moderate (blue), and low (yellow) impact in terms of greenhouse gas emissions reductions.

3 Where we live: risky area – do not enter!

Climate change and the ensuing high frequencies of extreme weather events are changing the risk landscape. Today, ever more homes are in risky areas subject to flooding, storms or wildfires. Consequently, the economic damage caused by extreme weather events is on a clear upward trend (Figure 6). Many residents in today's risk areas moved there when the risk situation was more benign. The question is how to help them when rising insurance premiums might become an unaffordable burden – and thus a social issue that affects millions?

Figure 6: Economic damage by extreme weather, in USD bn



Sources: OurWorldinData.org, Allianz Research.

There are no easy answers but three lines of defense can keep the situation manageable, the most important being risk-adequate premiums. At first glance, this seems counterintuitive – after all, it is the complete pricing of risks that can often make premiums „unaffordable". But without knowledge of the risks, there is no insurance. Non-disclosure of the actual risks through artificially low premiums is not insurance, but (hidden) transfers that create false incentives. And it is hard to think of a more anti-social benefit than subsidized insurance premiums for wealthy property owners.

How can we deal with risk-adequate premiums that might be too high to afford? It is relatively simple for new buildings and settlements, the price signal should be taken seriously, and construction should be discouraged. The question is, of course, different for existing properties. Those residents should be helped not through low premiums but by compensatory social transfers according to need. As with the carbon price, the price signal should not be watered down, but social hardship should be cushioned. The prevailing tendency to restrict the price mechanism is fatal and does climate policy a disservice.

Consequently, prices that are too low lead to inadequate adaptation measures and the transformation therefore only makes sluggish progress. At the same time, many of those affected are angry because of the higher price. This is precisely the policy that promotes „climate populism": Rising costs without corresponding results. It would be wiser to allow prices to rise consistently with the risks and to help those affected just as consistently. This also has the positive side effect that it is not the property (through low insurance premiums) but the occupant (through social transfers) that is supported. The truth expressed by „unaffordable" insurance premiums is that living in this zone is not a reasonable risk; eventually, the only sustainable solution is resettlement.

The second line of defense is risk prevention, which aims to strengthen the resilience of buildings and infrastructure against natural disasters. This is easier to achieve for new buildings but requires a rethink in architecture: we can no longer build for eternity but require flexible, modular structures that can be rapidly repaired and renewed. The earthquake-stricken Japanese, with their swaying skyscrapers and the tradition of completely rebuilding their most important shrine, the Ise Shrine, every 20 years, can serve as a model. Even more important, however, is the consistent observance of risk zones: the best risk protection is reducing exposure and avoiding building in high-risk areas. Unfortunately, too little attention has been paid to this. The increase in losses from natural catastrophes is, therefore, only to a smaller extent due to their increasing number and severity; the main driver is the strong growth in assets in the affected areas. But improvements can and should also be made to existing buildings. The right incentives play a decisive role – with a central role for the insurance premium: a reduction in risk through investment in resilience must be "rewarded" by a corresponding decrease in the premium.

Last but not least, are public-private partnerships in which the state assumes the role of „re-insurer of last resort" and thus acts as a backstop in the event of a loss that exceeds the capacity of the insurance sector. This ensures that risks from natural disasters can continue to be insured. However, it is crucial that the involvement of the state should not affect the actual insurance value chain – from product design and pricing to claims settlement. Easier said than done. Political decision-makers often cannot resist the temptation to pursue other social objectives with the state's involvement, above all to ensure reasonable prices. Therefore, it is often not a partnership, but rather the state takes the lead and determines the parameters of the insurance with insurance companies relegated to the role of utilities.

Ultimately, this leads to state insurance programs: They take on risks for which no buyers can be found. This phenomenon can be observed particularly in the United States. This makes building in risk zones easier instead of more difficult. As a result, losses increase exponentially – and often with fatal consequences. Hence, due to price distortion and perverse incentives, mandatory insurance schemes should generally also be rejected. Their inherent logic is to reduce premiums in high-risk areas through cross-subsidization across all policyholders. However, this overrides the decisive price signal that could indicate the real risks. Ultimately, this will also lead to increased risk exposure in these zones beyond the reasonable level.

Preventive measures, new technologies and smart partnerships can shift the limits of insurability – and these possibilities should be consistently utilized – but they cannot remove risk. Uninsurability should be respected – even if the consequences (from not building new homes) to relocating may be distressing. Even more painful is the alternative of dampening the price signal through subsidies to provide the pretense of insurability. The false incentives this creates lead to excessive risk exposure as development in high-risk areas is enabled. The result is ever higher loss amounts, which require ever higher subsidies: a vicious circle that will eventually collapse under its own weight, as we can already observe in some regions of the United States. Postponing necessary adaptation measures leads to higher costs in the future. But adaptation measures are not free either.

