Climate Governance Initiative Australia

A JOINT PUBLICATION BY Australian Institute of Company Directors | CSIRO

DECEMBER 2023

Climate Change - Science Snapshot 2023

An overview for Australian company directors

Introduction

This snapshot provides company directors with a high-level overview of the latest information on potential impacts of climate change on Australia and its industries. This information can be used to inform boardroom discussions on the need for climate scenario analysis and transition planning.

Current as of December 2023, this snapshot provides accessible information on:

1. Key climate change concepts
2. Overview of Australia's changing climate
3. Future global outlook
4. Outlook for Australia
5. Key questions to guide boardroom discussions

SUMMARY OF KEY FACTS ON CLIMATE CHANGE

- Human influence on the climate system is now considered unequivocal. The average global temperature at the Earth's surface has warmed by 1.1°C since the second half of the 19th Century due to global greenhouse gas emissions. As a result, Australia experienced its warmest winter on record in 2023, and this trend will continue.
- As part of global efforts to reduce greenhouse gas emissions, in 2015, 196 countries including Australia, adopted the United Nations Framework Convention on Climate Change's **Paris Agreement**. The treaty aims to limit the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.
- Some future climate change is already "locked in" even if the Paris Agreement goals of limiting global warming to 1.5°C are met.
- Under current emission reduction policies, the world will experience global warming by the end of the century of 2.5 to 3.0°C. Further, without an immediate and significant reduction in emissions, the global 1.5°C warming limit is expected to be breached in the early 2030s, or possibly at the end of this decade.

1. Key climate change concepts

Human influence on the climate system is now considered unequivocal, as confident a statement as scientific research can give. The average global air temperature at the Earth's surface has warmed by 1.1°C since the second half of the 19th Century, because of human activity. The June-August period of 2023 was the warmest on record for Australia and globally. Further, average global sea levels have risen by around 25cm since 1880, and there have been large-scale changes to seasonal patterns such as the monsoon, and to the intensity and frequency of extreme weather events.

These observed changes are largely attributable to increases in the amount of greenhouse gases in the atmosphere from global industrialisation. Approximately 90 per cent of the world's emissions of carbon dioxide (CO_2), the largest contributing greenhouse gas, come from the burning of fossil fuels – mainly for electricity, heat and transport.

CO_2 concentrations in the Earth's atmosphere are likely to be at the highest point in history, for at least the past two million years. Concentrations are continuing to rise contributing to the warming of the planet.

As part of global efforts undertaken to reduce global greenhouse gas emissions, in 2015, 196 countries including Australia, signed the United Nations Framework Convention on Climate Change's Paris Agreement (the Paris Agreement). This legally binding international treaty aims to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels".

CLIMATE TERMS EXPLAINED

The term **climate** describes the predominant weather of a geographic region and is commonly described in terms of averages of key variables (e.g. temperature, rainfall) taken over a period of decades.

Climate variability refers to the year-to-year and, sometimes, decade-to-decade variations that occur around the average conditions, for example associated with **La Niña** and **El Niño**. Due to climate variability, consecutive summers will not all be the same, with some cooler and some warmer than the long-term average.

Climate change refers to a long-term trend or shift in climate that occurs over many decades, around which climate variability will still occur. These changes may be due to natural variations (such as changes in the Earth's orbit), but since the 1800s, human activities changing the composition of the atmosphere have been the main drivers of climate change. Both climate change and climate variability contribute to climate-related hazards.

CLIMATE-RELATED HAZARDS ARE INCREASING IN AUSTRALIA

The most recent Intergovernmental Panel on Climate Change (IPCC) Assessment Report shows the socioeconomic costs of climate variability and climate change have been increasing in Australia. This is due to a combination of **Chronic hazards** and **Acute hazards**.

The risk of climate-related impacts arises from a combination of climate-related hazards and the vulnerability and exposure of human and natural systems. As the frequency and intensity of climate-related hazards increase, physical climate risks may also increase for the environment, community and businesses.

