Five ways mining businesses can build climate resilience

The decarbonization imperative is putting pressure on the mining sector. Driven by stakeholder pressures and changing exposures, future-ready metals and mining businesses are embracing five steps to build resilience against climate risk.

Climate change is driving the mining sector to think strategically

Climate change is impacting the extractives sector as businesses continue to:

- Appraise their role in a low-carbon future through mining the necessary metals and minerals
- Rebalance commodity portfolios and shift away from fossil fuels
- Drive to decarbonize their operations and supply chains
- Manage exposures to legal challenges associated with historical emissions, environmental degradation, potential 'greenwashing' allegations and directors' and officers' (D&O) insurance claims related to climate change
- Shore up the resilience of their assets, operations and supply chains to the physical impacts of climate change

In building resilience across assets, operations and supply chains, it is critical to examine the impact of weather and climate events and identify priority actions. Mining investment decisions have long lead times and long-lasting effects. Future-ready business leaders are taking action now.

Priority actions for mining companies to build climate resilience

1. Build climate resilience into existing processes

Planning now for the impacts of a changing climate makes good business sense — both to minimize the risks and capitalize on the opportunities. Building climate resilience is about integrating it within existing risk management and planning procedures. Leaders' energies may be wasted in reinventing the wheel. From planning, to operation and maintenance, to decommissioning and closure, there are multiple opportunities for climate risk considerations to be integrated into existing activities so mining businesses can take a step on their energy transition journey with minimal disruption.

2. Identify climate sensitivities and critical thresholds

Identifying critical climate-related thresholds is a key early step in physical climate risk assessments. Critical thresholds represent the boundaries between tolerable and intolerable levels of risk. A critical threshold may, for example, be the original tailings storage facility design operating freeboard, a maximum safe working temperature for personnel, or the volume/frequency of local communities' complaints.

Figure 1 shows that in a stationary climate, the threshold may be designed to tolerate infrequent breaches and their consequences. In the future climate, the threshold may be crossed more often and with greater intensity, leading to intolerable levels of risk. To ensure continued successful operation, adaptation would be required to increase the coping range (e.g. by raising the height of the dam spillway).

3. Stress-test strategies across future climate scenarios

Scenario testing overlays unknowns with analysis to aid decision-making. Scenario testing cannot predict the future, but as an approach advocated by the TCFD[2], testing enables leaders to explore the implications of different plausible futures.

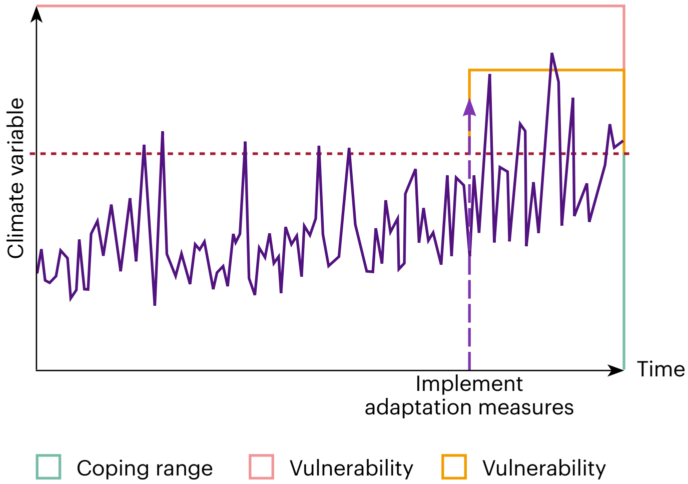
Current weather and climate data, and future climate information (termed climate projections) are essential inputs into scenarios for climate-related risk assessments. Scenarios usually include three time periods, typically: 2030 (2021-2040); 2050 (2041-2060) and 2080 (2071-2090). The 2050s represent a medium-term outlook, which typically aligns with asset lifecycles, and the 2080s period of post-closure and decommissioning.

Mining and metals companies should also explore a range of potential climate futures representing different global climate change mitigation ambitions. Generally, it is recommended that companies utilize low-, medium- and high-emissions scenarios which correspond to Shared Socio-Economic Pathways (SSPs): (i) SSP1-2.6; (ii) SSP2-4.5 and (iii) SSP5-8.5.

As part of this process, tipping points should be incorporated into scenarios. Tipping points are defined by the the Intergovernmental Panel on Climate Change as critical thresholds beyond which a system reorganizes, often abruptly and/or irreversibly[3], e.g. reduction in area of Arctic Sea ice, permafrost thawing, accelerating loss of the Greenland and West Antarctic ice sheets. Without incorporating tipping points, businesses are likely to be underestimating the business impacts of a 2-3+ °C world.