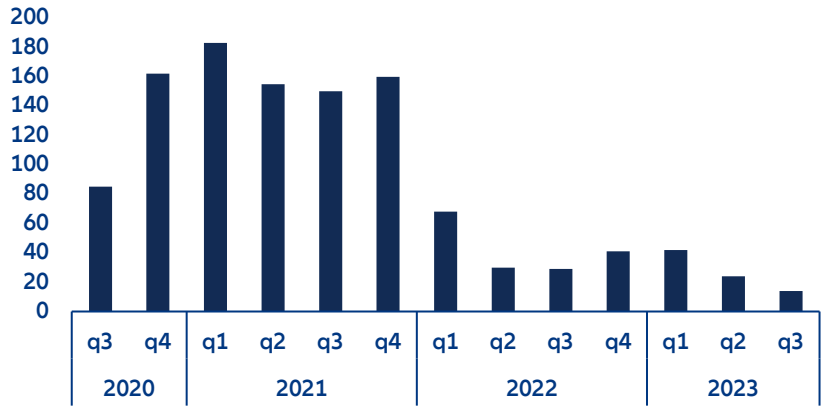
4 How we can benefit from climate change: sustainable savings

Companies and infrastructure without a sustainable business model will lose significant value in the future. In the Net Zero World, companies that continue to cause emissions, ignore the circular economy or disregard the preservation of biodiversity will have little chance of survival. This is not only for regulatory reasons but simply because their offering will no longer be competitive. For investors, the matter is therefore clear: if they do not want to risk high losses in value – cue stranded assets – they should invest in sustainable business models.

If only it were that simple: There are two significant problems. One is the time horizon. When will we be living in a Net Zero World? The target date for most countries is 2050, but almost all countries are behind schedule. And in the interim, there is still good money to be made from fossil fuel business models, as the last few years of record-high energy prices have shown. When is the right time to switch? As we all know, life punishes those who come too late and sometimes those who come too early. It's a variety of the well-known problem of the "tragedy of the horizon". The second problem concerns selection. Sustainable business models will prevail in the long term – but which technologies and companies will be among the winners? This is still uncertain today. Who today remembers the pioneers of the German solar industry or the internet? In times of radical transformation, long-term investments are fraught with high risks.

It is, therefore, not surprising that, after the initial euphoria, the investment theme of sustainability has lost some of its luster. This becomes clear when looking at the inflows into sustainable funds (including ESG funds). In the third quarter of 2023, only USD14bn flowed into these funds worldwide, a fraction of the inflows from two years ago. However, the difficult investment environment of rising interest rates, recession fears and global fragmentation is also likely to have played a role. Given the political backlash against the ESG acronym as part of the crusade against „wokeness", it is unsurprising that funds have even been withdrawn in the USA on balance (-USD 3bn) (Figure 7). How can these two problems be solved or at least mitigated?

Figure 7: Global sustainable fund flows, in USD bn



Sources: Morningstar, Allianz Research

The key lies in a consistent preference for long-term investments: the risk-return profile should be distorted in favor of long-term investments. If you invest your money for the long term, you automatically invest sustainably. The tax system is decisive. For example, payouts from pension funds and insurance companies could be tax-privileged. Generally, old-age provision plays a central role in this context. Pension funds and insurance companies are the natural sources of capital for the long term – and are predestined to drive the decarbonization of the economy from the investment side for two reasons. First, they are not subject to the "tragedy of the horizon". As they enter into commitments that extend over decades, they are not subscribed to short-term increases in value but seek stable returns over prolonged periods. Unlike banks, interim fluctuations in value do not create a need for liquidity – which is why they are of little significance. Secondly, their investment approach is comprehensive, and their perspective is similar to that of a "maximizer of the common good". This is because the large number of assets in their portfolio means that they are interested in the profitability of the individual investment and in the costs at which this profitability is achieved for the other assets. For example, if a company increases its profitability by accepting higher greenhouse gas emissions, this increases the likelihood that other companies will suffer because the climate is adversely affected. Therefore, broadly diversified portfolios of insurers and pension funds tend to precisely promote developments that allow companies to grow and prosper sustainably. In fact, according to ECB data, the proportion of green bonds in the portfolios of pension funds and insurance companies is already twice as high as that of all investors combined. This needs strengthening. But the focus should be on more than the payout phase. Particularly in countries such as Germany, where capital-funded pension provision only plays a subordinate role, this part of the pension system should be consistently expanded, with a clear focus on the second pillar, the occupational pension provision. All means – from tax allowances to less bureaucracy and a clear information policy – must be exhausted.

