MarshMcLennan

AT A GLANCE

TACKLING THE HEAT CHALLENGE

A SHIFT FROM ANALYSIS TO SOLUTIONS FOR EXTREME HEAT RISK

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Extreme heat is a growing challenge for businesses and communities across sectors and geographies. Infrastructure, buildings, products, and services that are not designed to endure sudden spikes in high temperatures or prolonged heatwaves may face risk of damage and failure unless adapted and made more resilient.

Businesses can take action by using a combination of stress testing tools to evaluate how extreme heat impacts their operations, financial health, and people. By spotting weaknesses early, businesses can improve their ability to intervene to increase resilience, improve performance, and minimize the risk of costly losses and disruption. Stress testing helps businesses to move beyond mere impact assessment, enabling them to implement focused adaptation strategies at both the asset and system levels.

1. Why is extreme heat an issue?

First and secondary impact on people, on physical assets, on nature, on capital

In our previous report, *Turning Down the Heat*, we discussed the pervasive impact extreme heat can have on health, business operations and productivity, and wider system-level risks in supply chains, infrastructure, and across entire sectors. Because of its nature, extreme heat often leads to limited physical damage, but its financial disruption consequences can be severe.

Recent extreme heat events around the world continue to demonstrate a series of adverse challenges that businesses can face due to sustained periods of high temperatures. **In Australia**, extreme heat has caused productivity reductions of around 30% for outdoor workers and machinery operators, resulting in an estimated US$6.2 billion in annual economic losses.

In Ethiopia, Africa's top coffee producer, extreme heat and erratic weather threaten yields, with projections estimating a potential 25% drop in coffee yields by 2030 due to heat stress and climate variability. **In Germany,** Rhine shipping continues to be disrupted, resulting in forced cuts to production for chemical manufacturers and steel producers, with wider economic implications. Analysis suggests that the prolonged drought in 2018 led to a 0.5% decrease in Germany's GDP due to resulting supply disruptions. **In Taiwan**, the electronics industry was badly disrupted after extreme heatwaves and drought in 2021. One large contract chipmaker spent over $26 million on additional water trucks amidst drought conditions. Uncertainty around water supply has motivated several chip companies to leave Taiwan permanently. **In the Gulf Region**, refineries and power plants that have long relied on seawater cooling systems for their turbine condensers are now considering redesigning their cooling methods to adjust for warmer sea temperatures.

The indirect and chronic nature of extreme heat risks mean that businesses frequently overlook the impacts in traditional risk assessments. Yet the cumulative financial and operational consequences can be just as serious, if not more, than immediate dangers. Our climate adaptation framework aims to capture these systemic vulnerabilities (see Figure 1), helping organizations to manage climate risks more effectively and comprehensively.

Figure 1: *The Marsh Adaptation Framework illustrates the different vectors from which extreme heat-related risks many arise for an organization.*

2. What are organizations doing to address extreme heat?

At Marsh McLennan, we are seeing a range of responses to extreme heat across different sectors. As illustrated by the examples below (Table 1), organizations are employing innovative tools and strategies to remain resilient and competitive in the face of extreme heat.

Table 1: From assessing to addressing risk: How Marsh McLennan teams helped different sectors handle extreme heat challenges