Figure 1:

The relationship between coping range, critical threshold and vulnerability — including some examples[1]



Examples

- Water resources for hydropower
- Performance of equipment under different temperature ranges
- Pollution levels/discharge limits
- Worker health and safety in temperature extremes
- Overtopping of flood defences and drainage capacity

4. Quantify risk

It's important to identify, assess and financially quantify your risks — both for disclosure requirements and to guide business planning and investment decisions. However, translating climate impacts into robustly quantified financial risks remains a challenge.

Physical climate risks may lead to a range of business impacts, some of which are financially quantifiable (e.g. physical damage, business interruption, production loss and costs), and others which are more difficult to quantify (e.g. brand equity, reputation, legal action, compensation). Quantifying the potential financial impacts of physical climate risk should balance two robust approaches:

- Probabilistic nat cat models are recognized and used within the insurance industry to price such risks. These models can be used for acute hazards, such as flooding and storms (including hurricanes, typhoons, extratropical cyclones and tornadoes). These models

[1] Willows, R.I. and Connell, R.K. (Eds.). (2003). Climate adaptation: Risk, uncertainty and decision-making. UKCIP Technical Report. UKCIP, Oxford. https://www.ukcip.org.uk/wp-content/PDFs/UKCIP-Risk-framework.pdf
[2] TCFD (2017). Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities. https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Technical-Supplement-062917.pdf
[3] IPCC (2024). IPCC glossary. https://apps.ipcc.ch/glossary/

probabilistically consider the potential damages to property, contents, machinery and equipment, as well as the potential business interruption caused by the hazards. These models can be adjusted to reflect different shared socioeconomic pathways scenarios, and the leading vendors are increasingly providing these future views of risk for a range of geographically specific hazards (e.g. U.S. hurricane, European windstorm and Australian wildfire).

- Scenario-based analysis — supported by climate data — can provide plausible ranges of impact in better, bad and average years. For hazards that are less likely to cause physical damage, such as heat stress and drought, the financial impact is typically associated with business interruption and loss of revenue.

5. Stay agile when it comes to risk management

Risk management (adaptation) options can cut across all areas of the business and cover multiple dimensions. The adaptation options presented in Figure 2 may be a useful framework to ensure that the full suite of available options are identified and considered. Some measures will be high-cost and complex (e.g. new infrastructure, or actions involving multiple stakeholders), while others will be low-cost and easier to implement (e.g. operational changes, capacity building and training).

Actions can be sequenced into adaptation pathways. Adaptation to a given risk will often involve a package of individual measures, with progress made over time and systematically. Adaptation pathways show how the measures can be sequenced.

The general rules for developing adaptation pathways are that:

1. Informational and institutional/policy actions often need to be undertaken first, as these form the building blocks for future decisions. Contracting and insurance arrangements should also be reviewed in the short-term.
2. Operational measures (OPEX) often make sense to implement in the short- to medium-term, as they are generally more flexible, reversible and lower cost than physical modifications.
3. Actions that are likely to be deferred until later, are those that are more costly and which address long-term risk. These are typically physical modifications, involving significant capital expenditure (CAPEX).

The pathways support a decision strategy that can evolve and adjust as circumstances change, new knowledge emerges, or climate-related thresholds are met.

Figure 2:

Types of risk management (adaptation) options to address climate-related risks

	Type of option	Description
	Informational	• Scoping of detailed risk studies • Monitoring of hazards • Appraisal of existing controls
	Institutional	• Integrating climate risk into existing risk assessments • Stakeholder engagement • Oversight and governance of climate risks
	Contracting and Insurance	• Extending cover • Engaging with insurers on adaptation measures that have been implemented
	Operational (OPEX)	• Reviewing and improving maintenance regimes and H&S protocols • Reviewing and improving usage of water and energy • Post-event repair and restart
	Physical modification (CAPEX)	• Back-up systems • Upgrading to higher specification on replacement • ‘Hard’ engineering solutions • ‘Soft’ Nature-based Solutions (NbS), e.g. trees for shading

Mining companies are facing increasing pressure to take action

Physical climate risks are mounting

The mining and metals sector is exposed to a range of direct and indirect physical climate risks due to:

- A reliance on long-lived and capital-intensive fixed assets
- Often operating in regions that are highly vulnerable to extreme weather
- Having extensive product transport networks and reliance on deep and complex supply chains
- A dependence on workforces and communities that are vulnerable to a changing climate
- A need to manage complex environmental permitting arrangements, and social licence to operate, which can be undermined by the effects of a changing climate

In recent years, the resilience of mining production systems and infrastructure has been tested by extreme weather and nat cat events. It is estimated that global nat cat insured losses breached the 10-year average by approximately 40% in 2022[4] and 2023 was the fourth successive year that global nat cat losses breached the $100 billion barrier[5]. This is having significant impacts on those operational mines in exposed regions, construction phases of projects and the availability of insurance cover[6].