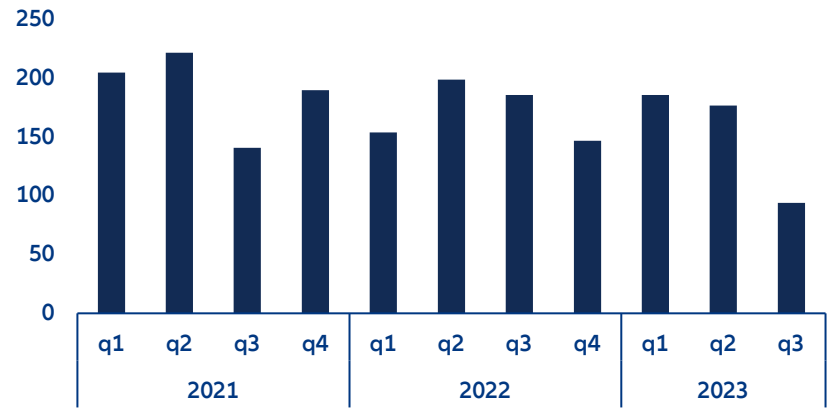
However, long-term investments should also be given preference if not directly related to old-age provision. Fortunately, the EU has a corresponding instrument: ELTIFs (European long-term investment funds). ELTIFs have existed for years but have had a frail existence so far. This should change with reforms enacted for this year that make them more alluring to retail investors. The idea behind ELTIFs is compelling: they are a vehicle for investing safely in illiquid assets, from start-ups to infrastructure projects. A favorable tax regime would make them even more attractive. Even direct subsidies are conceivable: Governments could top up each investment with EUR20 for every EUR100 invested, up to a specific limit. It would be an initiative that is easily understood and should prove popular. The funds could come directly from the NextGen EU program, an elegant way to leverage its effectiveness.

Bottom line: For the individual investor, there should be no reason to be tempted by short-term fossil profits if the long, sustainable haul is so rewarding.

5 Finding the funding for climate actions: sustainable borrowing

Sustainable finance is an issue not only for investors, but also for borrowers. One challenge is the considerable uncertainty about future returns on new investments. Of course, this applies in principle to any investment. In the case of green investments, however, technological uncertainties and fluctuations in demand play a role, but there is the added dimension of politics. Whether the new energy plant will pay off depends largely on the development of energy prices – which are significantly influenced by politics, especially the price of CO2. Given the erratic actions of policymakers and the lack of a clear, long-term framework, it is hardly surprising that investors and financiers tend to be cautious. This can be seen, for example, in the development of ESG bond and loan issuance in Europe: in the third quarter of 2023, it fell by almost 50% year-on-year and quarter-on-quarter. (Figure 8). Another problem relates to the lending practices of banks. As a rule, loans are collateralized primarily by real assets. However, in times of increasing climate change and the resulting rise in the risk of physical damage, it is becoming increasingly difficult to value these assets. How can this be solved?

Figure 8: European bond and loan issuance, in EUR bn



Sources: afme, Allianz Research

In the case of uncertain returns, it is primarily up to policymakers to create reliable framework conditions. So-called contracts of difference are one instrument that can be used to guarantee investors constant returns over long terms, regardless of energy price fluctuations. To a certain extent, they are an insurance policy, offered by policymakers, against their own fickleness. But insurance solutions can also help. In the case of green technologies, for example, performance guarantees can be used to transfer a large part of the operational risk to insurers. The question of the recoverability of collaterals is primarily an insurance issue – as long as an asset is insurable, it is also recoverable, i.e. protected against loss due to physical damage by NatCats. But, of course, the trade-off between insurability and affordability can arise here. In this respect, a form of public-private partnership makes sense here, too, in the form of subsidized loans for retrofitting measures, i.e. investment in risk prevention.

