Actuaries Institute.

Climate Change – Technical Paper for Appointed Actuaries

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Introduction

Climate change is a material strategic risk and one of the major challenges facing financial institutions today. Regulators recognise that the financial risks associated with climate change could undermine financial stability and are quickly increasing their expectations around the measurement and management of climate change risks and opportunities. Investors are demanding disclosures on climate risks and opportunities, with the Task Force on Climate-Related Financial Disclosures ("TCFD") now seen as the global standard, the recent release of the International Sustainability Standards Board IFRS S1[1] and S2[2] standards, and the Australian Treasury in the process of consulting on mandatory climate disclosures for certain entities[3].

This Technical Paper provides Appointed Actuaries with an outline of how insurance operations may be impacted by climate change and offers suggestions to address these issues in a Financial Condition Report. Australian Prudential Regulation Authority's ("APRA") Prudential Standard CPS320[4] outlines the requirements for the Appointed Actuary ("AA") in writing a Financial Condition Report. In this note we refer to individual sections of this prudential standard where appropriate.

This information may also be helpful in many other situations when advice is provided to financial institutions.

It is noted that climate change is just one aspect within wider sustainability considerations. Sustainability is commonly defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs", where human needs include a sound environment, a just society and a healthy economy[5]. Given the regulatory focus on climate change and considering that actuarial involvement in climate change is more developed, this Technical Paper addresses climate-related risks and opportunities only.

This Technical Paper does not constitute legal or financial advice.

Any interpretation or commentary within the Technical Paper regarding specific legislative or regulatory requirements does not guarantee compliance under applicable legislation or regulations. Accordingly, Members are encouraged to seek clarification from the relevant regulator and/or seek legal advice in the event they are unsure or require specific guidance regarding their legal or regulatory obligations.

Climate change is a rapidly evolving area; members are encouraged to refer to the latest legislative and regulatory requirements and to consider the wide range of information sources available beyond those mentioned in this paper. The information presented in this paper is generic and does not allow for the unique nature of each organisation. This paper is for education and information only and a member should rely on their own research and analysis in forming their views and giving advice.

Members should also refer specifically to the following APRA regulations:

- Prudential Standard CPS320 Actuarial and Related Matters.

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[1] International Sustainability Standards Board (June 2023) *IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information*
https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s1-general-requirements/
[2] International Sustainability Standards Board (June 2023) *IFRS S2 Climate-related Disclosures*
https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s2-climate-related-disclosures/
[3] Australian Government, The Treasury (June 2023) *Climate-related financial disclosure consultation paper*
https://treasury.gov.au/sites/default/files/2023-06/c2023-402245.pdf
[4] APRA, *Prudential Standard 320 Actuarial and Related Matters*, July 2019
https://www.apra.gov.au/sites/default/files/cps_320_standard_only.pdf
[5] https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

- Prudential Standard CPS220 Risk Management.
- Prudential Standard CPS510 Governance.
- Prudential Practice Guide CPG229 Climate Change Financial Risks.

This Technical Paper does not override the requirements in these documents or in any other Professional Standards, Practice Guidelines or other Regulatory Standards that are relevant to this area of work.

This Technical Paper was prepared by a subgroup of the Climate and Sustainability Working Group. Ongoing feedback from Members is encouraged; any feedback should be directed to the Climate and Sustainability Working Group via ppd@actuaries.asn.au

Summary for Appointed Actuaries

This Technical Paper is intended to complement *CPG229 Climate Change Financial Risks, CPS220 Risk Management* and *CPS510 Governance* to assist an AA in understanding climate risks and opportunities, and if they are material, to address them as part of their statutory requirements, particularly in the Financial Condition Report (FCR).

This Technical Paper does not impose any new requirements on Appointed Actuaries. It is intended only to educate an actuarial audience on what climate related risks and opportunities may include, and to assist the audience in considering how these might affect an insurer's business.

Within an FCR, an AA could provide their assessment of whether, within the context of the broader Risk Management Framework of the company:

- The right level of governance and leader engagement exists across the business to address climate risk.
- The business understands the financial, strategic, and operational risks associated with climate change.
- The business has an effective plan for considering and addressing climate risk.
- The customer considerations and reputation risk have been adequately considered and addressed by the business.

The AA could consider which aspects of climate risk, such as those discussed in this Technical Paper or those identified through the insurer's risk management processes, are material to the insurer's business. For risks that are considered material, the AA could assess whether they are adequately managed by the insurer, and if deemed necessary, comment on them in the FCR.

Background

There has been increasing interest from regulators and investors over recent years in how financial institutions are managing their climate risks. APRA has made it clear that it is imprudent for entities to ignore risks just because they are long term, because the time horizon is uncertain, or because there is uncertainty about future government policy.

Climate risk has been described by APRA as "distinctly 'financial' in nature," "foreseeable, material

and actionable now" and having "potential system-wide implications"[6]. APRA is concerned not only about the impact of natural disasters on insurers' capacity to pay claims, but also the affordability and availability of insurance in high-risk areas, and the flow on effects of reduced financial resilience for households and businesses unable to purchase insurance. They expect to see continuous improvement in the awareness and action of regulated entities in relation to climate risk[7].

Regulators expect the financial services sector to not only manage their climate risks, but also to play a key role in supporting an orderly transition. There is reputational risk in not supporting this, not only from regulators, investors, and customers, but also from other business partners in the supply chain, including service providers and reinsurers.

CPG229 Prudential Practice Guide

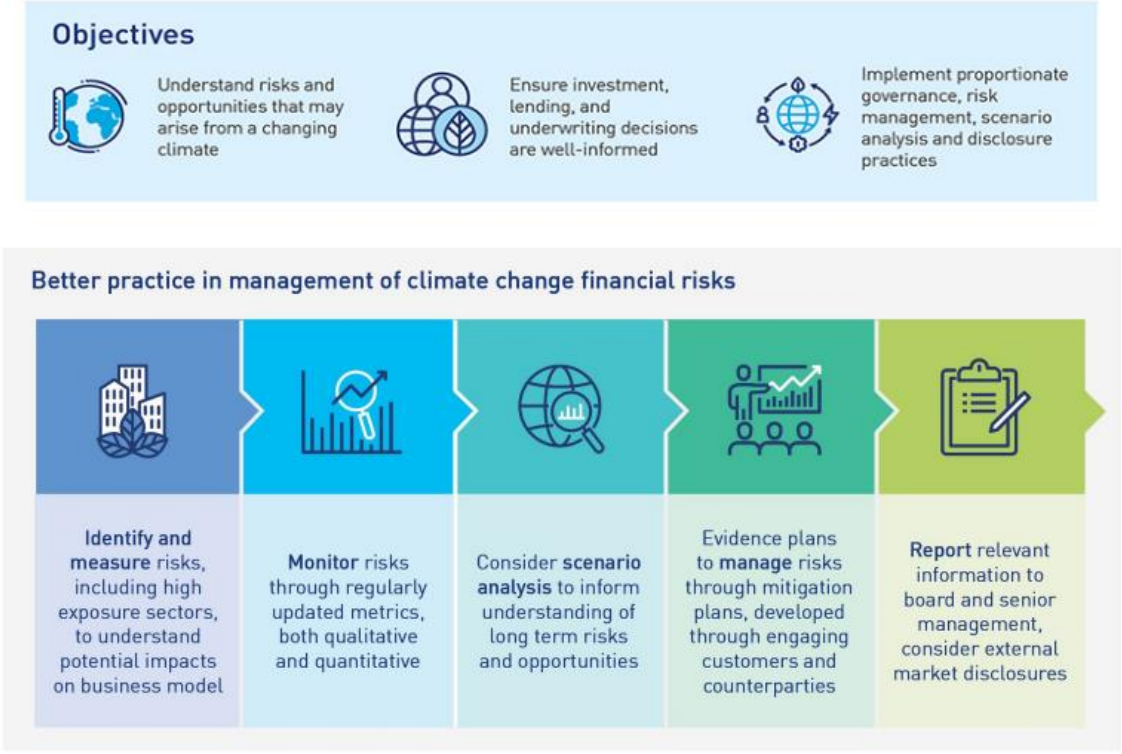
In November 2021, APRA released *CPG229 Climate Change Financial Risks*[8] which assists APRA-regulated entities in complying with *CPS220 Risk Management* and *CPS510 Governance* but does not impose any new requirements. CPG229 broadly reflects the TCFD framework for considering and managing climate risks.

[6] Summerhayes, G. (2017) *Australia's new horizon: Climate change challenges and prudential risk*, Insurance Council of Australia Annual Forum, Sydney, 17 February 2017 https://www.apra.gov.au/news-and-publications/australias-new-horizon-climate-change-challenges-and-prudential-risk

[7] APRA, *Information Paper, Climate Change: Awareness to Action*, 20 March 2019 https://www.apra.gov.au/sites/default/files/climate_change_awareness_to_action_march_2019.pdf; pp4

[8] APRA Prudential Practice Guide (Nov 2021), *CPG229 Climate Change Financial Risks* https://www.apra.gov.au/sites/default/files/2021-11/Final%20Prudential%20Practice%20Guide%20CPG%20229%20Climate%20Change%20Financial%20Risks.pdf

Figure 1 CPG229 Better practice in management of climate change financial risks[9]



Key messages from CPG229 include:

- APRA envisages that institutions will choose to work with customers, counterparties, and organisations to improve the climate risk profile of those entities, before considering standard risk mitigation options such as adjusting pricing or applying exposure limits.
- APRA expects institutions to evidence management of climate risks within its risk management policies, management information and Board reports. This may involve establishing procedures to provide monitoring and mitigation actions on material climate risk exposures to the Board and senior management.
- Each institution has the flexibility to manage climate risk in a way that suits its business objectives, and that practices will vary depending on size, business mix and complexity of the institution.

This Technical Paper is intended to complement APRA's Prudential Practice Guide on climate-related financial risk and assist an AA addressing climate change, particularly in the FCR. In preparation for increasing scrutiny by regulators and Boards of Directors, the AA could explicitly discuss the insurer's approach to climate risk and climate strategy in the FCR.

Climate vulnerability assessment

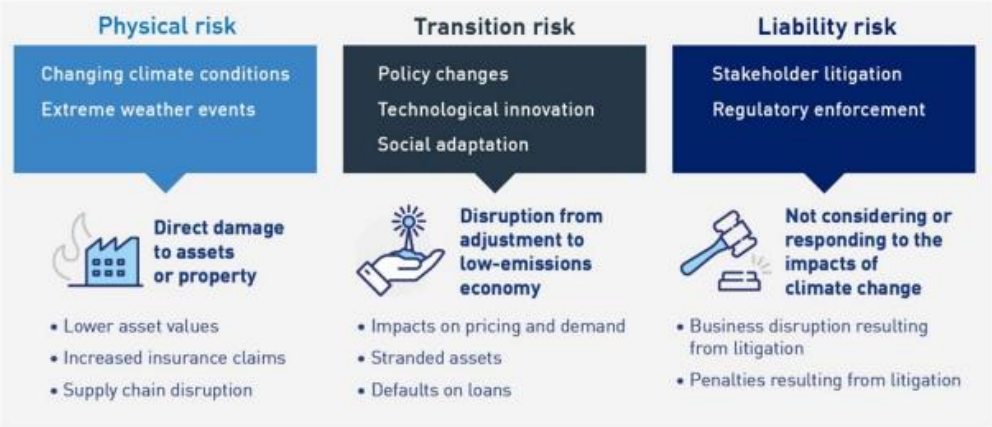
APRA conducted a Climate Vulnerability Assessment (CVA) in 2021-22 to assess the nature and extent of

[9] APRA Prudential Practice Guide (Nov 2021), *CPG229 Climate Change Financial Risks* https://www.apra.gov.au/sites/default/files/2021-11/Final%20Prudential%20Practice%20Guide%20CPG%20229%20Climate%20Change%20Financial%20Risks.pdf; pp6

climate risks to Australia's five largest banks (ANZ, CBA, Macquarie Bank, NAB and Westpac) [10]. APRA's 2023-24 corporate plan[11] explains that the next CVA will assess the impact of climate risk on access and affordability of general insurance.

Figure 2 below summarises the CVA scenario analysis approach which was designed to capture quantitative and qualitative assessments of physical and transition risk impacts at both portfolio and counterparty levels.

Figure 2 APRA CVA scenario analysis approach[12]



Key insights from the 2021-22 CVA include:

- Climate scenario analysis showed a measurable impact on lending losses; however, the participating banks are likely to be able to absorb these impacts.
- Climate risk impacts are likely to be more concentrated in specific regions or industries.
- The banks' response to increasing physical and transition risks under the scenarios included adjusting their risk appetite and lending approaches.
- Climate scenario analysis accelerated capability development and risk awareness.
- Climate-related data quality and accessibility remain a challenge, however this should not preclude financial institutions undertaking climate risk analysis now.

Disclosure by financial institutions

While assisting insurers to comply with external disclosure requirements goes beyond the scope of this paper, the following discussion may be useful as background information for an AA.