A word of caution, though. The newsworthy nature of extreme events generates interest in planning for more severe and frequent climatic events. Incremental changes in climate conditions are more likely to be overlooked. Rising temperatures, for example, can have cumulative impacts as small efficiency losses affect a broad range of equipment such as pumps, compressors and electrical equipment. To help get ahead, companies should identify the risks associated with both incremental changes and extreme events.

> **"In Australia, specific increased deductibles and inner limits for wildfire, tropical cyclone and flood are becoming commonplace, thus pushing risk retention back to the insured parties."**
>
> Ben Rabb,
> Associate Director, Physical Risk,
> Climate Practice, WTW

[4] WTW (2023). Mining Market Review, 2023. https://www.wtwco.com/-/media/wtw/insights/2023/05/mining-market-review-2023.pdf
[5] Insurance Times (2024). Increasing natural catastrophe losses necessitate a resilience focus. https://www.insurancetimes.co.uk/analysis/increasing-natural-catastrophe-losses-necessitate-a-resilience-focus/1451687.article
[6] WTW (2023). Mining Market Review, 2023. https://www.wtwco.com/-/media/wtw/insights/2023/05/mining-market-review-2023.pdf

Figure 3:

Example impacts for the mining and metals sector from a range of climate hazards

	Impacts for the mining sector		
Climate hazards	Core operations and infrastructure	Critical inputs and third-party infrastructure	Local communities & habitats
Increase in air temperatures	Increased equipment breakdown and loss of efficiency	Reduced efficiency and lower output for power plants, electrical switchgear and substations	Heat stress and heat stroke amongst local communities and workforce
Increase in water temperatures	Reduced efficiency of processes requiring cooling water e.g. refineries	Increased algae growth causing blocking of inlet pipes e.g. at desalination plants	Damage to local habitats and liabilities around the temperature of effluent discharge
Changes in precipitation patterns and surface water discharges	Increase in precipitation leads to water management infrastructure being inadequate e.g. water treatment systems, tailing storage facility stability	Ground subsidence and heave affecting the stability of infrastructure e.g. rail	Pollution runoff from site and contaminating local community water supplies Infectious and vector-borne disease (e.g. malaria, dengue fever)
Changes in wind patterns	Increased dust emissions requiring suppression	Damage to electrical transmission and distribution infrastructure	Transport of dust from site, affecting the wellbeing and health of nearby populations and/or damaging crops
Extreme weather events (e.g. stronger and/or more frequent storms, flooding, wildfires)	Flooding causing damage and disruption to site infrastructure and overwhelming drainage systems and/or tailings management systems Extreme windstorms and wildfires leading to damage, downtime and lost production	Heavy rainfall and flooding (surface water and fluvial) causing road or rail washouts Increasing risk of wildfires leading to energy supply interruption (blackouts)	Increased incidents and accidents among the local workforce, third-party property damage and/or bodily injuries, pollution
Sea level rise and storm surge	Infrastructure damage due to coastal flooding Supply chain disruption (e.g. fuel delivery or product export) during adverse conditions (e.g. storm surge)	Sea level rise causing increasing saline groundwater levels and sea water intrusion of underground infrastructure	Increased flooding of coastal communities and damage to nearby habitats

Stakeholder expectations are escalating

Driven by central banks and regulators, investors, insurers and banks are expected to facilitate the transition to a low-carbon, climate-resilient economy by moving capital. Disclosure of climate risks is mandatory. Companies will be expected to understand and manage their climate risks in increasingly sophisticated ways.

Around the world, national governments continue to introduce climate-related targets and legislation. Insurers have stated that the terms and conditions of insurance contracts will change in response to a changing climate, and many non-governmental organisations are advocates for community climate change resilience. A high level of social interest is also increasing pressure on corporations to take action on climate change, which is further fuelling the retail investor market and shareholder pressures.

Looking ahead: taking action is the gateway to success

Climate change is a complex issue, with inherent uncertainty about the timing, pace, and severity of possible impacts. However, this isn't a reason for inaction. The mining sector will need to develop robust responses to today's and tomorrow's climate[7]. By responding to the risks and opportunities associated with future climate change methodically and comprehensively, companies can ensure that they implement actions that both build resilience and deliver strong financial returns in the long run.

Decisions, backed by data, should target ensuring business continuity, making prudent investments, limiting future liabilities and safeguarding the sustainability of local communities and ecosystems. The most innovative and proactive companies will no doubt reap the rewards.

Anna Haworth Associate Director, Research Climate Practice, WTW
Anna.Haworth@wtwco.com

Dr Ben Rabb, Associate Director, Physical Risk, Climate Practice, WTW
Benjamin.Rabb@wtwco.com

[7] Wilby, R., and Dessai, S. (2010). Robust adaptation to climate change. Weather 65: 180-185. https://doi.org/10.1002/wea.543