6 How to make green investments profitable: the future is now

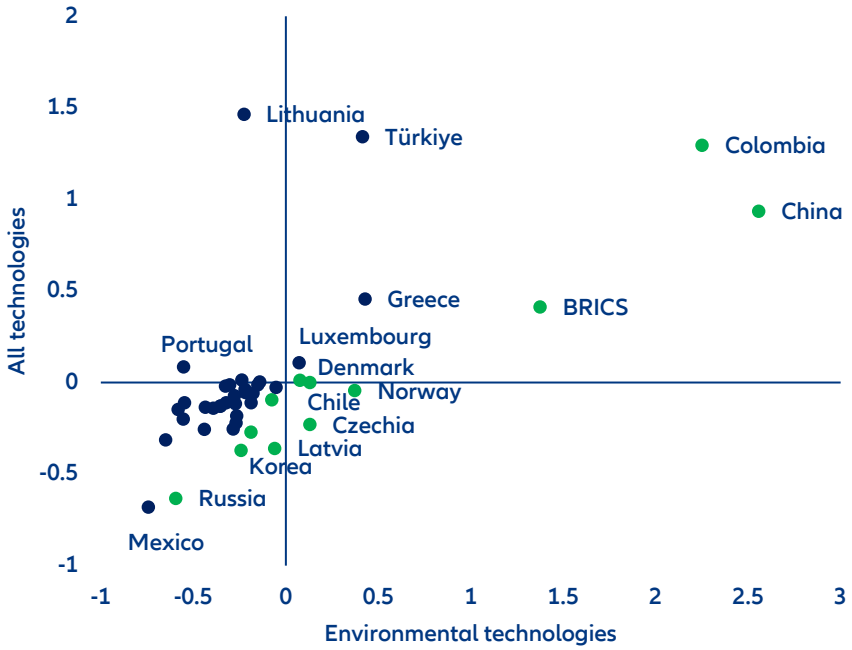
Energy and climate issues push governments and firms to invest in energy efficiency and climate-friendly technologies. Economies worldwide are struggling with two crises – energy and climate – causing supply chain disruptions and energy market instability. This has led to unprecedented price volatility, threatening the post-pandemic recovery. But climate change exacerbates the challenges, with rising extreme weather events and potentially irreversible damage. Firms are contending with higher energy costs due to the war in Ukraine. At the same time, climate change poses long-term threats, evidenced by increasing economic losses from extreme weather events and the need to shift to climate-friendly technologies. A swift green transition is crucial, requiring short-term support for energy price spikes and long-term commitment to investing into the green transition. Over the last two years, private-market investment in climate-related initiatives surpassed the broader market in deal activity, capital deployment, and fund inflows. This trend is expected to persist as governments, corporations, and investors intensify efforts to advance climate technologies to enhance energy security, affordability and sustainability goals.

Firms invest in green technology if it is profitable. These investments in green energy solutions and emission-friendly technologies are frontloaded for firms but will, ultimately, save the day. As long-term investments might shave off revenue in the short run, government involvement is vital in driving this transition, alongside private-market investments in climate adaptation and mitigation. Understanding firms' responses to this uncertain business environment is essential for effectively navigating these challenges. Firms invest in green tech solely for profitability, driven by financial rewards rather than a "greener" image. But they also scale up green investment to avoid penalties for not meeting environmental regulations. However, not all firms can implement ambitious green strategies, and some may see decreased financial performance, at least in the short term, due to a shift in resource allocation away from their standard operations and production. Still, corporates need to see environmental investment as a long-term strategy to improve performance.

Private investments still need encouragement to go green. Governments can set the playing field by implementing significant legislative and regulatory action to support climate and energy transition priorities and provide funding for R&D of green technologies. They can support this process further by offering financial incentives such as tax breaks or subsidies for green investments. Unprecedented government programs in the US and Europe are set to provide a significant boost to climate technology, unleashing substantial capital to address the challenge of achieving net-zero emission commitments by 2050. The US Inflation Reduction Act (IRA) allocates over USD370bn to combat climate change. The EU Green Deal can potentially dedicate more than EUR1tr to public and private funds focused on this cause. The new equilibrium thus entails a rise in sustainable investments, accompanied by heightened state intervention and increased associated costs, reflecting a shift towards a more environmentally conscious economic model.

Private investment in green innovation is slowing in many economies due to high uncertainty surrounding the transformation. While significant progress has been made in green innovation, the momentum has slowed considerably, hindering the spread of promising technologies. Green innovation, which peaked at 11% of total patent filings in 2019, has slightly declined to 9.9% in 2021 due to factors like the reduced oil prices from hydraulic fracking and technological maturity in certain areas. Over the longer term, however, the picture looks better. While patent filings have generally dropped by -9% between 2015 and 2021, green patents fell by only -7% in the same period – but with a significant divergence across countries. In some countries, environmentally-related patent growth is faster than overall innovation (in green), including in Australia, China, Chile, Colombia, Czechia, Denmark, Korea, Latvia, Norway, Indonesia and Russia (Figure 9). However, it is slowing in many OECD economies due to high economic and political uncertainty surrounding the green transformation and energy security. This indicates generally less private spending in R&D with implications not only for the progress of green transformation but also for the economy as a whole as the doubling of green patent filings could boost GDP by 1.7% after five years.