Taskforce for Climate related Financial Disclosures (TCFD)

[10] Australian Prudential Regulation Authority (Nov 2022) *Climate Vulnerability Assessment Results* https://www.apra.gov.au/sites/default/files/2022-11/Information%20Paper%20-%20Climate%20Vulnerability%20Assessment%20Results.pdf

[11] Australian Prudential Regulation Authority (2023) *APRA Corporate Plan 2023-24* https://www.apra.gov.au/apra-corporate-plan-2023-24#introduction

[12] Australian Prudential Regulation Authority (Nov 2022) *Climate Vulnerability Assessment Results* https://www.apra.gov.au/sites/default/files/2022-11/Information%20Paper%20-%20Climate%20Vulnerability%20Assessment%20Results.pdf

The Taskforce for Climate-related Financial Disclosures (TCFD) of the Financial Stability Board ("FSB") was established in 2015 to develop a methodology to consistently report on climate-related financial risk disclosures for use by financial institutions to provide more explicit information for investors and external stakeholders. The TCFD recommendations are voluntary, and are designed to encourage disclosures that are consistent, comparable, reliable, clear, and efficient, and provide decision-useful information to lenders, insurers, and investors[13].

The TCFD recommendations have been strongly supported by insurance regulators globally. Since the recommendations were released in 2017, there has been significant progress in their implementation with a steadily increasing percentage of companies disclosing information in line with the Task Force's recommendations each year as well as the amount of TCFD- aligned information companies disclose.

The TCFD calls for companies to disclose under four pillars: Governance, Risk Management, Strategy (including scenario analysis) and Metrics & Targets.

The AA, as part of their management role, could be involved in the development and review of the disclosures. In the context of the FCR, the AA could consider the following:

- Governance – As part of the discussion of the risk management framework, the AA may have visibility of the governance commentary in the TCFD disclosures, to enable any inconsistencies to be identified.
- Risk Management – As part of the discussion of the risk management framework, the AA could discuss the effectiveness of the framework in the context of climate risks.
- Strategy / Scenario Analysis – The Climate Scenario analyses in the TCFD disclosures are likely to be longer-term than those assessed in an ICAAP or FCR strict three-year horizon, but the AA could review the consistency of the TCFD strategy and scenario analysis with the work done for the FCR and the ICAAP. Similarly, consistency between commentary on Strategy in the TCFD disclosures and commentary on business strategy in the FCR could be considered.
- Metrics and Targets could require some commentary if there are any inconsistencies with the broader risk management framework.

Actuaries may be involved in advising insurers (and other financial institutions) on climate-related disclosures, including reporting to investors on the governance, risk management, strategy, scenario analysis, and metrics and targets deployed to manage climate-related risks and opportunities.

While TCFD disclosures are now seen as the global standard relating to climate risks and are expected by investors for large insurers, there are also several emerging related disclosure standards relating to sustainability and climate change. The Australian Treasury is also in a consultation process on proposed mandatory climate disclosure standards. These are discussed further in the "Climate disclosures" section.

Liability risk for directors

As well as their duties towards their insureds under their insurance contracts, insurers have a fiduciary duty to stakeholders to address financial and strategic risks, including climate change. In 2019, Noel Hutley SC and Sebastian Hartford Davis provided an updated legal opinion that the need for directors to consider climate risks and opportunities continues to rise and reinforced the urgency of improved board-level governance of this issue.

[13] https://www.fsb-tcfd.org/

This elevation of liability risk since the original 2016 Hutley opinion arises due to:

1. The coordinated engagement by financial regulators on climate change,
2. New reporting frameworks such as the Taskforce on Climate-related Financial Disclosures (TCFD) and recommended disclosure guidance from the Australian Accounting Standards Board and the Auditing and Assurance Standards Board,
3. Heightened pressure from investors, customers, suppliers, bankers and insurers to inform the market of the climate-related financial risks, and also to set emissions reductions targets and transition businesses away from direct emissions and exposure to high emitting customers and suppliers in the value chain,
4. Advances in scientific knowledge, and
5. Increased litigation risks.

The advice concludes that: "*In our opinion, these matters elevate the standard of care that will be expected of a reasonable director. Company directors who consider climate change risks actively, disclose them properly and respond appropriately will reduce exposure to liability. But as time passes, the benchmark is rising.*"[14]

Although the TCFD reporting is voluntary, the representations made in these reports influence investment decisions. Shareholder class actions have been filed in the US and Europe alleging a misrepresentation of climate related financial risks, and/or a breach of directors' duties for a failure to govern for those risks.

There is also a growing number of climate change litigation cases globally and in Australia[15], which is driving continuous development of the precedents that can be used for deciding subsequent cases involving identical or similar facts, or similar legal issues; increasing litigation risks for directors and their insurers.

Greenwashing

There is an increasing number of organisations claiming to sell environmentally friendly, sustainable, or ethical products, as well as those claiming carbon neutrality, emissions reduction strategies, net zero ambitions, investment exclusions, and other 'green' goals. It is currently difficult for an individual investor or customer to assess whether these claims are credible.

ASIC defines greenwashing as "*the potential for funds to overrepresent the extent to which their practices are environmentally friendly, sustainable or ethical… or overstating green credentials that are not sufficiently reflected in their operations*."[16] This includes situations where certain components of a product are certified by a scheme, but not the entire business. E.g. ASIC has been focused on managed funds and superannuation funds to establish whether products promoted as 'ESG-focused' are as described. From 1 July 2022 to 31 March 2023, ASIC's greenwashing surveillance activities resulted in:

- 23 corrective disclosure outcomes,
- 11 infringement notices issued, and
- in one case, the commencement of civil penalty proceedings[17].

[14] Supplementary opinion of Hutley & Harford Davis (2019); https://cpd.org.au/2019/03/directors-duties-2019/; p2
[15] See here for record of cases: Climate Change Litigation Databases - Sabin Center for Climate Change Law (climatecasechart.com)
[16] Armour, C. (2021) *What is "greenwashing" and what are its potential threats?* https://asic.gov.au/about-asic/news-centre/articles/what-is-greenwashing-and-what-are-its-potential-threats/
[17] 23-121MR Update on ASIC's recent greenwashing actions | ASIC

The ACCC is also investigating businesses that may have overstated their environmental claims. There is an expectation that businesses provide robust evidence for 'environmentally friendly', 'green' or 'sustainable' claims through reliable scientific reports, transparent supply chain information, reputable third-party certification, or other forms of evidence.

An AA could ensure that any limitations and uncertainties in climate-related analyses are understood and are adequately explained to manage greenwashing risk. The AA could also check that any claims like 'environmentally friendly', 'green', or 'sustainable' can be backed up with evidence (such as reliable scientific reports, supply chain information, reputable third-party certification or other forms of evidence).

Climate change scenario analysis

Future climate impacts will depend on many political, technological, and economic factors. Therefore, rather than determining a single 'best estimate' future outcome, it is best practice to consider a range of future climate change scenarios covering a range of greenhouse gas emissions pathways.

The Paris Agreement, within the United Nations Framework Convention on Climate Change (UNFCCC)[18], is a commitment by nearly all the world's nations to undertake ambitious efforts to combat climate change and adapt to its effects, with the central aims to:

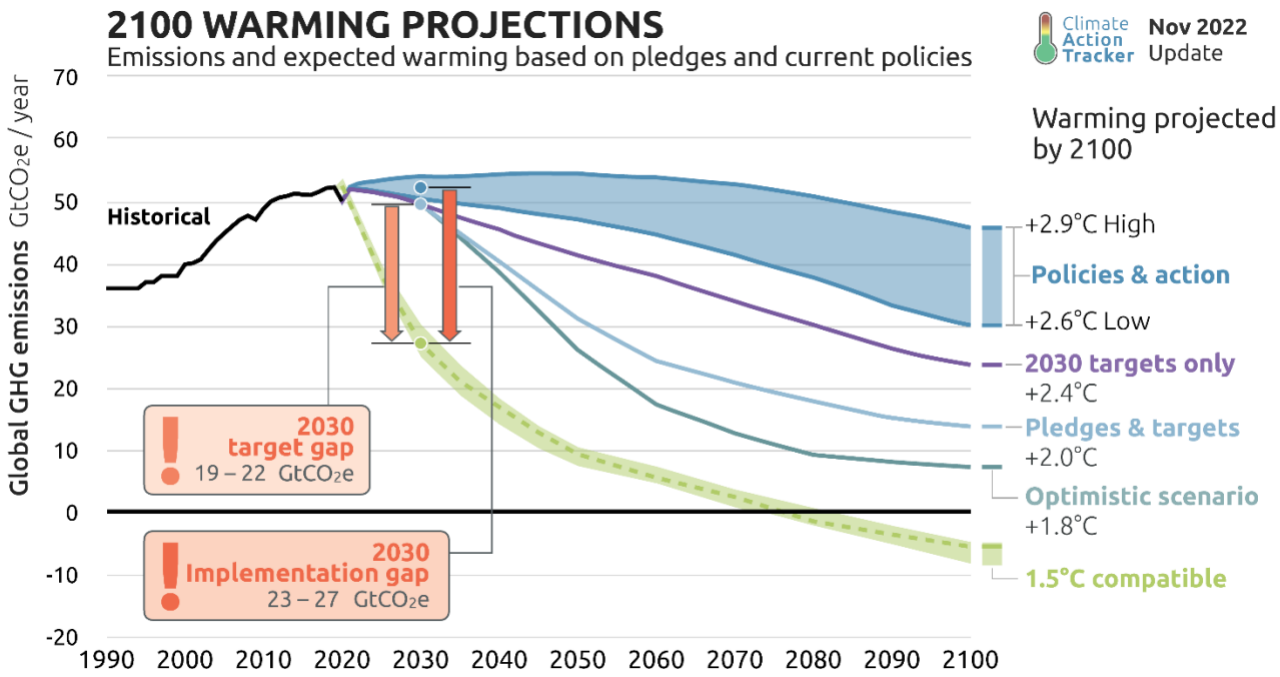
- Keep the average global temperature rise this century well below 2°C above pre-industrial levels (1880), and
- Pursue efforts to limit the temperature increase even further to 1.5°C, including achieving net-zero global emissions by 2050.

Current impacts of global warming, including more extreme weather, will remain above historical levels as anthropogenic emissions remain in the earth's atmosphere for centuries. The Paris Agreement seeks to limit further damage.

The following graph shows that current policies in place around the world are projected to result in approximately 2.7°C warming, and long-term net zero targets reduce this figure to around 2°C above pre-industrial levels[19].

[18] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[19] Climate Action Tracker (Nov 2022) *Addressing Global Warming* https://climateactiontracker.org/global/temperatures/

Figure 3 Climate Action Tracker 2100 warming projections[20]



The climate science community refers to a common set of scenarios to ensure comparability across different models and studies, and these are often used as the basis of internal and TCFD reporting. The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report[21] (AR5) uses four Representative Concentration Pathway (RCP) scenarios that describe different greenhouse gas emission trajectories.

Since AR5, the IPCC Sixth Assessment Report[22] (AR6) has been published. AR6 considers five Shared Socioeconomic Pathway (SSP) narratives that define societal changes (such as population, education, and government policies), together with some new, intermediate RCPs. The temperature outcomes considered in AR6 are listed in Table 1.

Table 1 IPCC AR6 Scenarios

SSP	Forcing level	Scenario	Estimated warming (2041-2060) °C	Estimated warming (2081-2100) °C	Very likely range (2081-2100) °C
1	1.9	Very low GHG emissions: CO_2 emissions cut to net zero around 2050	1.6	1.4	1.0 – 1.8
2	2.6	Low GHG emissions: CO_2 emissions cut to net zero around 2075	1.7	1.8	1.3 – 2.4
3	4.5	Intermediate GHG emissions: CO_2 emissions around current levels until 2050, then falling but not reaching net zero	2.0	2.7	2.1 – 3.5

[20] Climate Action Tracker (Nov 2022) *Addressing Global Warming* https://climateactiontracker.org/global/temperatures/
[21] Intergovernmental Panel on Climate Change (2014), *Fifth Assessment Report*, available at: https://www.ipcc.ch/assessment-report/ar5/
[22] Intergovernmental Panel on Climate Change (2021), *Sixth Assessment Report*, available at: https://www.ipcc.ch/assessment-report/ar6/

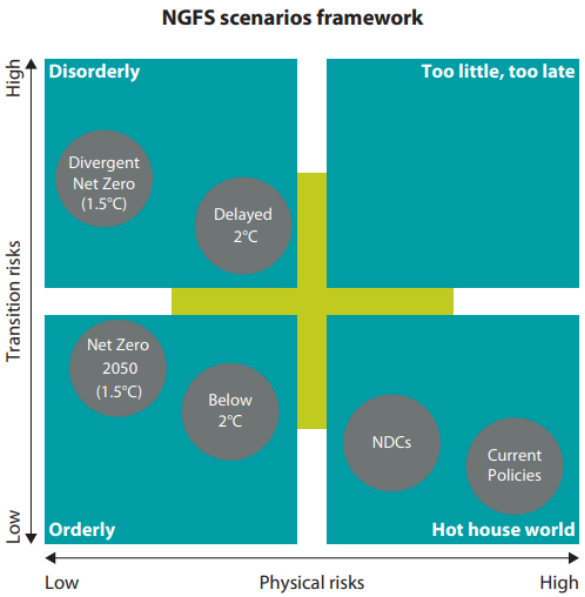
		by 2100			
4	7.0	High GHG emissions: CO_2 emissions double by 2100	2.1	3.6	2.8 – 4.6
5	8.5	Very high GHG emissions: CO_2 emissions triple by 2075	2.4	4.4	3.3 – 5.7

The impacts of global warming are not uniform. In general, locations further away from the equator experience higher surface temperature increases. Warming is also stronger over land than in the oceans, and strongest over the Arctic.