In the **public infrastructure and utilities sectors**, organizations are developing bespoke stress test models to reduce the risks of heat-related disruptions and outages.	A European utilities provider was facing regulatory pressure and climate disclosure requirements. We modeled the financial impact of extreme heat to the client's core utilities assets, pulling upon academic links and regional data, to build a bespoke stress testing model that captures the nuances of the organization. Additional stress testing was performed to model both blackout and business interruption risk as energy usage shifts with demand under different climate scenarios. We worked with the client to develop adaptation recommendations with facility managers to replace cooling systems, introduce hybrid fuels, refurbish grids, reduce evaporation rates, and install carbon capture and storage systems.	Read more about heat stress testing in Section 3a.
The **US public sector** is promoting training, prevention strategies and emergency response measures to cope with daily extreme temperatures.	In North America, The National Commission on Climate and Workforce Health, in partnership with Mercer, is promoting more leaders to create heat-stress-management plans that include training, prevention strategies and emergency response. Some key initiatives include providing easy access to cool drinking water, encouraging regular hydration breaks, encouraging lightweight clothing, and scheduling strenuous activities for cooler parts of the day. For more information, download the Commission tip sheets. In particular, we are seeing the construction industry take notice of this advice and address these impacts head on.	Read more about Mercer's Climate Risk Forecaster in Sections 3b and 3c.
In the **food and beverage sector**, organizations are re-calibrating their supply chains to account for extreme heat-related yield risks.	A global food and beverage distributor, based in Europe, was cognizant of the significant threat of agricultural yields on its product, but did not fully know the growing locations in its supply chain. Leveraging Sentrisk, Marsh McLennan's AI-powered supply chain management tool, the business mapped its supply chain, revealing the growing locations deeper within its supply chain. It was then able to model climate risk under different scenarios, linking the potential yield impacts to its bottom line. These insights have allowed the business to develop stronger business continuity measures, including back-ups for growing locations in other regions.	Read more about Sentrisk in Section 3c.
In the **energy sector**, organizations are considering asset-level adaptation measures to renewable energy projects to combat rising heat risks.	An organization operating one of the world's largest solar parks, critical to national and international climate action plans, knew that in order to remain operational, it needed to have a longer-term adaptation roadmap. A climate physical risk assessment revealed that extreme heat was the dominant risk for this organization. Based on this information, we assisted the business in calculating a return on investment for various potential heat adaptation measures. Knowing the measures that provided the strongest ROI, and the timing of predicted future heat impacts, the business developed an implementation roadmap, which was also used to report to external stakeholders.	Read more about climate stress testing in Section 3a.
Financial institutions are assessing heat risk to different sectors and integrating projections into lending decisions and promoting adaptation among counterparties.	Oliver Wyman has worked with a range of financial institutions to translate complex climate scenarios into financial performance drivers. The approach uses seven climate perils, of which extreme heat is one, integrating these into sector-specific financial projects that adjust revenues, costs and capital expenditures under multiple scenarios, including the Network for Greening the Financial System (NGFS) and regulatory stress tests. These insights are being leveraged by integrating climate risk into lending decisions and promoting adaptation among counterparties.	Read about Oliver Wyman's climate stress testing capabilities in Section 3c.
In the **agricultural sector**, organizations are modeling temperature and precipitation patterns to inform crop diversification and growing strategies	A sovereign wealth fund with a global agricultural portfolio has to meet food security objectives and manage their yields appropriately. We helped the fund model the impacts of temperature and precipitation patterns on agricultural yields, running a series of hypothetical scenarios, including improved irrigation adaptations. These assessments are informing the business' crop diversification strategy and irrigation solutions to help maximize yields whilst managing costs.	Read more about heat stress testing in Section 3a.

3. Insights and lessons learned for risk managers

To manage the significant challenges related to extreme heat, risk managers should consider ways to identify their biggest vulnerabilities, measure the potential impact of extreme heat-related risks on their people and operations, and take actions to improve resilience. There are various tools that can assist in understanding and addressing extreme heat risks, including:

a) Climate stress testing

Climate stress testing is a scenario-based exercise that assesses the impacts of climate-related risks (physical, transition, and liability risks) on organizations' portfolios and business operations. Unlike scenario modeling, which takes a broader approach, there is usually a focus on financial impacts and quantification, combining climate shocks with economic and financial variables to estimate potential losses, capital needs, and liquidity impacts over a defined time horizon (see Figure 2). Like scenario modeling, stress testing looks at the resilience of an organization under stress conditions of different severity, often for regulatory or supervisory purposes. Stress testing drills down into the impact of severe, adverse climate scenarios to assess resilience and inform measures that should be considered.

Stress test outputs should be linked to strategic adaptation planning, with insights gleaned from these tests informing decision-making processes. Although there will be sector-specific nuances, climate stress testing typically follows six steps.