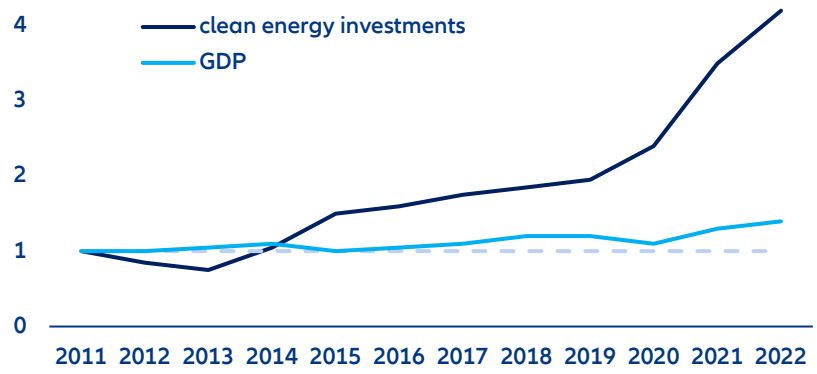
Figure 9: All patents versus green patents, change in % 2015-2021



Sources: OECD, Allianz Research
Note: Countries marked in green signal that environmentally-related patent growth is faster than overall innovation.

The right investment decisions can transform the energy crisis into a historic turning point toward a cleaner and more secure energy future. Global energy-related CO2 emissions rose by 0.9%, reaching a new record amount of 36.8bn tons in 2022. However, investment in clean energy technologies is still well below what it will take to bring emissions down to net zero by 2050. To get us on track to limit global warming to 1.5 degrees while ensuring sufficient energy supply, global annual investments must more than double (USD4tr) by 2030. Investments in clean energy transition are finally picking up. While annual growth in world real GDP averaged 5% between 2019 and 2022, clean energy investments grew nearly six times faster, at 29% per year, reaching USD1.8tr in 2022 (Figure 10). And the trend seems to continue. In 2023, USD1.7tr of the USD2.8tr set to be invested globally in energy is expected to go to clean technologies.

Figure 10: Relative growth of world real GDP and clean energy investments, 2011-2022 Index 2011 = 1



Sources: Corporate Knights, Allianz Research

A new global energy economy is emerging, and the governments and businesses that invest early and wisely stand to reap the benefits. New incentives for green investments such as those contained in the US IRA, the EU Green Deal, Fit for 55, and REPowerEU packages or Japan's Green Transformation Plan are designed to stimulate hundreds of billions in new investments from the private sector. But companies should have incentives of their own. Since 2019, USD2.3tr in sustainable investments, representing over 10% of total CapEx (the largest segment of green investments), have led to USD12tr in sustainable revenue, representing over 6% of total revenue. Over the last three years, the top 20% of companies in terms of percentage of revenues and spending derived from the green economy have outperformed the most prominent index of global companies, the MSCI All-World Index (MSCI ACWI), by a factor of three. Their median annual returns are 14% compared to just 2% for the MSCI ACWI. While net-zero commitments are the foundation of a net-zero transition strategy, investments indicate what companies intend to do. Insurance can support green corporate investments by offering green investment products and risk management for sustainable projects, provide differentiated underwriting for insurance policies and specific products with performance-related incentives to incentivize environmentally friendly practices.

7 Not working till heatstroke: protecting workers

Heat stress poses a significant challenge to workers. It is defined as the body's inability to tolerate excess heat without physiological impairment, and it poses challenges to economies and productivity worldwide. Heat stress can be fatal at temperatures over 39°C, and even without fatalities, it can drastically reduce work capacity. By 2030, it's projected that over 2% of global working hours will be lost annually due to heat stress, equating to decreased productivity. This loss could reach 5% in Southern Asia and Western Africa, exacerbating inequalities between and within countries. Low-skilled and outdoor workers in informal manufacturing, construction and agriculture are particularly affected. Specifically, the agricultural sector, accounted for 83% of global working hours lost to heat stress in 1995, which is projected to decrease slightly to 60% by 2030. Meanwhile, the construction sector will see a significant increase in heat stress, rising from 6% of the total global working hours lost in 1995 to an estimated 19% by 2030. Workers in refuse collection, emergency repair, transport, tourism, and sports are also impacted.[10]

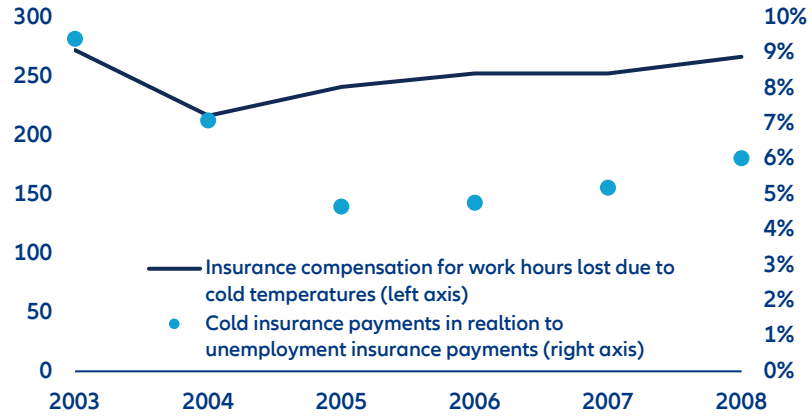
[10] „ILO (2019), Working on a WARMER planet - The impact of heat stress on labour productivity and decent work" and „The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harms"