The financial impact of climate change will arise both from physical changes, and the associated economic impacts. Physical and transition risks (defined below) affect financial firms in distinct ways. In any single scenario, these risk types are interrelated.

For example, continued emissions will lead to rising temperatures that increase physical risks, but limiting these impacts requires substantial emissions reductions that increase transition risks, so any scenario for physical risks will also require some consideration of how the associated transition risk will emerge. Note that it is also possible for both high physical risk and high transition risk scenarios to occur simultaneously, such as in the 'too little, too late' scenario represented in the figure below.

Figure 4 NGFS Representative Scenarios[23]



When interpreting the results of climate change scenario analysis, it is important to understand which risks have been modelled, which have not been modelled and which are unmodellable. Unmodelled and unmodellable factors (which may include population growth, improvements in hazard adaptation over time, tipping points and non-climate and climate-related inflation, supply chain disruption etc.) may either amplify or mitigate the overall impact on the insurer. In addition, model risk, including the accuracy of the baseline climate model in the face of uncertainty in the climate science, should be taken into consideration.

[23] NGFS (2019) *NGFS Climate Scenarios for Central Banks and Supervisors* https://www.ngfs.net/sites/default/files/medias/documents/ngfs_climate_scenarios_for_central_banks_and_supervisors_.pdf.pdf

Types of climate risks

Financial Institutions are exposed to climate impacts through three main mechanisms, as identified by the Bank of England's Prudential Regulation Authority:

- **Physical risks**: The first-order risks arising from longer-term changes in climate (chronic risk) as well as extreme weather-related events (acute risk). Impacts may arise directly through damage to property and business interruption, or indirectly through subsequent events such as disruption of global supply chains and the resulting effect on commercial businesses.
- **Transition risks**: The financial risks arising from a transition to a low-carbon economy, including changes in domestic and international policy and regulatory settings, technological innovation, and social changes. These may result in changes to asset values, investment preferences and insurance portfolio composition.
- **Liability risks**: Directors or trustees may be held responsible for failing to mitigate against climate change physical risks, or the risks arising from the transition to a low-carbon economy, as they relate to their organisation. These risks can manifest directly from an insurers' own action or inaction, or through the activities of customers as risk is passed on to insurance firms under liability contracts such as professional indemnity and directors' and officers' insurance.

Climate risks may interact with or compound an institution's other risks, including:

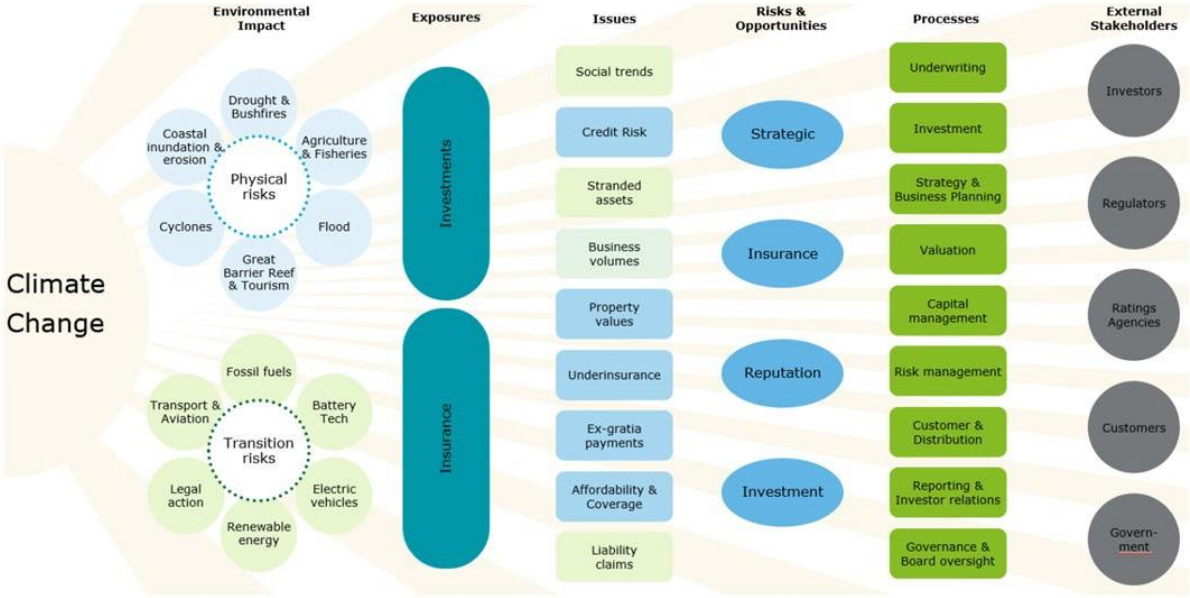
- Credit risk – potential defaults by businesses and households adversely affected by climate events.
- Market risk – from re-pricing of financial instruments and corporate debt.
- Operational risk – including supply chain disruption.
- Insurance risk – potential increase in insured losses from extreme weather events (general insurance) or health effects (life insurance, workers compensation, health insurance).
- Liquidity risk – increased demand for liquidity in response to extreme weather events.
- Reputational risk – community expectations impact an institution's ability to attract and retain customers and employees.

The following sections discuss the issues that actuaries of general insurers, life insurers, health insurers and reinsurers could consider in relation to the possible impacts of climate risk. Some issues, such as investment management (common to all insurers) and health impacts (common to workers compensation, travel insurance, life insurance and health insurance) are discussed in the 'All Insurers' section.

All insurers

Climate change may have a wide range of impacts on insurance processes, leading to a range of risks and opportunities. The below diagram is illustrative and not necessarily a complete list of all the ways climate-related issues may impact an insurer.

Figure 5 Climate change issues and impacts



This Technical Paper firstly considers the processes linked to areas of actuarial practice for insurers broadly. The specific considerations for the General Insurance, Life Insurance and Health Insurance entities are detailed separately; in particular, how the physical, transition and liability risks impact the product pricing, underwriting and design, the valuation of liabilities and other areas of actuarial practice within these entities.

Capital management

The ability of an insurer to continue to attract capital will require consideration of the impacts of climate change through the capital management framework and the company's risk management strategy.

CPS320[24] states that the AA must include "*general observations on the insurer's approach to capital management*" and "*an assessment of the insurer's current and future profitability and capital adequacy*"[25] in the FCR.

Target capital

Within the capital management framework, the methodology for determining stress margins on insurance risks may need to be tailored to allow for the uncertainties associated with climate change. This is particularly relevant to insurers with material exposure to natural hazards and the physical risks associated

[24] APRA, *Prudential Standard CPS 320 Actuarial and Related Matters* s 25(g); July 2019 https://www.legislation.gov.au/Details/F2018L00746;
[25] APRA, *Prudential Standard CPS 320 Actuarial and Related Matters* s 25(i), July 2019 https://www.legislation.gov.au/Details/F2018L00746;

with climate change.

A risk-based capital model may be used to estimate the level of target capital required to achieve the insurer's chosen risk appetite. It may also be used as a tool to assess and compare various risk mitigation actions or business strategies under different climate change scenarios.

In reviewing the capital modelling, actuaries could consider whether stress margins for target capital may need to be reviewed.

Stress testing

Stress tests will also be important tools for assessing capital adequacy, and the AA could comment on whether the insurer has performed appropriate stress and scenario tests to assess their risk.

Some considerations with relation to climate change include:

- Modelling outcomes over longer time horizons, as climate change impacts are longer term than the usual three-year stress test.
- The extent to which existing natural hazards models capture potential climate change impacts, noting they are typically parameterised using historical datasets based on the existing climate. There is difficulty in separating climate change impacts from the range of uncertain outcomes predicted and challenges in forecasting the future climate.
- The extent to which physical climate risks which are already happening are reflected in recent historical claims costs.
- The amount of premium written by the insurer may be impacted by technological or regulatory change in some sectors of the economy, under certain climate scenarios.
- There may be dependencies/correlations across risk types or lines of business.
- The value of investments may be impacted by climate change issues (see below for further consideration of this point).
- The extent to which climate change will change the geographic distribution of natural hazards risks.

While physical climate change impacts may occur over a longer period than a 3-year time frame, it is important to note that transition and liability risks may occur more quickly, for example, due to legislative or regulatory change.

The AA could consider whether any management actions identified as part of the scenario could be taken in advance as precautionary measures, or whether they would be relevant or desirable only if the scenario emerges.

Reinsurance

CPS 320[26] requires the AA to provide an assessment of the suitability and adequacy of the insurer's reinsurance strategy as part of the FCR.

In performing this assessment, the AA could consider the impact and materiality of:

- Any climate change impacts which might affect the price and availability of reinsurance over the medium to longer term.
- Forward looking risk modelling focusing on long-term climate trends - rather than wholly relying on historical loss data.

Insurers may also recognise that reinsurers do or will consider climate change risk in their pricing, underwriting and product design across general, life and health coverage. Reinsurers are seeking sustainable pricing in relation to natural hazards-related coverage and managing their accumulation to this risk. They are also managing their assets with consideration to transition risk and the potential for stranded assets associated with fossil fuels.

The largest global reinsurers have exposure to climate change risk through physical risk, transition risk and liability risk and have recognised climate change for some time.

Credit ratings

Credit rating targets may be incorporated in the insurer's risk appetite statement, and therefore need to be considered as part of the insurer's risk management. Credit rating agencies are already considering material climate risks in their credit rating determinations. They are assessing the climate change risks appropriate to the financial sector on a global basis and consider the disclosures made by each entity.

Impacts of climate change on health

The health impacts of climate change have the potential to affect all types of insurers – travel insurers, workers' compensation insurers, life insurers and health insurers will all be impacted. This section outlines the various ways in which climate change can impact on health broadly, and then each individual insurance section goes into more detail.

In recent years, work has been done to better understand the relationship between climate change and health in Australia, including the annual MJA–Lancet Countdown on health and climate change[27][28] which concluded that "Australia remains at significant risk of declines in health due to climate change, and that substantial and sustained national action is urgently required in order to prevent this."

There are many links between climate change and health[29] and a few key Australian examples include[30]:

- Rising temperatures and heatwaves are noted to have a high cost in lives and affect the health of the population through heat exhaustion and heat stroke, increasing hospital admission rates and

[26] APRA, *Prudential Standard 320 Actuarial and Related Matters*, July 2019 https://www.apra.gov.au/sites/default/files/cps_320_standard_only.pdf
[27] https://www.mja.com.au/journal/2019/211/11/2019-report-mja-lancet-countdown-health-and-climate-change-turbulent-year-mixed
[28] https://www.mja.com.au/journal/2018/209/11/mja-lancet-countdown-health-and-climate-change-australian-policy-inaction-0
[29] https://www.scientificamerican.com/article/climate-change-is-having-widespread-health-impacts/
[30] https://www.abc.net.au/news/health/2019-07-06/health-impacts-of-climate-change/11282926
https://actuaries.asn.au/Library/Opinion/2019/TheDialogue10ClimateWEBLres.pdf

death rates. In addition, extreme heat could potentially exacerbate pre-existing health conditions[31].

- Extreme weather events (e.g., the bushfires in 2019/2020 followed by flooding) can have both direct impacts on health through physical injuries, respiratory problems, and psychological distress, and may also indirectly affect health through affecting food and water security and the onset of mental illness exacerbated by loss of homes and livelihoods.
- Changes in temperature, rainfall and humidity affect the optimal conditions for the spread of disease. For example, this affects the distribution and number of mosquitoes, leading to the spread of malaria, dengue fever and Ross River virus where there may not have previously been cases.
- Climate change may worsen air quality through increased bushfire risk and changes to ozone[32].
  - Chronic exposure to air pollution increases the risk of cardiovascular disease, respiratory disease, and lung cancer[33] and can affect reproductive, urological, and neurological systems.
  - In Australia, the health impacts of exposure to particulate matter, particularly following bushfire and burn off events, are evidenced[34,35] Recent research shows that even relatively low exposure to particulate matter can lead to increased levels of cardiac arrest[36].
- In contrast, transitioning to a low carbon economy, such as moving from coal energy to renewables, may have a positive impact on air pollution and hence health. For those living near coal fired power stations, their cardiovascular and respiratory systems may be positively affected by transition from coal fired power stations in their local communities.
- Mental health is noted as a key issue for farmers, where reductions in crop yield and drought affect the rural communities and the mental health of farmers and their families. The flow on impacts on food prices may also lead to worsening health outcomes for low-income communities via food affordability and accessibility. As an example, the MJA Lancet Countdown reports in 2018 and 2019 identified an association between mean annual maximum temperatures (driven up by climate change) and suicide rates across states and territories.

The effect of climate change on health is complex. Insurers will need to consider the impact of climate alongside other trends, such as the ageing population or the rise in chronic conditions, on all types of insurance claims, noting that impacts vary across demographic groups (for instance that older people and those with underlying health conditions are known to be more vulnerable to heatwaves[37]).