Figure 1: Key examples of chronic and acute hazards

Chronic hazards	Acute hazards
Increasing mean temperatures	Heatwaves
Rising sea levels	Storm tides
Increasing ocean acidification	Marine heatwaves
Increasing sea surface temperatures	Floods
Decreasing mean rainfall	Storms and tropical cyclones
	Bushfires

Physical risks to a business may include damage and/or financial loss to organisational assets, supply chains and operations and markets due to exposure and vulnerability to climate-related hazards. For example, a business with a key factory in a low-lying coastal area may be exposed to more frequent coastal inundation due to sea-level rise. If the factory contains critical machinery that is easily damaged by floodwater and is expensive and time-consuming to replace, the business is also vulnerable and, therefore, at risk.

FURTHER GUIDANCE ON KEY CLIMATE CHANGE CONCEPTS AND RISKS

Directors can learn more about fundamental climate change concepts, how to start their board's climate change journey and the relevance of climate change in the context of non-executive directors' duties in the following Climate Governance Initiative (CGI) Australia resource: **Climate risk governance guide: An introductory resource for directors on climate risk governance**.

2. Overview of Australia's changing climate

FIGURE 2: A summary of key climate changes in Australia.

CHANGES IN AVERAGE CONDITIONS

2019 was Australia's hottest year on record. By the 2050s, this could be an average year.

Australia warmed by 1.47°C between 1910 and 2021. This trend will continue. This may seem like a small increase in temperature but it represents a significant and impactful change to our climate - most years are now warmer than almost any year during the 20th Century as a result.

Globally, oceans have risen by 25cm since 1880. In Australia, sea level rise varies regionally, with greater rises in the south east and Gulf of Carpentaria. These trends will continue.

Cool season rainfall has declined by 10-15 per cent in southern Australia. This trend is expected to continue. An increase in rainfall across Northern Australia has occurred since the 1970s.

CHANGES IN EXTREME CLIMATE EVENTS

The frequency of extreme heat events has increased. Extreme heat kills more people than any other natural hazard. The future will bring even more heatwaves and fewer cool days.

There has been a decrease in the number of tropical cyclones observed since at least 1982. This trend is expected to continue and when they occur, they are more likely to be intense.

Heavy rainfall has become 10 per cent more intense in some regions, with associated flash flooding risks. This trend is expected to continue.

Fire seasons have become more intense, and are starting earlier and lasting longer. This trend is expected to continue.

Marine heatwaves have been more frequent since the 1970s. This trend will continue.

Adapted from figure in **State of the Climate 2022.**
Source: Bureau of Meteorology and CSIRO

3. Future global outlook

EMISSION REDUCTION EFFORTS NOT ENOUGH TO LIMIT WARMING TO 1.5°C

Globally, additional policies are necessary to ensure the Paris Agreement goals are achieved. Current emission reduction policies put the world on track for global warming by the end of the century of 2.5-3°C[1]. This magnitude of global warming would be catastrophic and result in Australia's ecological systems drastically changing and the loss of Australian flora and fauna (refer to Table 1, page 8 for further examples of climate impacts under this climate scenario).

Failure to enact policies that achieve rapid and deep cuts in global greenhouse gas emissions may also have dire consequences as every increment of global warming increases the risk that the climate will pass a "tipping point" that could result in rapidly accelerating climate change and/or sea level rise[2]. An example is the collapse of Antarctic ice sheets.

If significant cuts in emissions are not made immediately, the global 1.5°C warming limit is expected to be breached in the early 2030s and could be breached by the end of this decade[3].

If the world is to have a chance of stabilising warming to 1.5°C, steep reductions in global emissions must be achieved this decade and global net zero emissions must be met by 2050, or earlier.

Net zero carbon emissions can only be achieved with significant investment in decarbonising the energy system, increasing energy efficiency and the development and deployment of new technologies that remove carbon from the atmosphere and store it for many centuries.

The magnitude of future climate change impacts is uncertain, but assessments of physical risks can still be made by considering plausible scenarios of the future, informed by socioeconomic scenarios, climate science and modelling and other lines of evidence.