Effective policies, technological investments, behavioral changes and insurance are necessary to cope with heat stress. Policies and workplace adaptations include speeding up the structural transformation of rural economies, skills development, sustainable enterprise promotion, smart urban planning and public infrastructure investment. Workplace adaptations could involve better on-site weather information, shifting working hours into cooler daytimes, modified workwear, and technological advancements.

Insurance plays a vital role in addressing the impact of extreme temperatures on construction worker productivity. In Germany, the „Bad-Weather-Money" insurance has historically addressed issues related to cold spells in construction, showing that similar measures could be applied to heatwaves. In the German construction industry, winter historically brought reduced employment and increased unemployment, significantly affecting construction workers' career paths. Traditionally, the sector allowed weather-dependent layoffs during winter without notice, though with a tentative plan to rehire in spring. The impact of this practice was starkly evident in 1956, when over 800,000 construction workers were unemployed in February, dropping to about 20,000 in summer. This pattern of employment led to income loss and reduced pension benefits. To mitigate these seasonal employment fluctuations, the industry and government recognized the need for collaborative solutions, including financial contributions from the state, particularly since public funds were already burdened with unemployment benefits.

Introduced in 1959, „Bad-Weather-Money" provided construction workers with compensation for weather-related work disruptions during bad weather periods, funded through unemployment insurance contributions. This approach was deemed more efficient and economical than financing regular winter unemployment. However, reforms were necessary after rising unemployment in the 1980s and growing deficits at the Federal Employment Agency „Bad-Weather-Money" evolved into "Winter-Loss-Money" in 1996 and later into "Seasonal-Short-Hours-Money" in 2006. These reforms included mandatory savings of working time credits for bad weather periods, an increase in the levy for the mandatory unemployment insurance part, and government subsidies, making the funding nearly cost-neutral for construction companies.[11]

Figure 11: German cold temperature insurance payments for work hour loss in EUR mn



Source: Allianz Research

[11] Gerhard Bosch, Frederic Hüttenhof (2022). Der Bauarbeitsmarkt - Soziologie und Ökonomie einer Branche. 2. Auflage.

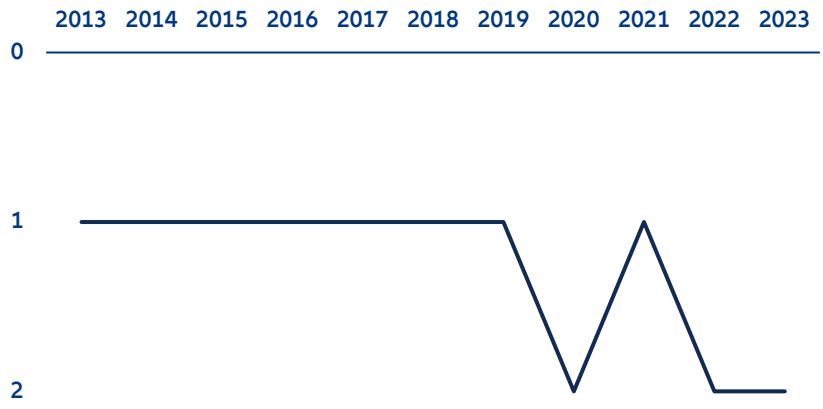
Figure 11 displays the payouts from the weather-related insurance scheme.[12] Annually, these transfers fluctuated between EUR 217 million and EUR 272 million, representing significant financial movements within German social security measures. In direct comparison, weather insurance transfers varied between 4.7% and 9.4% of unemployment insurance payments. In terms of working hours, this equates to a loss of between 15 million and 24 million hours during the respective winter seasons, averaging around 0.5% of the total working hours in the construction sector.[13]

Shifting the focus from cold to heat? Since 2010, the reliance on the Seasonal Short-time Work Benefit per construction employee has declined. Factors contributing to this include a robust construction economy in the 2010s, reducing downtime due to order shortages and fostering interest in winter construction due to profitable opportunities. Additionally, advancements in technology and materials have facilitated more consistent winter production. While warmer winters in recent years due to climate change have reduced downtime, the scheme does not yet address the impact of increasingly hot summer days on construction activity.