Operational risk

Climate change may affect people, processes, or systems, leading to operational risk for an insurer. Some examples include:

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[31] https://www.nri.com/en/knowledge/publication/fis/lakyara/lst/2023/02/01
[32] Orru et al., 2013. Impact of climate change on ozone-related mortality and morbidity in Europe
[33] World Health Organisation (WHO) (2018). Ambient air pollution: Health impacts. Available at: https://www.who.int/airpollution/ambient/health-impacts/en/
[34] Desservettaz, M.; Phillips, F.; Naylor, T.; Price, O.; Samson, S.; Kirkwood, J.; Paton-Walsh, C. Air Quality Impacts of Smoke from Hazard Reduction Burns and Domestic Wood Heating in Western Sydney. Atmosphere 2019, 10, 557.
[35] Centre for Air pollution, energy and health Research (2019). Bushfire smoke: what are the health impacts and what can we do to minimise exposure?
[36] Zhao, B., Johnston, F. et al (2020) Short-term exposure to ambient fine particulate matter and out-of-hospital cardiac arrest: a nationwide case-crossover study in Japan. The Lancet Planetary Health. doi.org/10.1016/S2542-5196(19)30262-1
[37] https://www.actuaries.asn.au/public-policy-and-media/thought-leadership/the-dialogue/the-impact-of-climate-change-on-mortality-and-retirement-incomes-in-australia

- Climate impacts on global supply chains may affect the cost and availability of services or parts for claims-related repairs.
- Clarity of product documentation on coverage and exclusions, for example in relation to ‘actions of the sea'.
- Data storage locations may be subject to climate impacts and so backup considerations are important.
- Staff may be affected by natural hazards or associated disruptions to transport or infrastructure, whether in the office or while working from home.
- Service providers including IT and administration services may be outsourced to different locations and exposed to different climate risks. The natural catastrophe preparedness of outsourced service providers may need to be considered.

Having clear policies may help an insurer to address these risks, including both mitigation actions implemented now and contingency plans after events occur.

Given the complexity of climate risk and the speed of development, there is a need for companies to educate themselves and ensure they have access to appropriate, skilled resources to understand and manage climate risk.

Under CPS 320, an AA is required to include general observations on the overall risk management framework, with a focus on financial risks, and how these risks are managed by the insurer[38]. The AA could note any material concerns in their assessment.

Investment management

Assessment requirements

APRA’s CPS 320[39] requires ”an assessment of the appropriateness of the investment strategy, having regard to the nature of the insurance liabilities.”

This section provides background to the considerations of an AA in relation to climate change in making this assessment.

Climate risk impacts on investments

Climate Change will impact investment portfolios through physical risk, policy and regulatory uncertainty, changing customer preferences and product substitution, disruptive technological shock and direct financial impacts as businesses models and costs change. These factors can impact the valuation of assets and the volatility of returns. The impact manifests at both a macroeconomic and portfolio level and can lead to positive as well as negative outcomes for individual investments and portfolios.

The potential directors’ liability in dealing with climate risks may also be considered in the investment strategy. Environmental, Social and Governance considerations are important considerations in long term investment strategies, and climate change is one key component of this. Addressing such risks in the

[38] `APRA, *Prudential Standard 320 Actuarial and Related Matters*, July 2019 https://www.apra.gov.au/sites/default/files/cps_320_standard_only.pdf

[39] `APRA, *Prudential Standard 320 Actuarial and Related Matters*, July 2019 https://www.apra.gov.au/sites/default/files/cps_320_standard_only.pdf

investment portfolio has implications beyond investment performance and capital protection, extending to liability and reputation benefits with respect to investors and customers.

CPG229[40] notes that APRA envisages institutions working with counterparties and organisations which face higher climate risks to improve their risk profile, before then considering applying limits to or divesting from these investments.

Investment challenges

Challenges incorporating climate change in the assessment and construction of an investment portfolio include:

- Politics affects response paths globally and hence the timing and impact of climate change effects and the policy responses to them.
- Obtaining appropriate, quality information on companies' and securities' climate-related financial risks and emissions is an ongoing work in progress.
- Climate modelling does not provide granular results to the level of individual customers and capability of modelling extreme events is developing.
- Economic modelling typically adopts macro approaches which do not necessarily capture climate tipping points or tail risks – for example sudden changes to physical risks, and/or sudden changes in investment outlook for sectors due to legislative or sentiment changes.
- The risk adjusted return in a constrained portfolio is theoretically less than in an unconstrained portfolio, so positioning a portfolio for transition risk requires careful consideration, as the risk adjustment is a volatility adjustment, which may not consider the risks being considered in determining the constraints. In this regard there is a difference between integrating Climate Risk ratings in a broader investment process and actively screening out individual investments.
- Focusing on carbon intensity in a portfolio is not in and of itself an adequate indicator of the risks to returns implicit in an investment strategy as returns are also driven by industry structures, product constraints and the ability to adapt in different policy environments over different timeframes.

Asset modelling

Traditional asset modelling approaches do not explicitly capture the impacts of climate risk. Climate change and related policy responses (both preventive and adaptive) together form a known pending exogenous shock, and in fact an accumulating shock, to such models.

The uncertainty that needs to be captured in interpreting asset modelling results could increasingly encompass consideration of the potential timing and impacts of such exogenous shocks.

While challenging, there is a need to question whether macroeconomic assumptions about growth, interest rates and inflation are appropriate given the systemic impacts of climate change and increased risk that climate tipping points will be passed.

Investment stress testing

As noted in the capital section, stress testing can be a valuable tool. In investment management too,

[40] APRA Prudential Practice Guide (Nov 2021), *CPG229 Climate Change Financial Risks* https://www.apra.gov.au/sites/default/files/2021-11/Final%20Prudential%20Practice%20Guide%20CPG%20229%20Climate%20Change%20Financial%20Risks.pdf

depending on the sophistication of the investment strategy, the investment manager may be testing overall business assumptions through drawing out the implications of different climate change scenarios and associated government action in responses on the portfolio.

The AA could regularly assess the appropriateness of the stress testing of the investment portfolio specifically, as well as capital more generally, against the sophistication and risk management framework adopted, including how that relates to the business' investment horizon.

The AA could consider applying climate change scenarios in stress testing to understand the exposure to material climate risks and the potential impact of the investment strategy on market-wide risks over both the shorter- and longer- term. Such risk stress would be undertaken in a manner that is proportionate to the size and complexity of the investments.

The scientific literature gives some guidance to the investment manager and the AA in understanding the likelihood of physical risks in the investment portfolio. In addition, attention to the policy responses is also needed to consider the transition risks in the portfolio. While government policy responses, technological, and behavioural change make it difficult to predict the distribution of outcomes for a given time horizon, the AA could review the appropriateness of the investment strategy's consideration of climate change against the time horizon of the investment strategy.

For example, the IPCC's 1.5 Degree Report (2019)[41] assesses what action is required to limit global warming to 1.5 degrees by 2100 – namely global greenhouse gas emissions should be reduced to net zero by approximately 2040-2055. The Report's assumption is that such reductions start immediately and that any delay brings forward the target date. Scenarios could also consider the timing of such reductions, and their implications for the investment portfolio.

This 20–30-year horizon to achieve net zero emissions is now crossing over some key investment and projection horizons. For example:

- The investment horizons for many industries, particularly infrastructure and capital-intensive industries, materially heightening the risk of stranded assets.
- The projection horizon for meeting customer promises. For example, net zero emissions would need to be achieved within the lifespan of anyone currently under 65 and the success or otherwise of the transition will directly affect their superannuation balances.

Questions for the investment manager

The questions below are broadly in increasing order of sophistication which the AA could consider as part of the review of the investment strategy for the FCR.

- What is the investment manager's approach to incorporating climate risks into investment analysis and/or its decision-making processes?
- What is the investment manager's approach to incorporating climate risks into ownership policies and practices (such as engagement or proxy voting on climate-related matters)?
- How might a portfolio be stress tested?
- What is the portfolio's exposure to potentially stranded or degraded assets?

[41] https://www.ipcc.ch/sr15/

- What is the portfolio's exposure to assets that may benefit from transition policy?
- How might portfolio risks differ according to time horizon?
- For longer term investment horizons has there been any consideration of possible tipping points?
- How would the investment portfolio perform if a 'shadow carbon price' (a translation of environmental and social costs of emissions into a monetary value) was applied to reflect either potential policy responses or the effective cost of transition due to changes in technology and behaviour?
- Is the assessment of Climate Change impacts upon economic growth and the investment portfolio consistent with the assessment of the impacts upon the business as a whole and its customers?
- How might one establish a decision-making framework to reposition the portfolio in response to different policy outcomes and emerging physical shocks?

Regarding the interaction with the impact of climate change on liabilities, consider that:

- The duration profile of liabilities will be impacted by reserving decisions.
- Liabilities will have greater volatility and uncertainty, which may impact liability driven investment.
- There is a risk to long term government bonds and their credit ratings under both physical and transition risk exposures.

General insurance

The section titled “General insurance” details specific considerations for general insurers. This section should be read in conjunction with the “All insurers” section.

Types of risk for general insurers

This section suggests a range of climate risks and opportunities that may impact general insurers. The AA could consider whether these risks, as well as those identified through the insurer’s risk management processes, are material to the insurer’s business, including consideration of any risk mitigants such as pricing response. For risks that are considered material, the AA could assess whether they are adequately managed by the insurer, and if deemed necessary, comment on them in the FCR.

Physical risk

General insurers may be exposed to physical risk through claims on insurable events, or through their asset portfolios. Examples of physical risk impacts include:

- Extreme heat as well as mean air temperatures are expected to increase with high degrees of confidence across all of Australia and New Zealand resulting in higher bushfire incidence and severity.
- Cyclones may deliver greater rainfall totals, increasing the impacts of water ingression and flooding. Although highly uncertain, cyclones may also be able to form and decay further south in latitude towards more built-up coastal areas (particularly southern Queensland). This potential increase in the cyclone hazard may occur in regions without sufficient cyclone resilient building codes (Region B).
- Heavy one day precipitation levels and pluvial (rainfall) flood is expected to increase in Northern Australia and Central Australia. This can result in increased pressure on urban drainage systems not designed for the higher volumes of water.
- River flooding is expected to increase with medium confidence across Australia and New Zealand, while mean precipitation is expected to decrease in Eastern and Southern Australia. These risks along with changes in cyclone paths would drive changes in the incidence of river flooding.
- Increased frequency of intense rainfall from both convective (short-duration, localised) and synoptic-scale (long-duration, regional) processes, leading to flash flooding and general storm damage.
- Coastal inundation and erosion risk is expected to increase as sea levels rise. While generally these are not covered by domestic property policies, they may be a source of reputational risk for insurers if claims are denied, or unanticipated costs if ex-gratia payments are made (for example recent coastal inundation caused by East Coast Lows in 2016 and 2020).
- Agricultural and ecological drought events are more likely to occur in Southern and Eastern Australia due to lower anticipated precipitation levels and drier soil conditions. Fisheries would be impacted by changes in ocean conditions including rising acidity levels and marine heatwaves. These changes in the environmental conditions for crops or fish species would have an impact on commercial operations.
- Tourism may be affected in certain locations, such as the Great Barrier Reef which may be degraded by increases in marine heatwaves and the levels of ocean and lake acidity, with impacts on commercial insurance.

- Changes in building codes in areas newly affected by severe events such as Bushfire or Cyclones could result in higher costs of rebuilding affected properties. This would result in historical claims information based on different building standards being unreliable for pricing or reserving purposes.
- Building supply chains may be affected by physical risk, and this may not be considered within traditional demand surge in catastrophe models.

Physical risk impacts are likely to differ greatly by region, with some communities more severely impacted than others. Physical risks may also impact the value of investment asset portfolios and the assessment of credit risk.

Climate impacts on mortality and morbidity risks, such as heat stress from working outdoors during heat waves, or sickness from working outdoors during high pollution days, are also relevant to workers compensation claims. Impacts on health are discussed in further detail in the Life Insurance and Health Insurance sections.

There are a number of Climate related initiatives and resources that provide guidance on performing a physical risk assessment, such as the Climate Measurement Standards Initiative.

Transition risk

A range of policy, legal, technological and market changes are likely to occur during the transition to a low carbon economy. Some examples of how these might impact a general insurer (excluding investments, which are considered separately) include:

- Fossil fuels – Transition to a low carbon economy is likely to result in lower growth, divestment and/or closure of industries based on fossil fuels. This can lead to poorer maintenance or higher risk practices, producing higher claim costs for property and liability products.
- Clean energy technologies, such as batteries, electric vehicles, and renewable energy, may have greater uncertainty associated with performance, increasing the risk of selecting inappropriate pricing and reserving assumptions. Risk may also arise if there are lower levels of capability and experience in underwriting clean global energy technologies.
- Transport and aviation – Shifts in consumption of carbon-intensive products may require strategies for rebalancing the product mix of a general insurer.
- Growth or contraction of certain sectors due to the transition to a low carbon economy may affect the amount of premium revenue a general insurer writes.
- Potential reputational impacts if transition is not managed in an orderly fashion.

Transitioning to a net zero economy requires investment flows to be geared towards mass deployment of clean energy. The International Energy Agency estimates that the annual investment required to achieve net zero emissions by 2050 will reach US$4.5 trillion by 2030 (including low carbon power and fuels, energy efficiency and other end uses, and EVs, grids and storage)[42]. Changing investment flows on this scale will require material policy, legal, technological and market changes.