1. Rogelj J, Fransen T, den Elzen MGJ, Lamboll RD, Schumer C, Kuramochi T, Hans F, Mooldijk S, Portugal-Pereira J, 2023, **'Credibility gap in net-zero climate targets leaves world at high risk'**, Science. vol. 380, no. 6649, pp 1014-1016. DOI: 10.1126/science.adg6248

2. David I. Armstrong McKay et al., 2022, **'Exceeding 1.5°C global warming could trigger multiple climate tipping points'**, Science. vol. 377, no.6611. DOI:10.1126/science.abn7950

3. Lamboll, R.D., Nicholls, Z.R.J., Smith, C.J. et al., 2023, **'Assessing the size and uncertainty of remaining carbon budgets'**, National Climate Change

4. Outlook for Australia

SIGNIFICANT CLIMATE CHANGE RISKS IN THE FUTURE

Future climate-related impacts experienced in Australia will be dependent on the level of global warming the world reaches.

If the Paris Agreement goals of limiting global temperature increase to 1.5°C or "well below" 2°C pre-industrial levels are met, significant additional changes to the climate are still expected.

If the world fails to meet the Paris Agreement goals, and global warming exceeds 2°C, the resulting changes to our climate will be even greater.

Government emission reduction policies and climate action by the public, private and not-for-profit sectors will influence how quickly emissions can be reduced globally, and therefore the extent to which global warming is limited. To learn more about the Australian Government's commitment to introduce mandatory climate- related disclosures, see the CGI resource: **A director's guide to mandatory climate reporting.**

A degree of future climate change is already "locked in" with the current level of global warming (1.1°C). For example, the science shows sea level rise continuing until well beyond the end of this century.

The effects of future climate change will be far-reaching, with consequences for the environment, economy and Australian people. However, some climate change risks may be mitigated if the federal, state and territory governments, businesses and communities are able to adapt and respond to the changing climate. In some cases, the success of these efforts may depend on how well the overseas communities on which Australia depends, also adapt.

Physical risks are projected to increase for a wide range of systems, sectors and communities. Table 1 below outlines nine key climate change risks identified by the Intergovernmental Panel on Climate Change (IPCC), and potential implications for Australian industries. The Australian government is currently in the process of conducting a National Climate Risk Assessment (NCRA) to identify priority risks for Australia.

FURTHER READING ON CLIMATE CHANGE IMPACTS AND ADAPTATION IN AUSTRALIA AND GLOBALLY

To read more on the latest knowledge (as at December 2023) of global climate change, its risks and impacts, and climate change mitigation and adaptation, visit the **IPCC Climate Change 2023: Synthesis Report.**

To find out more on current and future impacts of climate change on Australian ecosystems, biodiversity and society and climate adaptation across key sectors see **Chapter 11: Australasia, IPCC Climate Change 2022: Impacts, Adaptation and Vulnerability.**

TABLE 1: KEY CLIMATE CHANGE RISKS AND IMPLICATIONS FOR AUSTRALIAN INDUSTRIES[4]

Impact	Examples of Australian industries impacted	Risk for 1.5°C of global warming	Risk for 2°C of global warming	Risk for 3°C of global warming
Loss and degradation of coral reefs and associated biodiversity and ecosystem service values due to ocean warming and marine heatwaves	Marine fisheries and aquaculture, Tourism	Very high	Very high	Very high
Loss of alpine biodiversity due to less snow	Tourism	High (moderate to high with moderate adaptation)	High to very high	Very high
Transition or collapse of alpine ash, snowgum woodland, pencil pine and northern jarrah forests in southern Australia due to hotter and drier conditions with more fires	Tourism, Forestry, Emergency Management	Moderate to high (moderate with moderate adaptation)	High (moderate to high with moderate adaptation)	Very high (high to very high with moderate adaptation)
Loss of kelp forests in southern Australia due to ocean warming, marine heatwaves and overgrazing by climate-driven range extensions of herbivore fish and urchins	Tourism	High to very high	Very high (high to very high with moderate adaptation)	Very high
Loss of natural and human systems in low-lying coastal areas due to sea level rise	Coastal infrastructure owners and operators	Moderate	Moderate to high (moderate with moderate adaptation)	High to very high (high with moderate adaptation)
Disruption and decline in agricultural production and increased stress in rural communities in southwestern, southern and eastern mainland Australia due to hotter and drier conditions	Agriculture, Supply chains	Moderate	Moderate to high (moderate with moderate adaptation)	Very high (high to very high with moderate adaptation)
Increase in heat-related mortality and morbidity for people and wildlife due to heatwaves	Health	Moderate to high (moderate with moderate adaptation)	High (moderate to high with moderate adaptation)	Very high
Compound events involving cascading, and aggregate impacts on cities, settlements, infrastructure, supply chains and services due to wildfires, floods, droughts, heatwaves, storms and sea level rise	Critical infrastructure, Supply chains, Transport	High to very high (high with moderate adaptation)	High to very high (high with moderate adaptation)	Very high (high to very high with moderate adaptation)
Inability of institutions and governance systems to manage climate risks	All industries	High to very high (moderate to high with moderate adaptation)	High to very high (high with moderate adaptation)	Very high (high to very high with moderate adaptation)