8 Guarding the flow of goods from climate change: new supply chain management

Concerning the fixed assets of companies, especially buildings and factories, the same challenges arise as with private residential buildings: increasingly facilities are located in risk areas and are, therefore, becoming more expensive to insure. However, firms have a profit maximization motive to recover quickly from such a natural disaster shock as they can expect to increase their sales as the disaster has literally knocked out part of their competition. However, there is an additional problem for companies: not only are their own facilities affected, but also those in the entire supply chain. An earthquake in Japan or flooding in Thailand can lead to business interruptions in Germany. Barrot and Sauvggnat (2016)[14] find that customers of suppliers hit by a natural disaster experience a drop of 2–3pp in sales growth following an event in the US. Concerns about business interruption have been one of the top two risks for companies in the annual Allianz Risk Barometer for years, recently only being displaced from the top spot by the fear of cyberattacks (Figure 12).

Figure 12: Position of „business interruption" in the annual Allianz Risk Barometer



Sources: AGCS, Allianz Research

[12] Later years are unavailable as the measure isn't reported separately.
[13] Sources for insurance payments: https://statistik.arbeitsagentur.de. Sources for working hours: https://doku.iab.de.
[14] Barrot, Jean-Noël and Sauvagnat, Julien (2016). "Input Specificity and the Propagation of Idiosyncratic Shocks in Production Networks." The Quarterly Journal of Economics 131, 3, 1543–1592.

As with private residential buildings, a bundle of measures is needed. For companies, risk prevention is the top priority. On the other hand, insurers are called upon to offer innovative solutions, from simple parametric insurance policies that provide quick and uncomplicated compensation in the event of damage to public-private partnerships for the coverage of major risks. However, a risk-adequate price that sets the right incentives for risk prevention and avoidance, from selecting suitable locations to – as a last resort – relocating existing buildings, remains crucial.

However, coping with business interruptions goes beyond risk pricing and transferring. Joint strategies of insurers and companies are necessary for managing and preventing risks within the global supply chains. What is required is a holistic approach consisting of consulting and financial protection. In this way, the value proposition of insurers would be enhanced, from pure financial compensation to risk management and holistic service offerings to prevent and mitigate risks. Such a supply chain management will alter the global division of labor: It is no longer governed by the imperative of efficiency but by that of resilience and security – whereby climate and geopolitical aspects overlap. The necessity to reduce one-sided dependencies refers to rising NatCat events and increasing geopolitical fragmentation. The lesson from the tearing up of supplier networks during the COVID pandemic should be to weave the net even more tightly in the future, with duplications at neuralgic points: dual sourcing is the new mantra. Therefore, the reconfiguration of supply chains is not synonymous with a reversal of globalization but instead marks the beginning of a new era: from naïve hyper-globalization to sustainable and strategic globalization.

9 Rethinking the Circular Economy: Exploring Opportunities Beyond Recycling and the Impact of Insurance

The progress in achieving circularity in products and materials has been slow. The Circularity Gap Reporting Initiative indicates that merely 8.6% of the world operates within a circular model, with a concerning rise in the extraction of virgin materials since the Paris Agreement in 2015. This same report draws a connection between 70% of critical greenhouse gases and material handling and usage, underlining the urgency for more efficient material recovery.

Historically, the abundance and low cost of natural resources, coupled with the perceived infinite capacity of nature to absorb waste, have led to significant market failure. Producers rarely covered the total costs of environmental exploitation, resulting in high material throughput and the proliferation of products with short lifespans. Additionally, consumer habits have evolved with little regard for sustainability. This scenario is reflected in the current production model, where the environmental costs of resource extraction, production and usage are not accurately reflected in market prices. Addressing these challenges requires a shift in business models, consumer behaviors and policy frameworks. The circular economy, often misconstrued as merely enhancing recycling, focuses on maximizing product usage and lifespan through repair and reconditioning. Products-as-a-Service (PaaS) is an interesting approach that allows companies to maintain ownership or control over products, thereby promoting longer usage and sustainable practices. PaaS offers significant financial benefits to customers, including reduced initial purchase costs, lower ownership expenses, and the ability to distribute costs over time, ultimately enhancing product affordability and financial well-being. These benefits are especially pronounced when PaaS includes maintenance, repair, and insurance, which can be provided at reduced rates due to decreased ownership costs.