Figure 2: *Six steps to address risks through stress testing.*

1. Scenario selection	Choose relevant climate scenarios, including both physical (for example, extreme weather) and transition (for example, policy changes) risks. Scenarios should be severe but plausible and tailored to the institution's exposures.
2. Data collection	Gather internal and external data on exposures, emissions, and other risk drivers. Data should be granular and cover all relevant sectors and geographies.
3. Risk identification	Identify which risks (physical, transition, liability) are relevant for the institution's portfolio. Assess how these risks could materialize under the selected scenarios.
4. Modeling and analysis	Use models to quantify how climate risks impact financial and macroeconomic variables. This includes sectoral, portfolio, and macroeconomic modeling to estimate losses, credit risk, and other impacts.
5. Impact assessment	Assess the financial impact on the institution, including capital adequacy, profitability, and liquidity. This step often involves stress-testing key metrics under adverse scenarios.
6. Reporting and decision making	Summarize findings, report results to stakeholders, and use insights for risk management and strategic planning. This may also include regulatory reporting and internal decision-making.

For heat risk, this means considering drought and heat scenarios to project impacts for certain sectors, such as agriculture and energy. These exercises aim to help organizations and financial systems become more resilient to compound risk scenarios, such as water scarcity or grid failures.

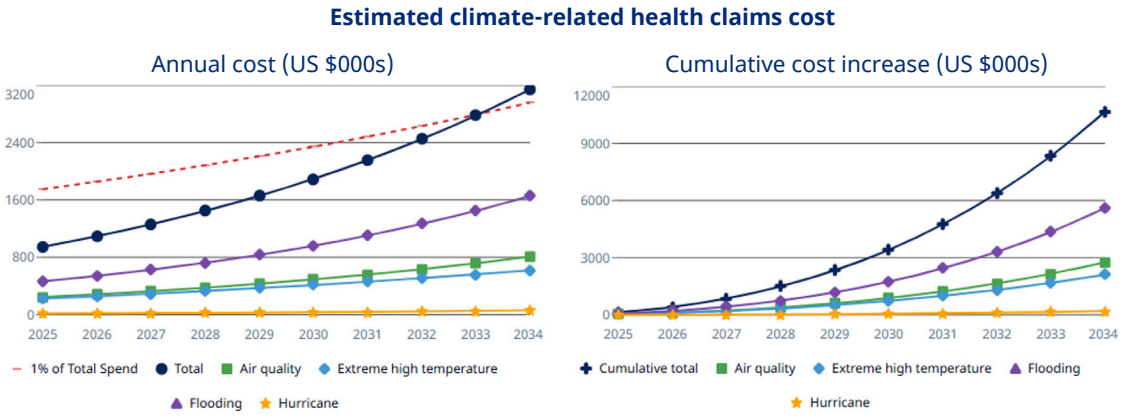
b) Occupational heat stress testing

Organizations can better address the risks posed to their employees from extreme heat by supplementing more traditional stress testing methods with specific tools to measure heat's impact on workers. To measure the overall heat load on workers, it is imperative to consider key factors like air temperature, humidity, radiant heat, and air movement. Occupational heat stress testing is a method used to evaluate how individuals or workers respond physiologically to heat exposure. It often involves monitoring environmental factors (temperature, humidity, and solar radiation) alongside physiological responses, such as heart rate and core body temperature, to determine heat strain and risk. Small increases can have an outsized impact on productivity and labor hours lost, with research indicating that 79% of work time lost at the midday hour can be recovered in the present climate if workers could move labor from the hottest hour of the day to an early morning hour.

c) Other notable assessment tools

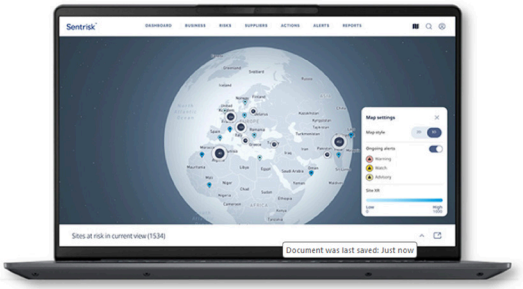
Employers can assess the financial impact of heat on their workforce using Mercer's Climate Health Cost Forecaster (see Figure 3). The digital tool — developed in partnership with the National Commission on Climate and Workforce Health — helps organizations to quantify the potential rise in heat-related illnesses and associated healthcare costs on their employees. The tool accounts for both direct and indirect health effects on individuals, including heat stroke and mental health issues.