Scenarios with high transition risk usually represent a delayed or divergent response in climate policy followed by significant correction over a short period to reverse earlier inaction. This is referred to as

[42] See the International Energy Agency's https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach

'disorderly transition' to a low-carbon economy and is more akin to a traditional stress scenario such as a large natural peril or collapse of larger reinsurer that is more likely to create a strain on capital. The AA could consider the broader environment to determine whether transition risk is likely to be heightened.

Liability risk

There is a clear responsibility and accountability for leaders in business and corporations to understand and manage climate risks. Failure to adequately manage climate risk may be interpreted as a breach of directors' duties and result in legal action, as explained in the "Liability risks for directors" section.

Liability risks may arise through Directors and Officers or Professional Indemnity insurance contracts, where the insured is held liable for failure to mitigate, adapt, or disclose climate change risks. It may also arise through 'greenwashing' claims as mentioned in the 'Introduction' section.

Under a 'greenwashing' claim scenario, D&O cover may respond to a lawsuit brought against directors and officers for miscommunication or misleading investors on climate change and its impacts on the business, inaccurate or incomplete disclosure of climate risks (considering enhanced public disclosures requirements), failure to assess climate risks in an acquisition, or failure to deliver on the company's public commitments.

Another example of Liability Risk could arise from a Pollution & Public Nuisance Litigation scenario where a case is brought against a company for their polluting impact on the climate and the public nuisance faced by companies and individuals as a result.

Attribution science may be used to directly attribute damage caused by the company to the environment, and damages awarded to plaintiffs because of current and future economic losses incurred by adapting to the changing climate.

Pricing, underwriting and product design

CPS320[43] states that an FCR must include "an assessment of pricing, including the adequacy of premiums". This includes the AA's assessment of whether the premiums being charged adequately price for climate change risk.

General insurance products are commonly sold as annually renewable contracts. This means premiums only need to be adequate to cover claims over the next year until the next contract renewal. However, risk-based pricing may drive high annual premium increases as models for natural hazards risk changes and models are recalibrated. Growing affordability pressure and continuity of coverage beyond the annual policy cycle may need to be considered, and there are regulatory and reputational risks associated with material increases in premiums or withdrawal of coverage over time. Consideration of premium affordability pressures today may be important, as well as future pressures on affordability. APRA's general insurance CVA[44] will assess the impact of climate risk on access and affordability of general insurance.

Monitoring leading indicators may help guide when pricing and underwriting need to change to reflect climate change impacts. One example of such an indicator is the Australian Actuaries Climate Index (AACI)[45].

Transition and liability risks may change over short time frames due to regulatory and legal changes.

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[43] APRA, *Prudential Standard 320 Actuarial and Related Matters*, July 2019 https://www.apra.gov.au/sites/default/files/cps_320_standard_only.pdf

[44] Australian Prudential Regulation Authority (2023) *APRA Corporate Plan 2023-24* https://www.apra.gov.au/apra-corporate-plan-2023-24#introduction

[45] Australian Actuaries Climate Index https://actuaries.asn.au/microsites/climate-index

Monitoring policy, regulatory and legal changes may help AAs keep abreast of material developments.

Climate change also brings opportunities for insurers to develop new products. The AA may comment on the design and pricing of any new products being developed and offered by the insurer, if appropriate.

Reserving

A General Insurance AA is required to determine values for central estimates and risk margins on the outstanding claims liabilities and premiums liabilities. All these values may be affected by climate change.

Most of the considerations discussed previously apply to Reserving, particularly to premium liabilities. Climate change may also increase the uncertainty around assumptions, which may need to be reflected in risk margins.

Other considerations relevant to the valuation of outstanding claims liabilities include:

- Most physical risks will be known to have occurred or not occurred at the time of valuation, but the ultimate claims cost may be uncertain at the valuation date. In some cases, climate risk could increase the uncertainty in ultimate claims costs. For example, the impact of demand surge may be exacerbated by the strain on global supply chains driven by climate-related events.
- Some physical risks, such as workers' compensation claims relating to exposure to air pollution from bushfires, may take longer to be reported.
- Some reserving methods may be significantly affected by shifts in the payment pattern, which may be more difficult to detect from historical data than changes in frequency and severity. For example:
  - Bushfires may become more widespread and take longer to assess than historical ones and require different demand surge assumptions.
  - Changes in underwriting and claims practices, and investment in resilience may also affect claim amounts and payment patterns.
  - Modern technologies emerging during transition to a low carbon economy may have little historical data, but exposure may increase rapidly as investment preferences shift.
- The timing and size of new transition and liability risks, as well as the potential cost and implications may be very uncertain.

Scenarios and sensitivities may aid the selection of best estimates and to quantify uncertainty.

Natural hazards catastrophe modelling

The most well-established catastrophe models focus on assessing physical risks with the highest historical losses, such as earthquakes, cyclones, bushfire, and floods[46]. Some of the natural hazard models may also be useful in quantifying transition and liability risk. Recently, there has been rapid development in some areas, partly driven by the TCFD recommendations, for example:

- Incorporating the effect of climate change in these models under various climate scenarios.
- Consideration of the changes in correlations between different natural hazards.
- Assessing perils expected to increase in importance in some areas, such as flood and

[46] Catastrophe modelling companies are likely to place more focus on the modelling of secondary perils due to their increasing importance under a changing climate. This may also result in changes to catastrophe modelling outcomes separate from climate change-related impacts.

bushfires.

- Refining the scale of models to understand different geographic impacts as the climate changes.
- Some issues that could be considered when using a natural hazards catastrophe model include:
  - How much of the current climate risk is captured by the model?
  - In modelling infrequent events, it is likely that long-term averages are being used to estimate frequency and size. It is important to understand the event set and how representative that experience might be for current exposures.
  - If there is an underlying trend due to climate change, it may be difficult to detect due to the cyclical weather patterns and high variability and exposure changes over time.
  - It is particularly complex to capture the interaction of our cyclical weather patterns considering the El Niño–Southern Oscillation (ENSO), Indian Ocean Dipole (IOD) and the Southern Annular Mode (SAM).
  - There is a risk that significant climate change has already occurred which has shifted the frequency and severity of perils in a way that is not represented in our current peril risk models. Due to the nature of peril risk (sparse events) and the short span of loss/climate records available, it may not be possible to either confirm or discredit this hypothesis with any confidence.
  - Property insurance is sensitive to 'extreme' weather conditions, while climate studies tend to focus on the 'normal' or 'rare' range of weather conditions. The types of weather systems which cause insured losses are therefore not well represented in climate change studies to date, and their signatures are not easy to extract from global climate models.
  - There is minimal available literature at a level of granularity and specificity to be relevant to insurance contracts, particularly for the Australian and New Zealand region.
- Are the effects of climate change likely to vary by locale?
  - Leading indicators, such as changes in rainfall or temperatures, may be found in the Australian Actuaries Climate Index or Bureau of Meteorology historical data.
  - Some changes may be subtle, for example, there may be more intense episodes of rain but no change in the average rainfall measure.
- The uncertainty associated with modelled climate impacts, especially at more granular levels, may need to be considered and communicated.
- Are building regulations associated with each property understood along with the changing vulnerability as flood or bushfire risk changes?
- Is there sufficient allowance for factors other than direct damage, for example, demand surge or business interruption?
- Are there features that suggest the possibility of non-linearity or step changes? For example, the combination of urban spread, drought and higher extreme temperatures might produce a step change in bushfire risk in a portfolio.
- Climate sensitivity analysis is often based on a steady linear pathway towards a changed climate. Certain climate mechanisms may lead to rapid changes. These tend to be poorly understood and

could materially impact the outcome and timing of climate change impacts. Examples include:

- If the Atlantic Meridional Overturning Circulation (AMOC)[47] collapses, this could result in a rapid and permanent shift to more La Niña-like conditions in eastern Australia, in addition to changes to weather patterns in Europe and North America which could disrupt reinsurance markets[48].
- Sea levels could rise at a rate greatly exceeding expectations, which could result in changes to coastal risk but more importantly demographic and economic shifts due to climate refugees. This could occur, for example, due to the earlier than expected collapse of the West Antarctic ice sheet[49].
- Bushfire risk may change in a non-linear way due to compounding factors such as changes to atmospheric mixing induced by extreme fires creating feedback loops, reduced opportunities for containment, reduced effectiveness of containment measures, and dryness-induced increases to fuel availability[50].
- Potential for changes to El Niño-Southern Oscillation (ENSO) cycles resulting in increased frequency of both El Nino (dry, bushfires) and La Niña (wet, floods and cyclones) conditions, and reduced periods of neutral ENSO[51].
- The melting of permafrost around the Arctic Circle will release unprecedented amounts of methane which can rapidly accelerate velocity and severity of climate change[52]. Conversely natural events such as volcanic eruptions can cause temporary cooling.

Climate transition and liability risks could be understood through developing scenarios and estimating frequency and severities for these. This could involve consideration of social, political, industrial and economic drivers under different RCP Scenarios. Different applications within insurance have different time horizons and so may need different approaches, per Table 2.

Table 2 Timeframes and potential considerations

Timeframe	Example Activity	Consideration
Short-term	Annual pricing and valuation	Consider whether the natural hazard catastrophe model adequately captures the current climate risk or small annual increments
Medium-term	Portfolio steering over 5-10 years	Consider sensitivity testing with a trend or step change in natural hazard catastrophe model parameters

[47] Met Office, *What is the Atlantic Meridional Overturning Circulation?* https://www.metoffice.gov.uk/weather/learn-about/weather/oceans/amoc
[48] Orihuela-Pinto, B. & England, M. (06 June 2022) *Interbasin and interhemispheric impacts of a collapsed Atlantic Overturning Circulation* https://www.nature.com/articles/s41558-022-01380-y
[49] Intergovernmental Panel on Climate Change (19 March 2023) *AR6 Synthesis Report* https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_FullVolume.pdf
[50] Intergovernmental Panel on Climate Change (2022) *Sixth Assessment Report* https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf
[51] Intergovernmental Panel on Climate Change (2022) *Sixth Assessment Report* https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf
[52] Intergovernmental Panel on Climate Change (2022) *Sixth Assessment Report* https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf

Long-term	Impact on capital position, and designing business strategies for rebalancing business by geographical area or line of business	Sensitivity testing under different climate scenarios may be useful. Consider potential reputation risks of refusing cover.

Life insurance

The section titled “Life insurance” details specific considerations for life insurers. This section should be read in conjunction with the “All insurers” section.

Types of risk for life insurers

This section suggests a range of climate risks and opportunities that may impact life insurers. The AA could consider whether these risks, as well as those identified through the insurer’s risk management processes, are material to the insurer’s business, including consideration of any risk mitigants such as pricing response. For risks that are considered material, the AA could assess whether they are adequately managed by the insurer, and if deemed necessary, comment on them in the FCR.

Physical risk

Life insurers may be exposed to physical risk through:

- Claims arising from the health and/or mortality impacts of climate change,
- The impacts that the physical risks of climate change have on their asset portfolios, and/or
- The impacts that physical risks may have on their customers’ ability to pay premiums, with consequent impacts on lapse rates and new business sales.

Examples of how the physical risks of climate change may impact life insurers include:

- Major flood or bushfire events can lead to large numbers of customers experiencing financial hardship. This may lead to material numbers of customers needing to access premium relief and/or making changes to their policies that assist with affordability.
- For mortality protection, insurers could face the risk of increasing claims costs as changes in weather patterns drive additional deaths. For example:
  - Extreme weather events may result in loss of life[53]. Historically heatwaves have killed more Australians than any other natural hazard[54].
  - Broader shifts in climate patterns (e.g., ambient temperature[55,56]) may drive changes to the overall shape of the mortality curve.
- Insurers who bear morbidity risks (through Total and Permanent Disability, Income Protection and to some extent Trauma product offerings) are also exposed to the impacts that climate change may have on health. Some examples include:
  - Heat-related stressors and impacts on respiratory and cardio-vascular health from the impact of climate change on air quality (as noted in the section titled “Impacts of climate change on health”).
  - Mental health impacts, for example the psychological impacts of bushfires can continue for at least ten years following a major event[57].
- Insurers with exposure to longevity risk may benefit from lifetime income streams ending earlier than

[53] Åström et al., 2013. Attributing mortality from extreme temperatures to climate change in Stockholm, Sweden
[54] https://actuaries.asn.au/Library/Opinion/2019/TheDialogue10ClimateWEBLres.pdf
[55] Gasparrini et al. 2017, Projections of temperature-related excess mortality under climate change scenarios
[56] Gasparrini et al. 2016, Mortality risk attributable to high and low ambient temperature: a multicountry observational study
[57] https://mspgh.unimelb.edu.au/centres-institutes/centre-for-health-equity/research-group/beyond-bushfires

expected if mortality deteriorates due to climate change.

People with existing health conditions and/or comorbidities, the very young and older people, and socio-economically vulnerable people are more exposed to the health and mortality risks of climate change. Consequently, Australian life insurers with exposure mainly at the working ages have been minimally impacted by climate change to date, however impacts may emerge over the long term.