4. Lawrence, J., B. Mackey, F. Chiew, M.J. Costello, K. Hennessy, N. Lansbury, U.B. Nidumolu, G. Pecl, L. Rickards, N. Tapper, A. Woodward, and A. Wreford, (2022): ***Australasia. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*** , [H.-O. Portner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegria, M. Craig, S. Langsdorf, S. Loschke, V. Moller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 1581–1688, DOI: 10.1017/9781009325844.013

5. Key questions to guide boardroom discussions

1. What is our process for integrating the latest climate knowledge into our strategy and risk management approach?
2. What process do we need to follow to undertake robust scenario analysis for our business? Are our chosen scenarios aligned with the Paris Agreement goals, and do they also consider alternative global projections with increased greenhouse gas emission concentrations?
3. What scientific assumptions are underlying our transition plan?
4. How is the board/management team upskilling themselves on physical risks and their material implications for our organisation?
5. What expertise do we need internally and/or can access externally to support us to understand and manage climate change impacts and risks?

Glossary

Acute hazards – relate to changes in the frequency, intensity, duration and location of extreme events.

Chronic hazards – relate to changes in average climate conditions.

Climate – describes the predominant weather of a geographic region and is commonly described in terms of averages of key variables (e.g. temperature, rainfall) taken over a period of decades.

Climate change – any long-term trends or shifts in climate over many decades, from natural variations or human activities.

Climate-related hazards – can occur naturally or from climate change (e.g. droughts, floods, storms such as cyclones)

Climate variability – the year-to-year variations around the average conditions.

El Niño – El Niño tends to bring dry, hot conditions to much of Australia, due to warmer than average sea-surface temperatures in the tropical Pacific Ocean.

La Niña – La Niña tends to bring wet, cool conditions to much of Australia, due to cooler than average sea-surface temperatures in the tropical Pacific Ocean.

Net zero emissions – when emissions of greenhouse gases to the atmosphere are balanced by the removal of greenhouse gases from the atmosphere by deliberate human activities.

Paris Agreement – an abbreviated term for the the United Nations Framework Convention on Climate Change's Paris Agreement, a legally binding international treaty on climate change.

Physical risks – risks to human or natural systems as a result of climate-related hazards. Climate change is increasingly contributing to physical risks through both acute and chronic hazards.

About CSIRO

Changes to Australia's climate from past and future emissions of greenhouse gases will continue to impact the environment and businesses into the foreseeable future under all plausible global warming scenarios.

Together with its research partners, CSIRO continues to provide the best available climate science and decision-making processes – informed by business and government needs – to enable them to make better decisions.

Contact CSIRO today to discuss how they can help you mitigate the risks of climate change through knowledge and services.

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ADDITIONAL RESOURCES

CSIRO and Bureau of Meteorology (2022) **State of the Climate 2022**

IPCC **Working Group I Regional Fact sheet – Australasia**

IPCC (2023) **Climate Change 2023: Synthesis Report - Summary for Policymakers.** Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

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The AICD is committed to strengthening society through world-class governance. We aim to be the independent and trusted voice of governance, building the capability of a community of leaders for the benefit of society. Our membership includes directors and senior leaders from business, government and the not-for-profit sectors.

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