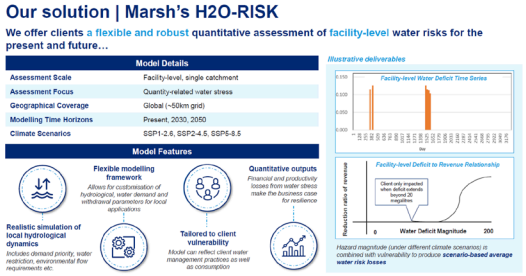
Figure 3: *Mercer's climate health forecaster.*



Organizations can use Sentrisk to analyze vulnerabilities throughout their supply chain and assess the potential impact on their operations. For extreme heat, this means identifying geographic hotspots of heat exposure across facilities, suppliers, and logistics networks to help proactively manage cascading risks triggered by heat stress, such as water scarcity or labor productivity losses. Marsh Asia's H20 product allows organizations to stress test regulatory or water restriction changes, sectoral (for example, agriculture) demand increases, climate-driven precipitation changes, and other change drivers.

Figure 4: *Sentrisk (left) helps facilitate the identification of an organization's riskiest sites, suppliers, components, and products and compares them using a proprietary XR score. H20 (right) is a quantitative assessment of facility-level water risks for the present and future.*





Oliver Wyman's financial stress testing capabilities allow businesses to simulate the economic impacts of extreme heat scenarios on their balance sheets, cash flows, and operational costs. This includes modeling indirect costs, such as increased energy consumption for cooling, supply chain disruptions due to heat-induced infrastructure failures, and shifts in market demand.

We believe that risk managers should integrate a combination of these tools into resilience and financial planning in order to identify vulnerabilities, assess capital adequacy, and develop robust adaptation strategies that safeguard long-term organizational resilience.

4. Dealing with the financial impacts of heat stress

The analyses above mainly focus on assessment opportunities for managing heat risk. But how can organizations reduce the financial impacts of heat stress? Below we explore three methods:

a) Sourcing finance for interventions

Securing funding for adaptation to extreme heat entails mobilizing resources to support measures that mitigate heat-related risks. This can be accomplished in different ways, including through blended finance approaches that integrate public grants, private investment, and philanthropic capital. Organizations can also leverage risk financing tools like insurance and catastrophe bonds, dedicated adaptation funds, environmental impact bonds, or microfinance schemes.

Effective mobilization of resources necessitates embedding financing within adaptation strategies, engaging stakeholders at an early stage, and leveraging public funds to attract private sector investment. The exploration of innovative financial instruments — such as climate bonds or revolving funds — can unlock further capital and distribute risk. Financial planning tailored to specific sites and risks, for example investing in water futures to address increasing irrigation demands, can also be considered. It is essential to monitor and evaluate the outcomes of these interventions to ensure accountability and foster investor confidence. Financing methods applied in other physical risk areas, like flood risk management, may also be adapted or expanded. For example, Oliver Wyman, Marsh, and the Marsh McLennan community are pioneering a variety of innovative finance pilots aimed at climate adaptation initiatives. These efforts include the use of parametric insurance for risk mitigation and resilience planning, as well as the development of new financial mechanisms in collaboration with central governments, local authorities, and investors to strengthen financial resilience against climate-related hazards.

b) Design and prioritization of resilience implementations

Resilience interventions and insurance go hand in hand. One method that may allow insurers to avoid constant payouts and may help insureds to reduce their insurance premiums is the implementation of better strategies to defend against weather extremes. For example, by planting crops more resilient to drought or building cooler homes to protect against rising heat, insurers can set triggers higher. Businesses adopting heat stress testing and workplace adaptations — including hydration protocols, cooling centers, and adjusted shifts — may reduce heat-related health claims and operational losses, which in turn supports better insurance terms and lowers premiums.