Transition risk

Shifting towards a lower carbon economy may drive widespread change in the economy, particularly in sectors highly reliant on fossil fuels. These changes may lead to impacts on claims costs, asset values or risk exposure. For example:

- A disorderly transition may cause disruptions to job stability in some sectors, for example in industries undergoing carbon transition. This could have impacts on claims incidence arising from mental health, as there is evidence that becoming unemployed has a negative impact on mental health[58].
- Consumer preferences shifting away from carbon intensive products and processes may exacerbate any changes in industry and unemployment rates.
- New technologies could lead to growth in other renewable industries, bringing about potential offsetting impacts to shrinking industries and short-term uncertainty to current occupation ratings.
- Moving away from fossil fuels towards renewable power generation may reduce air pollution and have positive health outcomes.
- The impact of social trends on individual behaviour, such as more physical exercise or lower consumption of meat, may have positive health outcomes.

Given the sensitivity of claims rates to unemployment and mental health levels, transition risk impacts are likely to have greater material impacts on a life insurer's risk portfolio than physical risks in the short term.

Liability risk

Liability risks may arise for insurers, for example in cases where they are held liable for losses due to climate change, or for inadequate assessment and/or disclosure of climate risks to shareholders. More detail is included in the section titled "Liability risk for directors".

Pricing, underwriting and product design

Life insurance in Australia covers mortality, morbidity, and longevity risks through retail and group markets. While life insurance products have 'guaranteed renewability', repricing mechanisms may help manage emerging risks, including climate risks. The introduction of products or features to meet the changing needs of Australians for long term products could consider the climate change risks in pricing and in the reviewability of pricing.

In the short term there are:

- Uncertainties in quantifying and attributing climate risks, and understanding the effect of climate adaptation measures.
- Limitations of data availability and monitoring.

Despite these limitations, over the long-term, insurers may aim to develop a better understanding of

[58] http://iwh.on.ca/summaries/issue-briefing/unemployment-and-mental-health

climate risks through improvements to data availability and accessibility, as well as modelling improvements to enhance and support pricing.

Other pricing considerations include the impact of any regulatory changes specific to climate risks, and whether changes in underwriting relating to climate risks can be captured in pricing.

Reviewability as a risk mitigation strategy

Life insurers can use repricing mechanisms to manage some of the emerging risks that climate change brings. Whilst this may be a potential reactive strategy for most active life portfolios, some key considerations for repricing for emerging climate risks include:

- Limitations to Disabled Life Reserve portfolios – climate impacts for people already on claim, particularly long-term benefits.
- Commercial and operational feasibility of repricing, and whether revised premiums are affordable for the target market. Affordability issues may impact lapse rates and the size of the portfolio over time.
- Potential shock lapses, anti-selection and reputational risks resulting from premium changes.

Reserving

AAs could consider how the climate change effects discussed above affect the reserving process, including the data, modelling techniques used, and the assumption setting process. When considering these areas an assessment of viability, reasonableness and appropriateness could be applied.

There is recognised complexity in setting best estimate assumptions in accordance with the effects of climate change that will emerge over time, particularly as extrapolating historical trends may not provide a reliable guide to future developments. As part of regular reviews of assumptions, AAs could give consideration to the impact of climate change on best estimate assumptions, taking into account the option to reprice. Some examples that may arise include:

- Adjusting industry tables due to specific characteristics of the company's insured lives; or
- Adjusting current best estimate assumptions due to the existence of a new risk factor.

In deciding whether it is appropriate to make these adjustments, an assessment of the data's credibility, the materiality of the assumptions and whether it is viable to implement are also key considerations.

At present, due to the uncertainty around the long-term nature and level of climate change impacts, a practical approach is to recognise that climate change represents an additional source of uncertainty in future mortality and morbidity rates, and to consider its implications for reserving assumptions. If deemed material, the process could also include communication of how this uncertainty has been managed in the FCR.

Health insurance

The section titled "Health insurance" details specific considerations for health insurers. This section should be read in conjunction with the "All insurers" section.

Types of risk for health insurers

This section suggests a range of climate risks and opportunities that may impact health insurers. The AA could consider whether these risks, as well as those identified through the insurer's risk management processes, are material to the insurer's business, including consideration of any risk mitigants such as pricing response. For risks that are considered material, the AA could assess whether they are adequately

managed by the insurer, and if deemed necessary, comment on them in the FCR.

Physical risk

The effect of climate change on health is complex. Health insurers will need to consider physical risk in the context of the impact of other trends on health insurance claims, such as the ageing population or the rise in chronic conditions. Notwithstanding the complexity, examples of how the physical risks of climate change may impact health insurers include direct impacts from the health of the population (discussed earlier in the "Impacts of climate change on health" section), and indirect costs from the impact of the need to change the health system:

- Adverse weather events may cause disruption to supply chains, healthcare operations or access to healthcare facilities.
- The increased demand for mental health services as a result of adverse impacts on mental health from climate change-related disasters and prolonged periods of extreme weather, as well as climate change anxiety, particularly in young adults.
- Worsening health outcomes because of increased exposure to heatwaves and other natural disasters will require our health system to adapt[59].
- As the community's health needs change because of climate change, the health system will similarly need to adapt. There may be a need for the system to be able to more frequently satisfy surges in demand due to:
  - Heatwaves or extreme bushfire events, increased tropical diseases in areas where they have not previously been seen.
  - Increased prevalence of chronic conditions compounded by adverse weather events.
  - Deteriorating quality of air due to bushfires and warmer temperatures.
- Climate change-induced health impacts may alter patterns of healthcare demand and utlisation. For example, rural regions experiencing more bushfires will have different health care needs compared to other regions affected by changing disease patterns.
- Population health changes may not occur slowly enough for health systems to adapt in a planned and orderly manner.
- Less well-managed changes to the system potentially put upward pressure on costs to the health system, and therefore potentially health insurance premiums, in the long term.
- Health inequity for some subgroups of the population, such as the elderly, people with disabilities and pre-existing health conditions, as well as the First Nations communities, may be exacerbated by climate change.

Health insurers will need to consider the implications of the transitioning health system to design products that ensure changing health needs continue to be satisfied. Any increased volatility in health insurance claims will also have implications for insurers' reserves and the capital they hold.

Transition risk

[59] Already, we have seen that with the COVID-19 pandemic, the health policy response has been to rapidly re-organise the way the public and private health systems in Australia deliver care. This has resulted in material disruption to the finances of health insurers, quite aside from COVID-19's economic impact.

As with general and life insurance, the transition to a low carbon economy will have an economic cost with consequences for health insurers' investment portfolios. However, other transition risks weigh on health insurance differently and may impact claims costs or risk exposure. For example:

- A disorderly transition may cause disruptions to job stability in some sectors which could have impacts on claims incidence arising from mental health. There is much evidence that becoming unemployed has a negative impact on mental health.
- Transition risks affect economic activity, supply chains, business practices and consumer behaviour. This may affect the underlying exposures of customers to new and emerging technologies and industries altering the risks faced by customers on a day-to-day basis.

Rising energy costs can strain household budgets, leaving less disposable income available for discretionary expenses such as private health insurance, potentially leading to a drop in private health insurance participation.

Liability risk

Liability risks may arise in cases where directors are held liable for losses due to climate change, for inadequate assessment and/or disclosure of climate risks to shareholders, or greenwashing claims. More details included in the section titled "Liability risk for directors".

Product design, underwriting and pricing

Health insurance contracts are like general insurance products, given they are repriced annually, albeit being community rated based on the benefits offered rather than the risk exposure of individuals. Actuaries could consider:

- Potential worsening trends (e.g. spread of disease enabled by hotter or wetter conditions, or mental health impacts on farmers and rural communities due to materially changed economic circumstances).
- Potential beneficial trends (e.g. potentially less pollution related diseases due to energy transition).
- The time horizon these trends may reasonably be expected to evolve.
- The risk and potential impacts of extreme events, as frequency of extreme climate related events might be expected to change (e.g. heat waves causing heat stress impacts, particularly considering age profile of fund membership).
    - The immediate impact of such events may even have temporarily offsetting benefits for health Insurers (e.g. if an event impacts the ability to access health services). However, this can lead to the emergence of longer-term impacts.
    - If there is an existing allowance for extreme events in pricing, adjustments may be considered to allow for the bias implicit in past data that may underestimate the severity or frequency of future extreme events.

These trends may affect future premium adequacy. If the worsening trends outweigh the beneficial trends, then premiums may need to increase at a higher rate to ensure solvency and capital adequacy of health insurers. Regulatory and reputational risk issues can then arise where increasing premium trends persist.

Factoring the changing health profile of customers into the product design process may also create opportunities for insurers.

Reserving

Health insurance reserving is typically short tail and valued similarly to general insurance liabilities, although it incorporates an allowance for the Risk Equalisation Special Account.

Considerations for the impact of climate change on the expected value of claims costs include:

- Transition risks may affect the underlying exposures of customers to new and emerging employment industries and technologies, altering the risks faced by customers on a day-to-day basis.
- The level of engagement of Australian governments with health risks from climate change could affect issues such as:
  - The level of vulnerability to heatwaves (and heatwave mitigation plans).
  - The associations between increased extreme heat, drought, and mental health.
- More frequent extreme weather events may affect concentration risk and require potentially greater consideration of the distribution of policyholders, as well as the potential impact of demand surge affecting access and cost of health care. This may more immediately affect public health services, which could then have flow-on effects on the private health system funded by private health insurance.
- Medical inflation may arise from climate impacts on supply chains, damage to physical sites and occurrence of climate-related illnesses.

Climate disclosures

There is increasing focus by regulators and investors on climate disclosures. While it is not mandatory for an AA to be involved in producing climate disclosures for an insurance company, actuaries may support parts of the process, including scenario analysis and certain disclosure metrics (such as Average Annual Losses or Probable Maximum Losses from weather related natural hazard catastrophes).

The following section summarises information on emerging disclosure standards that may be useful background for an AA. It should be read in conjunction with the section on TCFD earlier in this paper.

IFRS S1 and IFRS S2

The International Sustainability Standards Board (ISSB) was established in 2021 by the International Financial Reporting Standards (IFRS) Foundation to provide a global baseline of sustainability disclosures to provide investors with reliable, comparable information. The standards were released in June 2023 and set out:

- IFRS S1[60] – general sustainability-related disclosure requirements.
- IFRS S2[61] – climate-related disclosure requirements.

The standards build upon the TCFD and adopt the same four-pillar construct, although with more detailed and granular requirements under each pillar than the TCFD. The standards require disclosure of:

- Governance – the governance processes, controls, and procedures the entity uses to monitor and manage sustainability-related risks and opportunities.
- Strategy – the approach for addressing sustainability-related risks and opportunities that could affect the entity's business model and strategy over the short, medium, and long term.
- Risk management – the processes the entity used to identify, assess and manage sustainability-related risks.
- Metrics and targets – information used to assess, manage and monitor the entity's performance in relation to sustainability-related risks and opportunities over time.

In addition to IFRS S1 and S2, entities are also required to consider the applicability of industry-based disclosure topics and metrics which have been derived from the Sustainability Accounting Standards Board (SASB) standards for each sector. The industry-based standards relating to the financial services sector are:

- IFRS S2 Volume B16[62] for commercial banks, which includes:
  - Disclosure of their approach in incorporating environmental, social and governance (ESG) factors into their credit analysis.

[60] International Sustainability Standards Board (June 2023) *IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information*
https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s1-general-requirements/
[61] International Sustainability Standards Board (June 2023) *IFRS S2 Climate-related Disclosures*
https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s2-climate-related-disclosures/
[62] International Sustainability Standards Board (June 2023) *IFRS S2 Industry-based Guidance on implementing Climate-related Disclosures*
https://www.ifrs.org/content/dam/ifrs/publications/pdf-standards-issb/english/2023/issued/part-b/ifrs-s2-ibg.pdf

- IFRS S2 Volume B17[63] for insurers, which includes:
  - Disclosure of their approach in incorporating environmental, social and governance (ESG) factors into their investment management processes and strategies.
  - Disclosure of policies designed to incentivise responsible behaviour.
  - Disclosure of physical risk exposure including Probable Maximum Loss (PML) of insured products from weather-related natural catastrophes, insurance pay-outs from modelled and non-modelled natural catastrophes, and the approach to incorporating environmental risks into underwriting and risk and capital management.

Australian Treasury Consultation

The Australian Treasury is currently undergoing a second consultation on mandatory climate reporting[64]. It is expected that these will align with the IFRS S2 standard. The proposed roadmap has the largest entities beginning mandatory climate reporting in the 2024-25 financial year, with disclosure requirements gradually extending to smaller entities that meet the specified thresholds by 2027-28.

Australian Institute of Company Directors

The Australian Institute of Company Directors (AICD) released a paper[65] in March 2023 on upcoming regulatory obligations for Australian directors. It explains that mandatory climate reporting is imminent and will be subject to scrutiny from regulators, investors, and other stakeholders. Boards can act now by reviewing governance structures, setting up a sustainability and climate strategy, and understanding resourcing, data, and disclosure needs.

The paper notes that while ISSB builds on the TCFD framework, it will also require a step up in the level of detail and granularity of disclosure. Some examples of where ISSB standards are an uplift from TCFD include:

- The proposals have explicit requirements on disclosure of emissions reduction targets and use of carbon offsets in relation to an organisation's transition plan.
- The ISSB standards require consideration of industry-based metrics relevant to an organisation's industry and activities. They also require a different disclosure treatment of greenhouse gases, including Scope 3 emissions.
- Companies will need to explain how targets compare with the latest international agreement on climate change, whether this has been validated by a third party and whether the targets have been derived using a sectoral decarbonization approach.