With the evolution of business models and a shift in ownership patterns, especially in the sharing economy, where consumers prefer renting or leasing over outright ownership, there's an increased demand for innovative insurance solutions. These might include custom property and casualty coverages, extended warranties, performance guarantees and usage-based insurance models. Furthermore, insurance responsibilities may shift from consumers to manufacturers as ownership models evolve. The push towards a circular economy also influences the risk and insurance sector, necessitating a shift to more sustainable products and business models. This economy is founded on principles such as designing out waste, maintaining product usage and regenerating natural systems, involving enhanced product life

through better design, maintenance and minimizing waste through reuse and repurposing.[15]

This transition is evident across various sectors, driven by supply chain security, Net Zero goals, evolving consumer and investor expectations and regulatory frameworks like the EU's Circular Economy Action Plan. This plan aims to create a circular economy by 2050 by incorporating measures such as construction product regulation reviews and sustainable textile strategies. In addition, the European Parliament adopted a „right to repair" proposal in response to public demand for more sustainable product usage and as part of the broader European Green Deal and circular economy objectives. Key aspects of this proposal include:

Legal Guarantee Period Repairs: Mandating free repairs within the legal guarantee period, barring scenarios where replacement is cheaper, impossible, or inconvenient.

Obligations Beyond Legal Guarantee: Requiring producers to repair specific products, like household appliances and smartphones, even after the legal guarantee period.

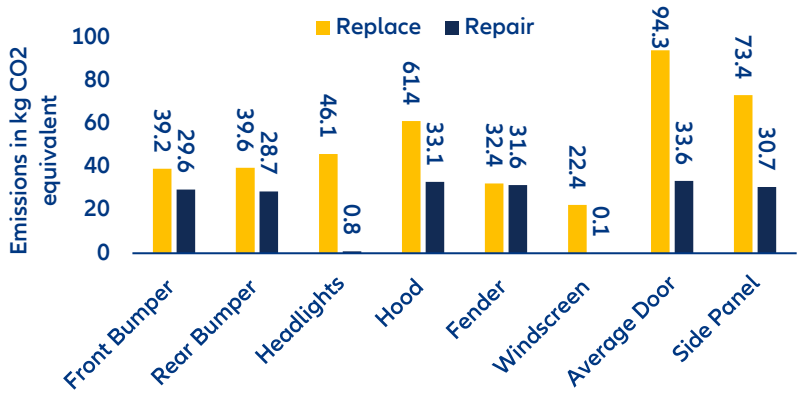
Transparent and Competitive Repair Market: Ensuring independent repairers and consumers access to spare parts, information, and tools at reasonable costs.

Online Platforms for Repair Services: Facilitating consumer access to local repairers and sellers of refurbished goods through national online platforms.

Enhanced Consumer Rights and Repair Culture: Strengthening consumer rights to repair and promoting a culture that values repair over replacement, aligning with other EU initiatives like the Ecodesign regulation.

Repair is usually more cost-effective and environmentally friendly: A result supported by an Allianz study investigating GHG emissions from repairing versus replacing damaged vehicle parts. Figure 11 illustrates the average GHG emissions for various vehicle body parts. The analysis shows that for each part studied, repairing results in a lower carbon footprint compared to replacement. The extent of this reduction varies, with the most significant being 99% for headlights and windscreens and the least being 4% for fenders. The time and emissions related to painting and drying processes were almost identical in both scenarios. Thus, the primary factor contributing to the emission difference is predominantly manufacturing new parts rather than repairing existing ones.

Figure 13: Emissions from repair and replacement (EU average, Volkswagen ID.3)



Source: Allianz Research

[15] See also EU ERDF and Stena (2022). Product as a Service in the circular economy.

In conclusion, repair should be the preferred option for minor vehicle collisions affecting bodywork and windscreens. Even a modest increase in repair rates can have a substantial impact: a 2% increase in Europe could save 29,781 tonnes of CO2e, equivalent to the energy consumption of 5,148 homes. Further environmental gains can be achieved through increased use of low-carbon energy and more efficient painting and drying processes.[16]

A further critical component of the circular transition is the role of independent repair, highlighted in a study by van der Velden et al. (2023)[17]. The study underscores the challenges and opportunities for repairers, focusing on access to affordable, quality spare parts and overcoming barriers like software pairing restrictions and hardware authorizations. Repair is a crucial link between expensive authorized repairs and product disposal, fostering a circular spare part economy both locally and globally.

The circular economy is far from being a mere buzzword. It aligns with critical risk challenges like Net Zero and ESG goals. As businesses design longer-lasting products, insurers must adapt and create new insurance products to support these evolving business models and risk profiles.

[16] Repair or Replace - Investigating the relative GHG emissions of repairing or replacing damaged vehicle parts (2023)
[17] van der Velden, M., Maitre-Ekern, E. & Wanja, D.K. The Role of Independent Repair in a Circular and Regenerative Economy. Circ.Econ.Sust. (2023).

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