c) Insurance and risk transfer

We see increased usage of parametric insurance products in agriculture and supply chain contexts to cover losses from heat-induced drought, crop failures, and supply chain disruptions. One example, Milkshake, is a parametric program for farmers to cover loss of revenue from reduced productivity of milk cows during heatwaves. Other examples include crop insurance that covers losses from heat-induced drought and water stress on agriculture to help farmers manage financial risks associated with extreme heat, and adjustments to worker's compensation policies to provide coverage for accidents caused by heat-related fatigue. These risk transfer mechanisms are discussed further in our report, *Turning Down the Heat.*

5. Next steps for businesses to increase their heat resilience

Each organization will have its own unique set of challenges when it comes to extreme heat. Importantly, there are a range of solutions that allow corporates to address heat risks. Here are our top takeaways for risk managers:

1. **Understand the impact of extreme heat:** Extreme heat poses significant risks to businesses, affecting employee productivity, physical assets, and supply chains. Risk managers should recognize that while physical damage may be limited, the financial disruptions can be severe, as evidenced by case studies from various sectors.

2. **Leverage a combination of tools:** Risk managers can utilize a number of tools to help them assess and address heat risks at the asset- and system-level. These include:

    a. **Implementing climate stress testing:** Organizations should adopt climate stress testing as a critical tool to assess the financial impacts of extreme heat on operations. This involves scenario-based exercises that quantify potential losses and inform strategic adaptation planning, enabling businesses to proactively address vulnerabilities.

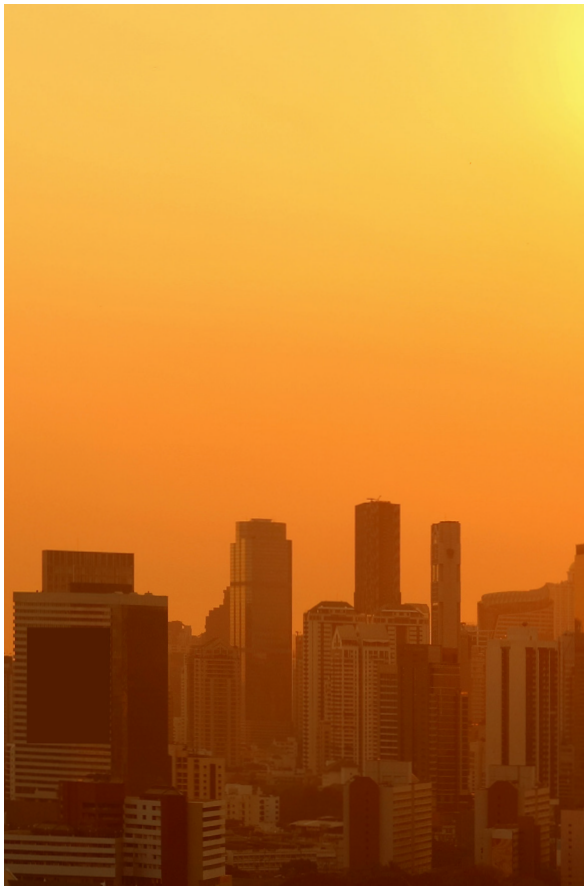
    b. **Adapting workforce management:** Risk managers should consider occupational heat stress testing to protect employees from extreme heat. This includes monitoring environmental factors and physiological responses to heat exposure, and implementing measures such as acclimatization programs and hydration stations to mitigate health risks.

    c. **Integrating other innovative tools:** Tools like Sentrisk and Mercer's Climate Health Cost Forecaster can help analyze vulnerabilities in supply chains and forecast the financial impact of heat-related illnesses. These tools can help identify geographic hotspots of heat exposure and quantify potential healthcare costs, facilitating informed decision-making.

3. **Explore ways to finance adaptation strategies:** Risk managers should explore innovative financing mechanisms for heat risk management, such as blended finance models and parametric insurance products. Engaging stakeholders and integrating financing into adaptation planning can mobilize resources to fund interventions that enhance resilience against extreme heat.

Organizations should consider the right combination, and effort required, to take these steps towards addressing extreme heat risk.

At Marsh McLennan, we are privileged to work on, and observe, a range of best-practice heat risk management techniques. It is important to note that there is no one-size-fits-all approach and all techniques need to be tailored to the specificities of the enterprise in question.



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