The ISSB standards also cover a wider scope than climate-related disclosures, including sustainability-related risks and opportunities such as biodiversity, fresh water, and human capital.

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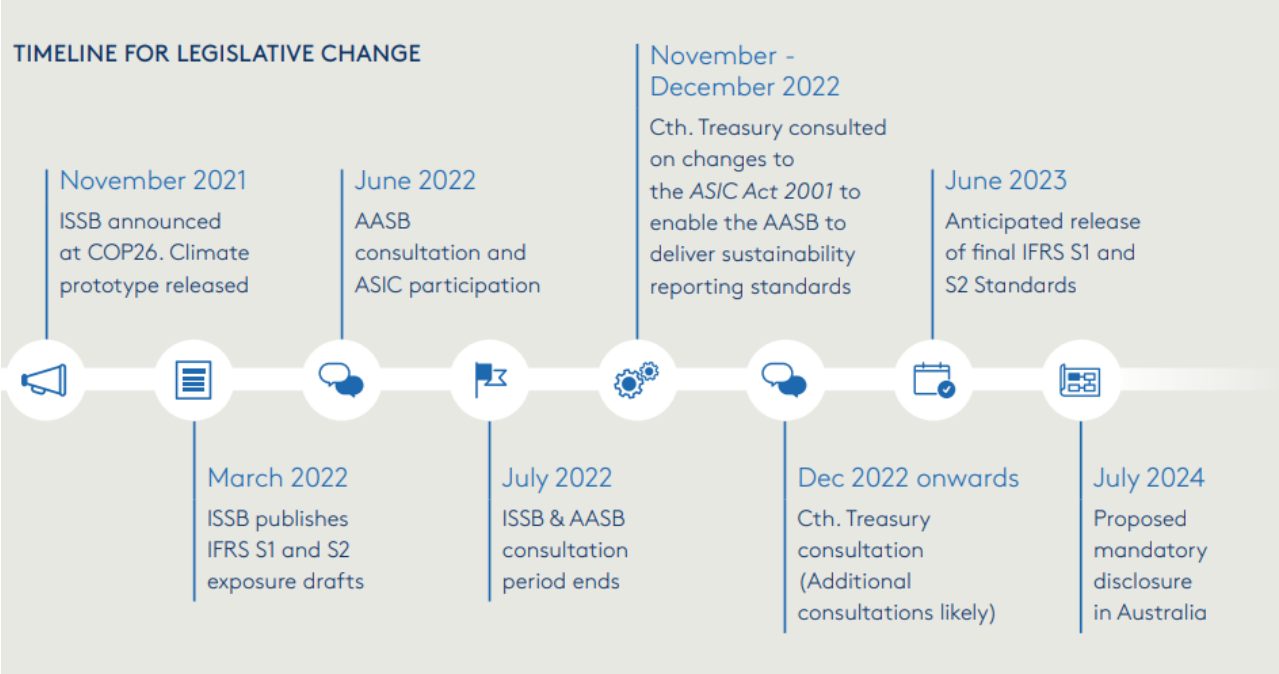
[63] International Sustainability Standards Board (June 2023) *IFRS S2 Industry-based Guidance on implementing Climate-related Disclosures*
https://www.ifrs.org/content/dam/ifrs/publications/pdf-standards-issb/english/2023/issued/part-b/ifrs-s2-ibg.pdf
[64] Australian Government, The Treasury (June 2023) *Climate-related financial disclosure consultation paper*
https://treasury.gov.au/sites/default/files/2023-06/c2023-402245.pdf
[65] Australian Institute of Company Directors (2023) *Gearing up for Mandatory Climate Reporting*
https://www.aicd.com.au/content/dam/aicd/pdf/news-media/research/2023/cgi-climate-reporting-primer-v4.pdf

The following figure[66] shows the proposed timeline for legislative changes in Australia.

Figure 6 AICD 2023 Timeline for Legislative Change[67]



The proposed ISSB climate standards require the disclosure of inherently uncertain forward-looking information to the market, and detailed transition plans. The AICD notes that public statements will need to be backed up with credible, reliable information, and that aspirations are not enough. The risk of greenwashing (overstating climate or ESG credentials or understating the risks) needs to be balanced against the risk of green-hushing (failure to disclose for fear of greenwashing).

NZIA and PCAF

The UN Environment Programme: Finance Initiative launched the Principles for Sustainable Insurance initiative in 2012. The Net Zero Insurance Alliance (NZIA) was formed in 2021 under this umbrella, including 30 of the world's insurers/ reinsurers representing 15% GWP at the time, although a number of members have since exited. NZIA commitments are aligned with a maximum temperature rise of 1.5°C above pre-industrial levels by 2100 and the COP21 Paris Agreement.

The NZIA target setting protocol[68], released in early 2023, requires members to set at least one target by 31 July 2023, and further targets by July 2024. It is expected that progress towards meeting targets will be reported annually.

The NZIA collaborated with the Partnership for Carbon Accounting Financials (PCAF) to develop the insurance-associated emissions formula (described below).

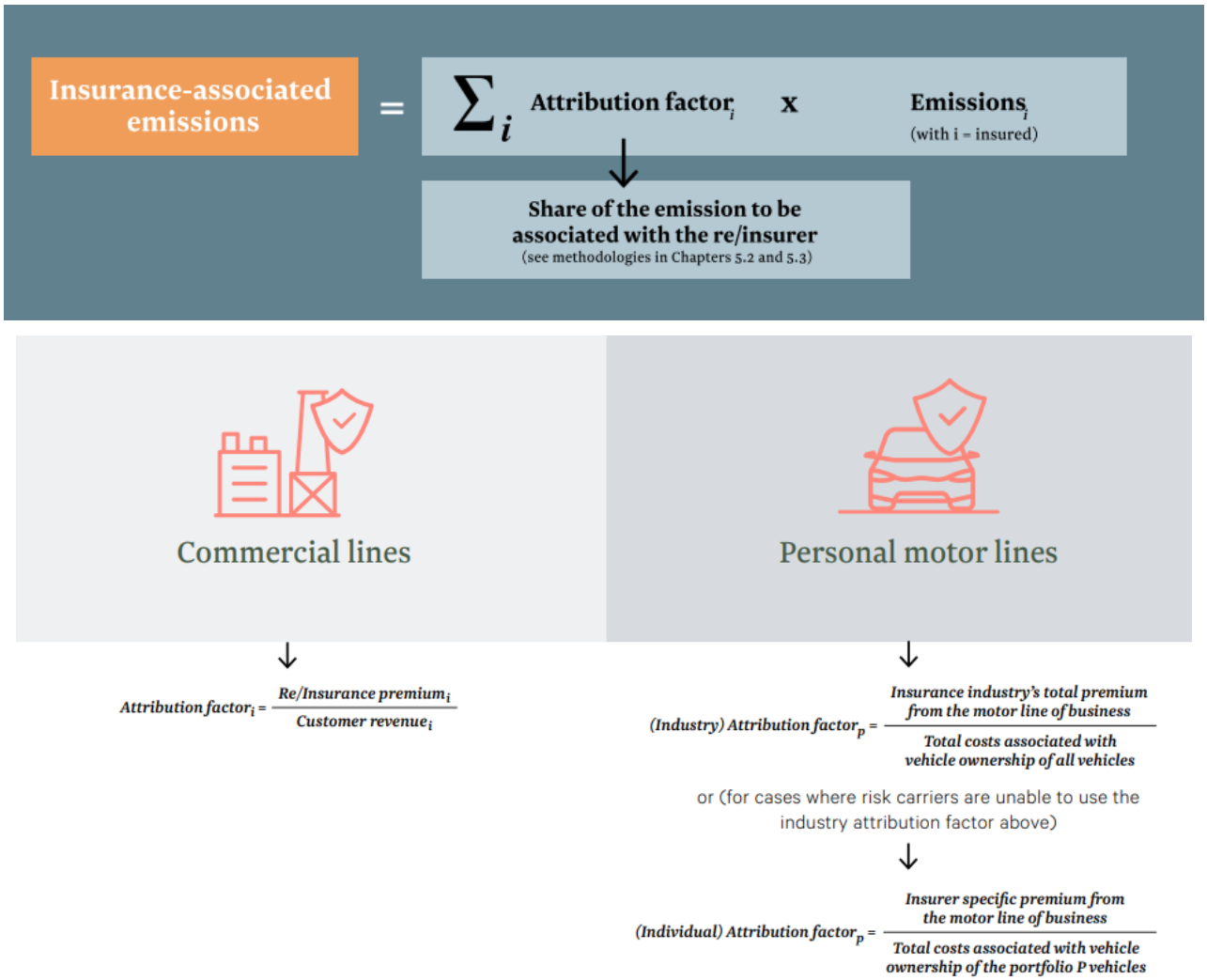
PCAF

[66] Australian Institute of Company Directors (2023) *Gearing up for Mandatory Climate Reporting* https://www.aicd.com.au/content/dam/aicd/pdf/news-media/research/2023/cgi-climate-reporting-primer-v4.pdf
[67] Ibid
[68] UNEP FI Publications (Jan 2023) *NZIA Target-setting Protocol Version 1.0* https://www.unepfi.org/industries/insurance/nzia-target-setting-protocol-version-1-0/

The Partnership for Carbon Accounting Financials (PCAF)[69] developed a Global GHG Accounting and Reporting Standard for measurement and disclosure of GHG emissions, including:

- Financed emissions – for listed equity and corporate bonds, business loans and unlisted equity, project finance, commercial real estate, mortgages, motor vehicle loans, and sovereign debt
- Facilitated emissions – for emissions associated with capital market transactions (to be launched in 2023)
- Insurance-associated emissions – for emissions related to re/insurance underwriting. The methodology for some lines of business (for example, life insurance, health insurance, reinsurance or trade credit) has not yet been determined.

Equation 1 PCAF formulas to calculate insurance-associated emissions[70]



[69] Partnership for Carbon Accounting Financials (Nov 2022) *PCAF launches the Global GHG Accounting and Reporting Standard for Insurance-Associated Emissions* https://carbonaccountingfinancials.com/en/newsitem/pcaf-launches-the-global-ghg-accounting-and-reporting-standard-for-insurance-associated-emissions

[70] PCAF (2023) *The Global GHG Accounting and Reporting Standard for the Financial Industry* https://carbonaccountingfinancials.com/en/standard

In July 2020, the Taskforce on Nature-related Financial Disclosures was announced, with the objective to develop and deliver a risk management and disclosure framework for organisations to report and act on evolving nature-related risks. The aim of the TNFD is to support a shift in global financial flows away from nature-negative outcomes and toward nature-positive outcomes. The final TNFD recommendations[71] were released in September 2023.

The TNFD's recommended disclosures fall under the 4 pillars of Governance, Strategy, Risk & Impact Management and Metrics & Targets. Disclosures are voluntary at present, but it is expected that, similarly to TCFD disclosures, there will be mounting pressure for insurers, financial institutions, and other companies to comply with the TNFD framework.

[71] Taskforce on Nature-related Financial Disclosures (September 2023) *Recommendations of the Taskforce on Nature-related Financial Disclosures* https://tnfd.global/final-tnfd-recommendations-on-nature-related-issues-published-andcorporates-and-financial-institutions-begin-adopting/

Figure 7 TNFD recommended disclosures[72] *s*

Resources for actuaries

International Actuarial Association climate series

The International Actuarial Association (IAA) is the worldwide association of professional actuarial associations, with special interest sections for individual actuaries. The IAA exists to encourage the development of a global profession, acknowledged as technically competent and professionally reliable, which will ensure that the public interest is served.

The IAA Executive Committee Task Force on Climate Risk (CRTF) took the initiative to develop a series on climate risk starting in 2020, reflecting a significant contribution from actuaries from around the world in terms of volunteer effort and content. The purpose of the climate series is to:

[72] Taskforce on Nature-related Financial Disclosures (September 2023) *Recommendations of the Taskforce on Nature-related Financial Disclosures* https://tnfd.global/wp-content/uploads/2023/08/Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf?v=1695118661

- Raise wider awareness of the potential impacts of climate-related risks on financial risk management, reporting and disclosure.
- Increase recognition for the potential contribution of actuaries as risk experts on the part of supranational organisations, government agencies, industry, and the public.
- Develop the actuarial profession's skill sets and capabilities to assist third parties in managing climate-related risks.

The papers released in the climate risk series, in chronological order, are:

1. *Importance of Climate-Related Risks for Actuaries* – September 2020[73]
2. *Introduction to Climate-Related Scenarios* – February 2021[74]
3. *Climate-Related Scenarios Applied to Insurers and Other Financial Institutions* – August 2021[75]
4. *Climate Science: A Summary for Actuaries - What the IPCC Climate Change Report 2021 Means for the Actuarial Profession* – March 2022[76]
5. *Application of Climate-Related Risk Scenarios to Asset Portfolios* – April 2022[77]
6. *Climate-Related Disclosures and Risk Management: Standards and Leading Practices* – October 2022[78]
7. *The Climate Change Adaptation Gap: An Actuarial Perspective* – May 2023[79]

The last paper planned in this series (yet to be published) will address the link between climate-related risk scenarios and social security.

Each paper released is accompanied by a webinar session, with presentation slides and webinar recordings available on the IAA landing page for climate issues[80].

The next section provides more context and summary of key points from the paper, "A Summary for Actuaries – What the IPCC Climate Change Report 2021 Means for the Actuarial Profession".

Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report

The recently published IPCC Synthesis Report demonstrates the scientific consensus about the urgency of the climate crisis and the need for near-term action. It is the final report of the IPCC sixth assessment report (IPCC6), summarising the past seven years of scientific, technical, and socio-economic information concerning climate change produced by hundreds of scientists around the world.

The International Actuarial Association's (IAA) Climate Risk Task Force (CRTF) released a joint paper with the United Nation's IPCC Working Group 1 (WGI) to produce a paper called "Climate Science: A Summary for Actuaries"[81]. It is a summary of the IPCC WGI's Assessment Report #6 (AR6) released in August 2021,

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[73] https://www.actuaries.org/IAA/Documents/Publications/Papers/CRTF_ImportanceClimateRelatedRisksActuaries_FINAL.pdf
[74] https://www.actuaries.org/IAA/Documents/Publications/Papers/CRTF_Introduction_Climate_Scenarios.pdf
[75] https://www.actuaries.org/IAA/Documents/Publications/Papers/CRTF_Application_Climate_Scenarios.pdf
[76] https://www.actuaries.org/IAA/Documents/Publications/Papers/Climate_Science_Summary_Actuaries.pdf
[77] https://www.actuaries.org/IAA/Documents/Publications/Papers/CRTF_Paper4_Asset_Portolios.pdf
[78] https://www.actuaries.org/IAA/Documents/Publications/Papers/CRTF_Paper5_Final_October2022.pdf
[79] https://www.actuaries.org/IAA/Documents/Publications/Papers/IAA_CRTF_Paper6_AdaptationGap.pdf
[80] https://www.actuaries.org/IAA/IAA/Publications/Climate_Issues.aspx
[81] https://www.actuaries.org/IAA/Documents/Publications/Papers/Climate_Science_Summary_Actuaries.pdf

with the most up-to-date physical understanding of the climate system and climate change.

This section summarises the information from the IPCC report relevant to actuaries.

First, better observational climate data and models have led to improved understanding of human influence on the weather and climate extremes. Climate science has concluded that observed warming is caused by emissions from human activities, with greenhouse gas warming partly masked by aerosol cooling.

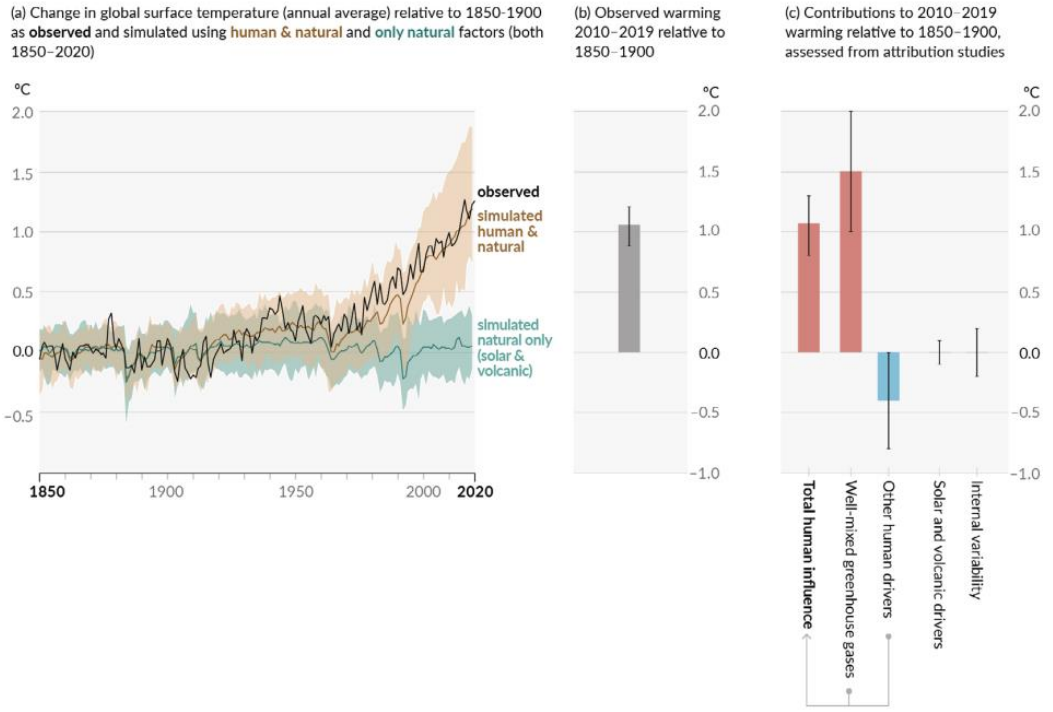

Figure 1 in Climate Science: Summary for Actuaries, adapted from SPM.1 and SPM.2

Second, human influence is already making many extreme climate events, including heatwaves, heavy rainfall, and droughts, more frequent and severe. For example, the way we live in cities impacts the climate. Cities and urbanisation and more extremes lead to:

- increased severity of heatwaves,
- increased runoff intensity from precipitation over and/or downwind of cities, and
- flooding in coastal cities due to extreme sea level events and rainfall or river flow.

Third, our climate futures depend on greenhouse gas emissions. Global warming levels of 1.5°C and 2°C will be exceeded unless deep reductions in carbon dioxide and other greenhouse gas emissions occur in the coming years and continue for decades. Many changes due to past and future greenhouse gas emissions are irreversible.

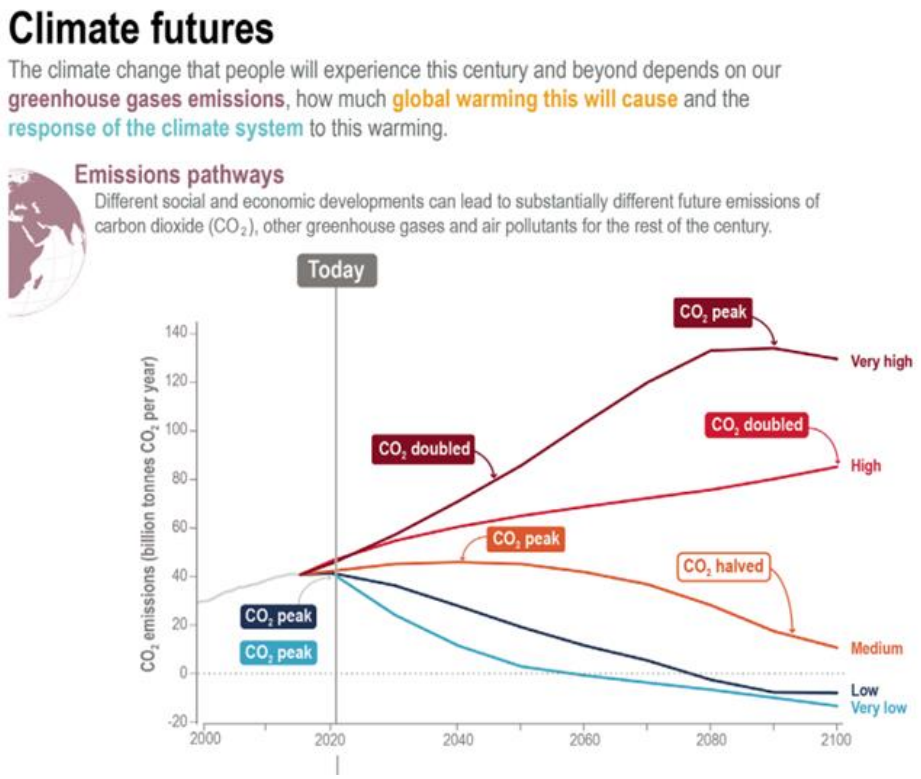

Figure 5 in Climate Science: Summary for Actuaries

Lastly, the five climate scenarios used in the AR6 report assume various levels of mitigation, although all five scenarios lead to similar warming until the 2050s. This is due to the time commitment needed to implement mitigation actions, hence warming in the near term continues, even in the scenarios that feature strong reductions in greenhouse gases and air pollutants.

Table 2 in Climate Science: Summary for Actuaries

	Projected global warming level (°C) at specific 20 year timeframe		
	Near term, 2021–2040	Mid-term, 2041–2060	Long term, 2081–2100
SSP1-1.9	1.5 (1.2-1.7)	1.6 (1.2-2.0)	1.4 (1.0-1.8)
SSP1-2.6	1.5 (1.2-1.8)	1.7 (1.3-2.2)	1.8 (1.3-2.4)
SSP2-4.5	1.5 (1.2-1.8)	2.0 (1.6-2.5)	2.7 (2.1-3.5)
SSP3-7.0	1.5 (1.2-1.8)	2.1 (1.7-2.6)	3.6 (2.8-4.6)
SSP5-8.5	1.6 (1.3-1.9)	2.4 (1.9-3.0)	4.4 (3.3-5.7)

The scenarios are based on a combination of information on socio-economic development and the resulting climate development. They are referred to as SSPx-y scenarios, where ‘SSPx’ refers to a specific Shared Socio-economic Pathway (SSP) describing the socio-economic trends and assumptions underlying the scenario, and ‘y’ refers to the approximate change in Earth’s energy balance by 2100 for a given scenario.

The following are brief descriptions of the climate scenarios:

- SSP1 Sustainability (Taking the Green Road) – shifting gradually towards a more sustainable path.

- SSP2 Middle of the Road – Social, economic, and technological trends do not shift markedly from historical patterns.
- SSP3 Regional Rivalry (A Rocky Road) – Concerns about competitiveness and security push countries to a more domestic or regional focus.
- SSP4 Inequality (A Road Divided) – Increased disparity in economic opportunity and political power lead to increasing inequalities across and within countries.
- SSP5 Fossil-fueled Development (Taking the Highway) – Increased faith in markets, innovation and participatory societies to lead to technological solutions as the path to sustainable development.

Climate related initiatives and resources

There are several initiatives with respect to climate, severe weather, natural peril and/or natural disaster risk in Australia to which the Actuaries Institute or membership is contributing, including:

- Climate Measurement Standards Initiative (CMSI)[82] is an industry-led collaboration between Australian banks, general insurers, and asset owners to develop guidance on scenario analysis for TCFD reporting on the impact of climate on natural disasters (climate-related physical risk). The CMSI has produced financial disclosure guidelines and climate science guidance for Australian banks, general insurers, and asset owners:
  - To provide guidance on interpretation of the TCFD in the context of the banking, general insurance, and asset owner sectors in Australia.
  - To obtain scientific advice in addressing the challenges around assessing changes in hazards due to climate change, including the development of scenarios to be used in TCFD scenario analyses.
- The Australian Sustainable Finance Initiative (ASFI)[83] is a collaboration of industry participants implementing a roadmap for sustainable finance in Australia. The roadmap, launched in November 2020, recommended pathways, policies, and frameworks to enable the financial services sector to contribute more systematically to the transition to a more resilient and sustainable economy, consistent with global goals such as the UN Sustainable Development Goals, the Paris Agreement on climate change and the Sendai Framework. The ASFI Taxonomy Project[84] is a joint industry-government initiative to develop an Australian sustainable finance taxonomy, building on work done internationally.
- Insurance Council of Australia's Climate Change Action Committee (CCAC)[85] is a multidisciplinary collaboration of insurance experts with a mandate to complete industry studies and information to:
  - Support the insurance industry to embed climate change issues and insights into decision making.
  - Work with stakeholders to raise awareness of climate change and the impacts of climate change, manage risk and develop solutions including awareness of disaster preparedness in communities, and improve disaster response and recovery.
  - Work with governments, regulators, and other key stakeholders to promote action on climate change and other environmental issues; and

[82] https://www.cmsi.org.au/reports
[83] https://www.sustainablefinance.org.au/
[84] Australian Sustainable Finance Institute, *Taxonomy Project* https://www.asfi.org.au/taxonomy
[85] https://climaterisk.insure/

- Support industry disclosure of climate risks and opportunities.

The Institute and membership are also aware of these other resources discussing climate risk and modelling.

- The National Resilience Taskforce (NRTF) reported[86] on climate and disaster risk, including information on Australia's National Vulnerability and a strategic approach to managing vulnerability[87].
- The UK Institute and Faculty of Actuaries' paper *The Emperor's New Climate Scenarios*[88] examines the limitations and assumptions used in climate change scenario modelling practices in financial services. Unmodelled risks such as tipping points and second order impacts affect the way in which model outputs should be interpreted, and it may be necessary to communicate these uncertainties.
- The Carbon Tracker's paper *Loading the DICE against Pensions*[89] discusses the disconnect between economic and scientific literature on how much damage climate change will do to the economy, and what this means for pension funds relying on these economic models.

November 2023

[86] https://www.aidr.org.au/media/6682/national-resilience-taskforce-profiling-australias-vulnerability.pdf
[87] https://knowledge.aidr.org.au/media/7710/03-vulnerability-guidance-strategic-decisions-climate-disaster-risk-2020.pdf
[88] Institute and Faculty of Actuaries (July 2023) *The Emperor's New Climate Scenarios* https://actuaries.org.uk/media/qeydewmk/the-emperor-s-new-climate-scenarios.pdf
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